Empire Offshore Wind LLC

and

EW Offshore Wind Transport Corporation

Empire Wind 2 Project

Article VII Application

Exhibit 3

Alternatives

August 2023

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ACRONYMS AND ABBREVIATIONS

Ac	acre
AIS	Automatic Identification System
BOEM	Bureau of Ocean Energy Management
CBRA	cable burial risk assessment
CLCPA	Climate Leadership and Community Protection Act
COP	Construction and Operations Plan
Empire or the Applicant	Empire Offshore Wind LLC and EW Offshore Wind Transport Corporation
EW 2 Project	Empire Wind 2 Project
ft	Foot
FLAG Atlantic Telecoms cable	Fiber Optic Link Around the Globe Telecoms cable
GW	Gigawatt
ha	hectare
HDD	horizontal directional drilling
HRG	High Resolution Geophysical (survey data)
HVAC	high-voltage alternating-current
HVDC	high-voltage direct-current
km	kilometer
kV	kilovolt
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0512
LIPA	Long Island Power Authority
LIRR	Long Island Rail Road
LWCF	Land and Water Conservation Fund
m	meter
mi	mile
MLLW	Mean Lower Low Water
MTBM	Microtunneling Boring Machine
MW	megawatt
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NYISO	New York Independent System Operator, Inc.
NY Project	EW 2 Project transmission facilities in New York

NY Project Area	The area associated with the NY Project, including the submarine export cable corridor, onshore export cable corridor, onshore substation site, interconnection cable corridor, Hampton Road substation site, and loop-in / loop-out lines within New York State jurisdiction.
NYOPRHP	New York State Office of Parks, Recreation, and Historic Preservation
NYSDOS	New York State Department of State
NYSERDA	New York State Energy Research and Development Authority
NYSPSC or Commission	New York State Public Service Commission
POI	Point of Interconnection at the Hampton Road substation
PANYNJ	Port Authority of New York and New Jersey
PSA	Purchase and Sale Agreement
PSEG-LI	PSEG Long Island
PSL	New York Public Service Law
Transco LNYBL	Transco Lower New York Bay Lateral gas pipeline
TSS	Traffic Separation Scheme
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
UXO	Unexploded Ordnance

EXHIBIT 3: ALTERNATIVES

3.1 Introduction

Empire Offshore Wind LLC and EW Offshore Wind Transport Corporation (collectively, Empire or the Applicant) proposes to construct and operate the Empire Wind 2 (EW 2) Project as one of two separate offshore wind projects to be located within the Bureau of Ocean Energy Management (BOEM) designated Renewable Energy Lease Area OCS-A 0512 (Lease Area). The EW 2 Project will require an electric transmission system to connect the offshore wind farm to the point of interconnection (POI) to the New York State Transmission System. An electric transmission line with a design capacity of 125-kilovolt (kV) or more, extending a distance of one mile or more, is subject to review and approval by the New York State Public Service Commission (Commission or NYSPSC) as a major electric transmission facility pursuant to Article VII of the New York Public Service Law (PSL). The EW 2 Project transmission system will extend a total of approximately 12.2 miles (mi) (19.6 kilometers [km]) within the State of New York and includes two 345-kV cable circuits.

The POI will be located on a parcel located along Hampton Road in Oceanside, within the Town of Hempstead, New York. The POI facilities (referred to herein collectively as the Hampton Road substation) will include both 345-kV and 138-kV substation facilities. The Applicant is proposing to permit all of these facilities, as well as the 138-kV "loop-in / loop-out" lines that will connect the substation facilities to two existing 138-kV cable circuits located under Lawson Boulevard owned by the Long Island Power Authority (LIPA) and operated by PSEG Long Island (PSEG-LI). LIPA will own and PSEG-LI will operate these loop-in / loop-out lines and the 138-kV facilities at the Hampton Road substation site. The ownership and/or operation of the 345-kV facilities at the Hampton Road substation will be determined through a mutually acceptable Interconnection Agreement between the Applicant and LIPA, as developed through the New York Independent System Operator, Inc. (NYISO) interconnection process. This application is being submitted to the Commission pursuant to Article VII of the PSL for the portions of the EW 2 Project transmission system that are located within the State of New York (the NY Project). The onshore portion of the NY Project will be located entirely within Nassau County, New York.

The NY Project includes:

- Two three-core 345-kV high-voltage alternating-current (HVAC) submarine export cables located within an approximately 7.7-nautical mile (nm, 14.2-km)-long submarine export cable corridor from the boundary of New York State waters 3 nm (5.6 km) offshore to the cable landfall;
- A cable landfall in the City of Long Beach, New York;
- Two 345-kV onshore export cable circuits, each with three single-core HVAC onshore export cables within an approximately 1.6-mi (2.5-km)-long onshore export cable corridor from the cable landfall to the onshore substation;
- An onshore substation in the Village of Island Park, within the Town of Hempstead, New York, which will house major control components for the electrical system and perform functions such as voltage regulation, reactive power compensation, and harmonic filtering;

- Two 345-kV interconnection cable circuits, each with three single-core HVAC interconnection cables within an approximately 1.7-mi (2.8-km)-long interconnection cable corridor from the onshore substation to the Hampton Road substation;

- The new Hampton Road substation in Oceanside in the Town in Hempstead, New York, which will include substation facilities that will provide the necessary breaker arrays and 345-kV/138-kV transformers; and

- Four 138-kV loop-in / loop-out line cable circuits, located within an approximately 0.1-mi (0.2-km) long cable corridor from the Hampton Road substation to existing LIPA transmission lines located under Lawson Boulevard in Oceanside, New York.

This Exhibit provides a description of NY Project alternatives that were considered, along with associated mapping, in accordance with the requirements of 16 New York Codes, Rules and Regulations § 86.4.

3.2 Purpose and Need

The purpose and need for the EW 2 Project is to develop a commercial-scale offshore wind energy facility in the Lease Area with wind turbine generators, an offshore substation, and electric transmission cables making landfall in Long Beach, New York to support the achievement of New York's renewable energy mandates.

In August 2016, the NYSPSC adopted the Clean Energy Standard.[1] Under this standard, 50 percent of New York State's electricity must come from renewable sources of energy by 2030, with 2.4 gigawatts (GW) of electricity generated by offshore wind. In January 2019, a plan was proposed that would require 70 percent of New York's electricity to come from renewable sources by 2030 and 100 percent renewable by 2040. As part of this plan, 9 GW of electricity must come from offshore wind by 2035. In July 2019, the Climate Leadership and Community Project Act (CLCPA) was signed into law; the CLCPA adopts a comprehensive climate and clean energy legislation and requires 9 GW of offshore energy by 2035. On July 21, 2020, New York's second offshore wind procurement was announced, under which procurement the New York State Energy Research and Development Authority (NYSERDA) sought up to 2,500 MW of offshore wind. On January 13, 2021, Empire's 1,260-MW EW 2 Project was announced as a winning bidder in the State's competitive solicitation for Offshore Wind Renewable Energy Certificates. Governor Hochul announced that Empire Wind LLC and NYSERDA entered into the Offshore Wind Renewable Energy Certificate Purchase and Sale Agreement (PSA) on January 14, 2022. The PSA requires Empire to design, obtain permits and approvals for, build and operate the NY Project and to sell the Offshore Renewable Energy Certificates generated to NYSERDA.

The NY Project is needed to meet Empire's obligation to NYSERDA to generate approximately 1,260 MW of clean, renewable electricity from an offshore wind farm located in the Lease Area for delivery into the New York State power grid at Oceanside, New York. The NY Project is an essential element in addressing the need identified by New York State for renewable energy and will help the State achieve its CLCPA mandate and other renewable energy goals.

3.3 Alternatives Analysis Methodology

The Applicant conducted a detailed analysis of NY Project alternatives to connect the offshore Lease Area to the POI. The Applicant evaluated siting alternatives for the submarine export cable route, onshore substation location, export cable landfall, and onshore export and interconnection cable routes to interconnect with the POI at the Hampton Road substation. Additionally, the Applicant evaluated siting alternatives for the loop-in

[1] Case 15-E-0302 & Case 16-E-0270, (NYSPSC 2016)

/ loop-out line lines that will connect the POI to LIPA's existing 138-kV transmission lines. Each alternative was assessed relative to constructability, reliability, environmental resources, and stakeholder impact criteria. Although each component is discussed separately, the siting process was undertaken holistically relative to submarine and terrestrial constraints in order to identify the most feasible and reasonable overall solution to deliver energy from the Lease Area to the grid, with the fewest negative impacts. The evaluation was informed by several factors, including desktop assessments, site-specific surveys, supply chain capacity, commercial availability, and engagement with regulators and stakeholders (a summary of stakeholder outreach and engagement is provided in **Appendix A: Agency Outreach and Correspondence**).

A high-level assessment of offshore constraints was conducted based on GIS data to identify the most feasible potential submarine export cable routes between the Lease Area and a cable landfall on the south shore of Long Island in Nassau County, New York. A siting comparison of the potential submarine export cable routes was then conducted. Section 3.5 summarizes the analysis and results for the identified submarine export cable alternatives within the boundaries of New York State waters. Submarine export cable route alternatives within federal waters are also considered as part of the Applicant's Construction and Operations Plan (COP) submitted to BOEM in January 2020, and subsequent revisions. The COP became publicly available following BOEM's issuance of a Notice of Intent to prepare an environmental impact statement in June 2021.

The Applicant also assessed the suitability of parcels near the POI for the development of a new onshore substation. The onshore substation will facilitate the connection, in accordance with electric grid interconnection standards, of the power generated by the offshore wind farm into the Oceanside POI at the Hampton Road substation.. The onshore substation functionality includes voltage regulation, reactive power compensation, and harmonic filtering. The onshore substation will also house the major control components for the electrical system. A discussion of cable voltage alternatives is provided in Section 3.10.3. In addition, the onshore substation will have operator stations and network equipment to control and monitor systems for the offshore Empire Wind 2 Project (the primary control room will be located at the Applicant's offsite Operation and Maintenance Base in Brooklyn, NY). Discussion of onshore substation alternatives is provided in Section 3.7.

To identify the potential cable landfall alternatives for the submarine export cable route, the Applicant conducted a coastal and waterfront engineering analysis of the risks and benefits of potential cable landfall locations at sites in the vicinity of the POI. This analysis was also informed by the submarine export cable routing analysis, which included geophysical, geotechnical, and benthic surveys.

Once the submarine export cables make landfall, they transition to onshore export cables to transport power from the cable landfall to the onshore substation. Interconnection cables leave the onshore substation underground to deliver power to the POI at the Hampton Road substation. The "onshore cable route" refers to the complete route traversed by the onshore export and interconnection cables between the export cable landfall and the POI at Hampton Road substation. The Applicant also assessed routes for the loop-in / loop-out lines to connect the POI to LIPA's existing 138-kV transmission lines. Within each of the alternatives assessments, the Applicant defined selection criteria and then compared the alternatives to determine the best overall, proposed alternative.

In addition to evaluating NY Project siting alternatives, the Applicant also considered the use of alternative technologies. This analysis considered alternative technologies for substation design, submarine export cable current type, cable landfall installation, submarine asset crossing methodology and onshore transmission (overhead versus underground). These alternative technologies were assessed relative to factors of technological feasibility, cost, and environmental impact, where applicable.

3.4 No Action Alternative

Under the No Action Alternative, the NY Project would not be built, the PSA contract between Empire and NYSERDA would not be fulfilled, and the NY Project's purpose to generate and deliver to New York renewable energy from the offshore wind farm in the Lease Area in furtherance of New York's renewable energy mandates and goals would not be met. The NY Project is designed to contribute to meeting the CLCPA's mandate that 70 percent of New York State's electricity is derived from renewable sources, including 2.4 GW from offshore wind by 2030, and 9 GW of offshore wind capacity by 2035. In the absence of the NY Project, New York's energy generation requirements would need to be met with other energy sources, potentially including more expensive renewable resources or even non-renewable energy options inconsistent with the CLCPA's mandate and New York's other clean energy goals. Additional information on the various economic benefits of the NY Project that would not be realized under a No Action Alternative are detailed in **Exhibit 6: Economic Effects of Proposed Facility**. Because it does not meet the NY Project purpose, the No Action Alternative is not a reasonable alternative and is eliminated from further consideration.

3.5 Submarine Export Cable Route Alternatives

Based on the selection of a POI in the proposed Hampton Road substation in Oceanside, New York, an analysis of offshore routing constraints was the first step in submarine export cable route assessment to identify potential submarine export cable routes between the Lease Area and the POI, to assess feasibility, and to understand potentially significant challenges along each route. After establishing potential alternative submarine export cable routes based on the constraints analysis, alternatives were further evaluated against selection criteria based on data from geophysical and geotechnical survey results and stakeholder input (e.g., United States Coast Guard [USCG], New York Harbor Operations Committee, United States Army Corps of Engineers [USACE], National Oceanic and Atmospheric Administration's [NOAA's] National Marine Fisheries Service, and commercial fishing). Further route refinements were made as detailed data were acquired along the potential submarine export cable routes.

The submarine export cable route begins where the route crosses into state waters 3 nm (5.6 km) offshore. The portions of the EW 2 Project outside of New York waters will be separately reviewed by BOEM and other agencies/stakeholders as part of the Applicant's COP. Alternatives described in the remainder of this Exhibit are limited to NY Project facilities (i.e., facilities within New York).

3.5.1 Offshore Constraints Analysis

The Applicant compiled data on available constraints and plotted this data along with information on the seabed from past surveys. **Figure 3.5-1** and **Figure 3.5-2** provide an overview of the offshore constraints analysis conducted for the NY Project's submarine export cable route.

The offshore routing constraints considered in the identification of potential NY Project route alternatives include:

- Segment length;
- Installation constraints and complexity, including water depth, slopes, and seabed features;
- Ability to adequately bury and protect the cable;
- Avoidance or minimization of anthropogenic hazards to cable installation and operations, and use conflicts (e.g., existing utility crossings, dredged and maintained channels, anchorages and de facto anchoring areas, vessel traffic separation schemes (TSSs), precautionary areas, safety and security regulated areas, charted danger zones, disposal areas, sand borrow areas);

- Avoidance of biological and cultural resources (e.g., eelgrass, shipwrecks); and
- Avoidance of high-use commercial and recreational fishing grounds.

Safety fairways and unexploded ordinance (UXO) areas were also considered in the offshore constraints analysis, although these are not present as mapped areas along the route alternatives in **Figure 3.5-1** and **Figure 3.5-2.**

In considering segment length, the most direct submarine export cable route served as the starting point in developing the export cable route. This is driven by technical constraints and costs, including cable costs, installation time, and limits associated with efficient HVAC transmission. Discussion regarding high-voltage direct current (HVDC) as an alternative for cable technology is provided in Section 3.10.

3.5.1.1 Installation Complexity and Cable Burial

Both regional bathymetry datasets (NOAA 2015) and project-specific high-resolution geophysical (HRG) survey data were collected to analyze general seabed conditions and specific seabed-related risks along the potential submarine export cable routes. These have allowed for routing to minimize traversing steeper seabed slopes and areas of complex seabed due to scour, mobile seabed, potential hardgrounds, or anthropogenic dredged channels. Steep slopes and abrupt changes in depth can pose a risk to cable installation and burial, as seabed cable burial tools are susceptible to stability issues and decreased burial potential as slopes increase. Areas of very shallow water also pose a challenge to the installation because a cable vessel suitable to install this type of cable typically requires an adequate draft to safely maneuver.

3.5.1.2 Cable and Pipeline Crossings

Existing utilities and other assets pose several challenges and risks with respect to the submarine export cables and may limit the methods and depth of burial available for a cable installation at the crossing. This may add cost and complexity to the installation, as well as residual risks to the installed cable from reduced burial in the area, the installation of external protection, and/or from maintenance activities for the existing asset. As such, cable crossings and close parallels are minimized to the extent feasible by the routing (see **Exhibit E-5: Effect on Communications** and **Exhibit E-6: Effect on Transportation** for additional information on existing offshore infrastructure).

3.5.1.3 Dredged and Maintained Channels

Dredged and maintained channels are under the purview of the USACE. The location and depths of navigation channels are authorized by the federal government, and the USACE periodically performs condition surveys to identify when maintenance dredging may be needed to keep the channel available at the authorized depth.

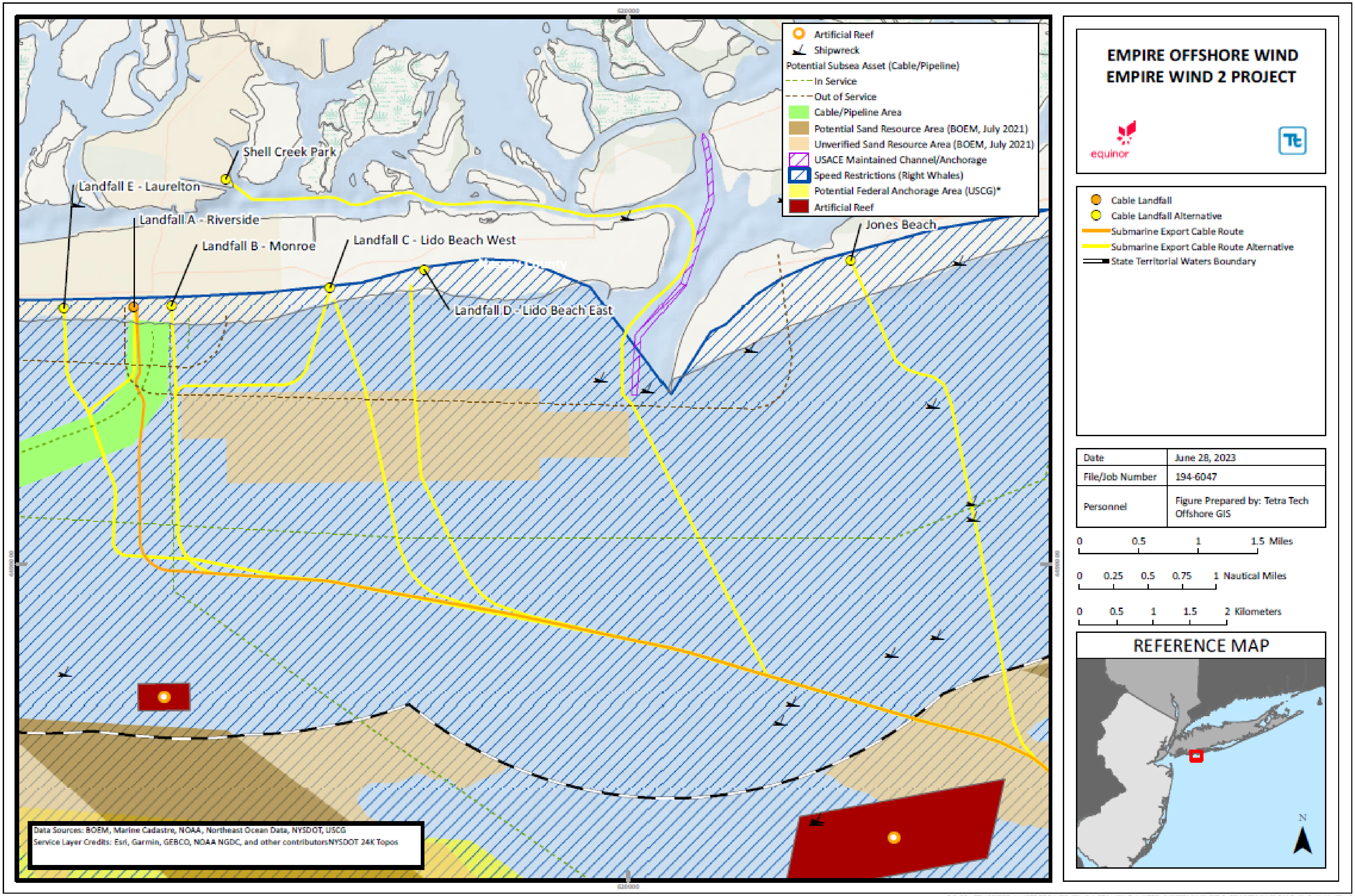


Figure 3.5-1 Submarine Export Cable Routing Constraints Analysis

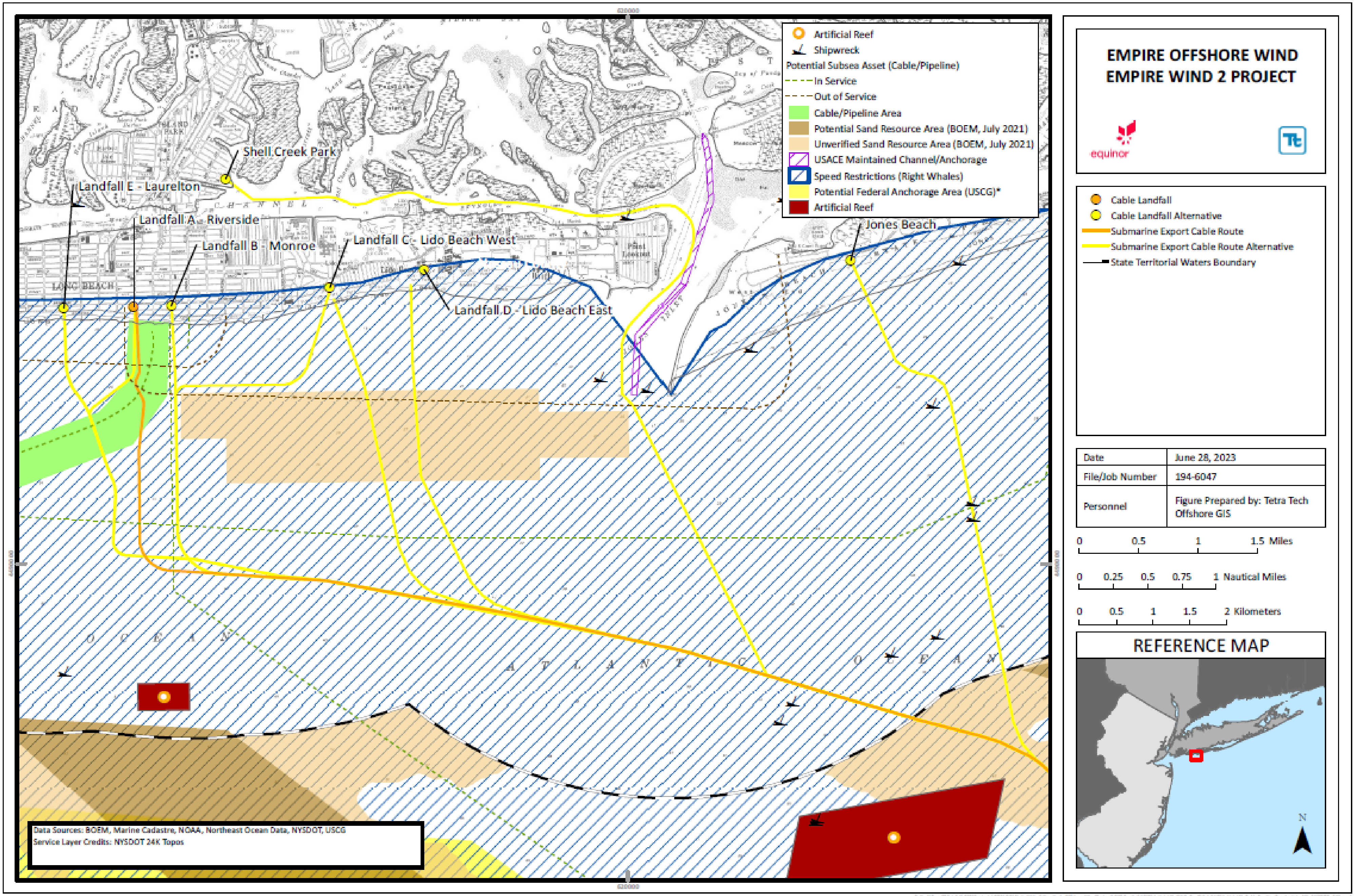


Figure 3.5-2 Submarine Export Cable Routing Constraints Analysis – NYSDOT Mapping

Should a cable route cross a maintained channel, the cable must be buried deep enough below the authorized depth to ensure that the channel can be safely maintained and to ensure that there is no risk to the cable. Although few vessels anchor in maintained channels, there is some risk that in an emergency, large vessels transiting the area may need to anchor there. Large vessels have greater anchor penetration. Maintained channels also may be subject to potential future maintenance dredging or deepening of the channel to allow use by larger vessels. To mitigate risk of impact to the submarine export cables from emergency anchoring, target burial depth in these areas will be informed by a cable burial risk assessment (CBRA). While cable burial depth can be used to mitigate risks of external aggression due to anchoring, the increase in depth required greatly increases installation time, complexity and cost. Very deep cable burial can be impractical as it leads to thermal issues and potential overheating of the cable, as well as causing greatly increased installation time and complexity. As such, the intersection with federally maintained channels is avoided to the extent practicable by the submarine export cable routing.

3.5.1.4 Anchorages

Some anchorages are federally designated and under the purview of the USACE. Other anchorages are managed by the USCG and the Port Authority of New York and New Jersey (PANYNJ). Anchoring areas may also exist in areas where vessels await their turn in the queue to enter the New York harbor area or are on standby for orders on the next destination; one such ad-hoc anchorage is located to the east of the NY Project Area. Vessel captains may anchor in a location out of habit rather than per specific instruction, making these "de-facto anchorages" difficult to fully regulate. Automatic Identification System (AIS) data from the vicinity of the NY Project gives an indication of the frequency and distribution of anchoring across the area and provides a first-order constraint on these risks. The USACE may directly require increased cable burial depths within federally designated anchorages and the USCG may also make recommendations for anchorage crossings.

Anchorages may be used primarily by smaller vessels, where anchor penetration is expected to be less than that of the large vessels more common within maintained channel areas. Other vessels, including articulated tug and barge vessels, may also anchor in anchorages. To mitigate the potential risk of impact to the submarine export cables from anchor strike, target burial depth within anchorages is informed by the CBRA considering anchor penetration depth. Although the Applicant can mitigate anchoring risk through the appropriate target burial depth, the increase in depth required in these areas by the CBRA typically results in greater installation complexity, duration and cost. Some of these areas may also be subject to potential future maintenance dredging or deepening to allow use by larger vessels. Therefore, crossing either designated anchorages or de-facto anchoring areas is avoided to the extent feasible in siting the submarine export cable route.

3.5.1.5 Traffic Separation Schemes (TSSs)

TSSs are commonly used to identify and constrain inbound and outbound traffic lanes, typically with a separation zone between, to minimize the likelihood of vessel collisions. These traffic lanes are considered from a cable routing perspective for two reasons. First, there is an increased level of activity in these areas, so the risk of an anchor drag or other mishap causing external aggression to a cable is greater. Second, the increased vessel traffic poses a concern and potential complication during cable installation operations.

Although the identified TSSs in the vicinity of the NY Project are located outside of New York State territorial waters, the presence of TSSs between the Lease Area and the cable landfall area provides a constraint on the submarine cable route in federal waters that also limits the potential locations where the route can cross the New York boundary.

Charted Danger Zones, Restricted Areas, and Warning Areas exist for a variety of reasons and serve to advise mariners and other users of the risks of navigating an area or conducting some type of bottom contacting activity, such as fishing or cable laying. For these reasons, traversing charted danger zones is avoided to the extent practicable. Where avoidance is not entirely possible, residual risk is analyzed and mitigated.

3.5.1.6 Ocean and Dredged Material Disposal Areas

Similarly, charted Disposal Areas warn of the risk associated with traversing an area of seabed. While some areas may contain relatively harmless material such as dredged spoils from maintained channels, others may contain "Acid Wastes" (an industrial byproduct), "Municipal Waste" (a sewage treatment product), or munitions. Additionally, material removed to maintain navigable channels may be deposited within ocean disposal sites, some of which may be later utilized for beach nourishment projects depending on the material and need. For these reasons, the traverse of ocean disposal and dredged material disposal areas is avoided by the submarine export cable routing.

3.5.1.7 Sand Borrow Areas

Sand borrow areas serve as source regions for beach nourishment projects, which are part of coastal resiliency measures. BOEM's Marine Minerals Program works to manage sources of material to mitigate and replenish coastline and related terrain lost to erosion. Additionally, both New York and New Jersey have identified Sand Resource Areas, which are areas deemed to have some likelihood to be used as a sand resource (MMIS 2019). Sand Resource Areas are leased or authorized for use by BOEM in federal waters and by the USACE in state waters, as necessary, for mitigation of coastal erosion and storm damage restoration. Major damage from the impact of Superstorm Sandy brought attention to the need for sand resources off New York State (BOEM 2014). The submarine export cable route has been sited to avoid known active sand borrow areas and potential sand resource areas to the extent practicable.

The waters in the vicinity of the submarine export cable route also contain evidence of areas formerly used for offshore sand and aggregate dredging for fill and construction. Other locations have been used for placement of materials, including Hoffman and Swinburne Island, which were both built using fill placed on natural shoals (NPS 2021). Some of these areas of historic fill or material extraction are no longer charted as such, but historic use has impacted the modern seabed features (USACE 1983). These areas are avoided to the extent practicable, as previous disturbances of the seabed often cause locally steeper slopes, enhance the formation of mobile seabed, and may have exposed underlying soils more challenging to cable burial.

3.5.1.8 Shipwrecks and Obstructions

Shipwrecks and other obstructions are cataloged in the NOAA Nautical Charts and within the NOAA Automated Wreck and Obstruction Information System database. These features may represent physical hazards to installation as well as being potentially historically or culturally significant. These features are avoided to the extent practicable by the submarine export cable routing. Where such features must be closely approached, the HRG survey provides insight into the location and nature of the feature through acoustic and magnetic datasets. Known and suspected shipwrecks and obstructions have been avoided to the extent practicable during pre-survey routing and subsequently refined following the acquisition of HRG survey data. Identified features and recommended buffer distances will be defined through review of the HRG survey data by a qualified marine archaeologist (see Section 4.8 of **Exhibit 4: Environmental Impact**) and the routes will be further micro-sited, if needed.

3.5.1.9 Biological Resources

The Applicant has minimized traversing sensitive habitats along the submarine export cable route to the extent feasible, including benthic habitats such as seagrasses and habitats supporting protected and commercially important species (see Sections 4.6 and 4.7 of **Exhibit 4**). The submarine cable route will be required to cross a Seasonal Management Area for Right Whales, where vessel speed restrictions are in place. Project-related vessels will comply with NOAA National Marine Fisheries Service speed restrictions as described in Sections 4.6 and 4.7 of **Exhibit 4.**

3.5.1.10 Commercial and Recreational Fishing

Fishing areas, artificial reefs, and regions of sensitive benthic habitat (see Sections 4.6 of **Exhibit 4**) are also avoided by the submarine export cable routing to the extent practicable. Areas of increased fishing effort are often difficult to identify and quantify, due to the transient nature of the activity. The Applicant has incorporated information from marine stakeholders in the submarine export cable route selection. Artificial reefs and fish havens are charted and are avoided by the submarine export cable route to the extent practicable, due to their potential to be a seabed hazard and out of a desire to minimize impacts on other seabed users.

3.5.2 Submarine Export Cable Route Alternatives Analysis

Based on results of the offshore constraints analysis, the Applicant evaluated eight submarine cable route alternatives in New York State waters for the NY Project (**Figure 3.5-3** and **Figure 3.5-4**), plus one route combination that uses two separate cable landfall locations. The submarine export cable routes evaluated within state waters are associated with assessment of different cable landfall alternatives (see Section 3.6). Although the offshore constraints evaluation and submarine export cable route evaluation are provided here separately, the ability to construct the associated cable landfall installation was also a factor in this submarine export cable route evaluation. The eight submarine cable route alternatives are described in this section. A description of the offshore and nearshore constraints evaluated is provided in Section 3.5.1.

3.5.2.1 Submarine Export Cable Route Alternative A (Applicant's Proposed)

Submarine export cable route alternative A extends a total length of 7.7 nm (8.8 mi, 14.2 km) from cable landfall Alternative A to the New York State boundary. The route crosses into New York State due south of Jones Beach, heading northwest, before turning directly north towards Riverside Boulevard in the City of Long Beach.

Submarine export cable route alternative A requires crossing a total of three existing, two planned, and two out-of-service submarine utilities, including the existing Transco Lower New York Bay Lateral (LNYBL), a 26-inch diameter natural gas pipeline approximately 3,037 ft (0.9 km) from shore, as well as the HVDC Neptune Power Transmission Cable and the FLAG Atlantic Telecoms cable (**Figure 3.5-1** and **Figure 3.5-2)**. The planned utilities are the Wall, New Jersey to Long Island (Wall-LI) telecommunications cable and the Poseidon transmission cable. These utility crossings are expected to involve the use of hard substrate cable protection measures on the seafloor (e.g., rock berm, concrete mattresses, etc.).

The most challenging aspect of the nearshore routing at this location is the potential Transco LNYBL crossing in shallow water. The Applicant evaluated trenched asset crossing solutions for this crossing as well as trenchless horizontal directional drilling (HDD) crossing solutions. HDD solutions included:

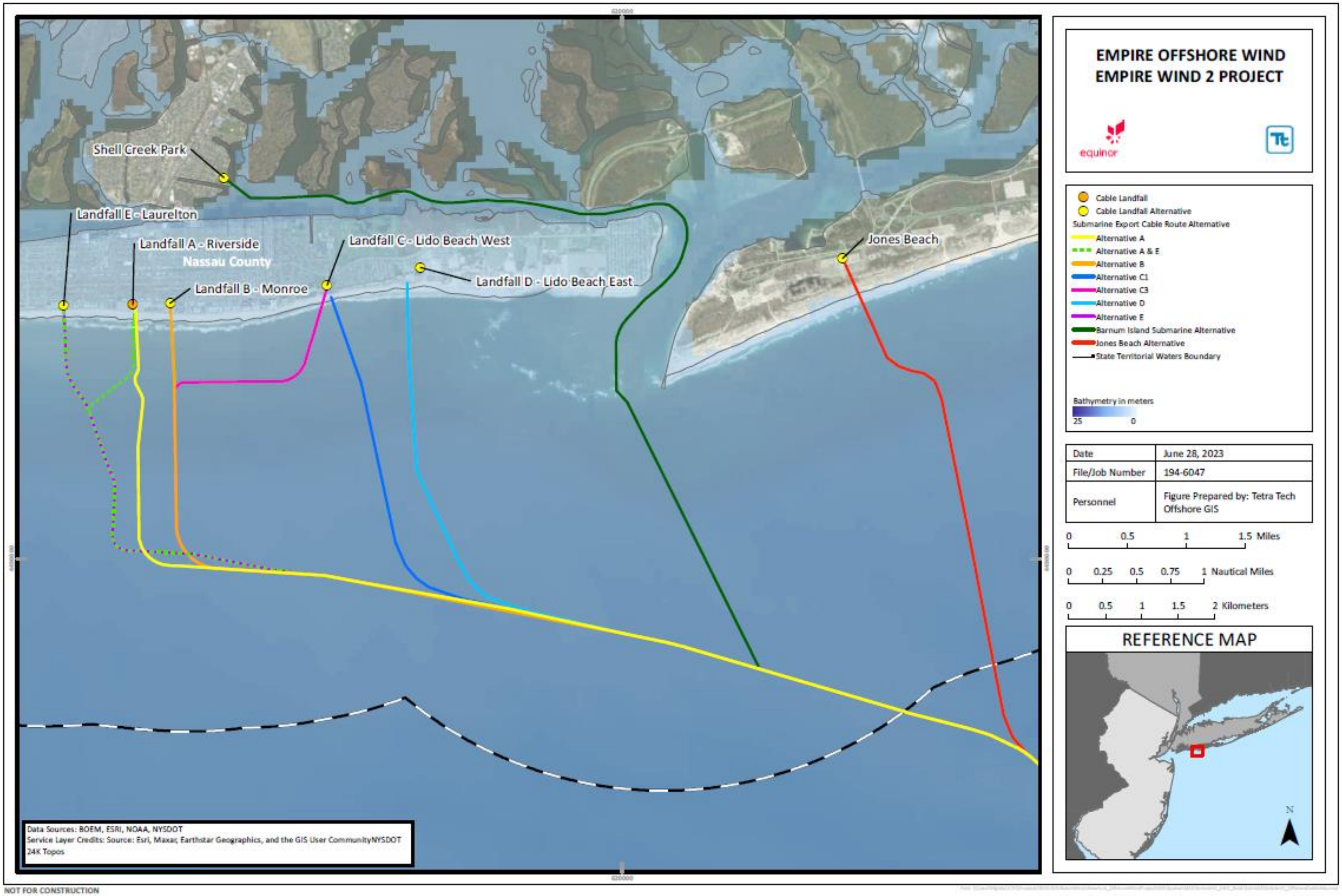


Figure 3.5-3 Submarine Export Cable Route Alternatives

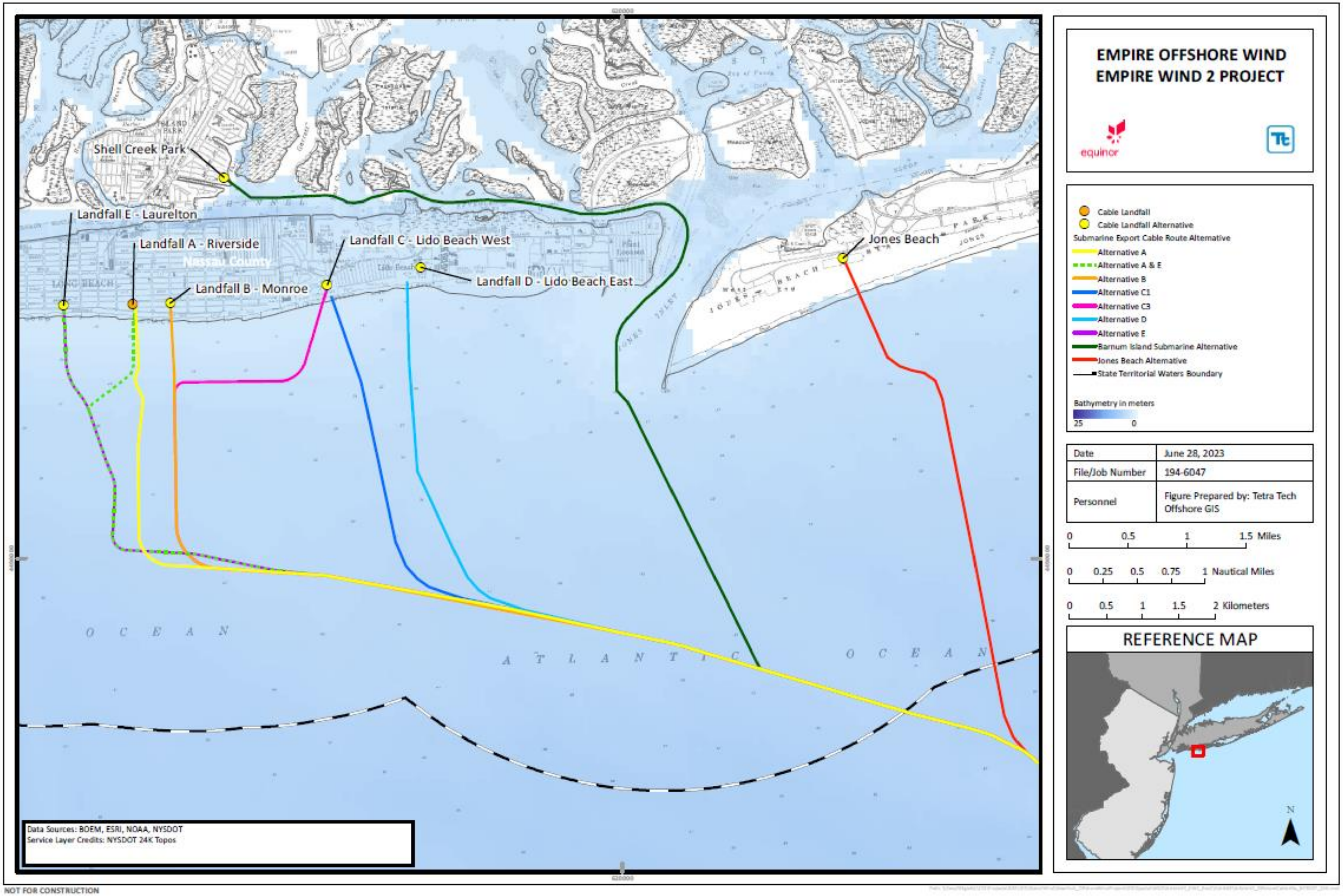


Figure 3.5-4 Submarine Export Cable Route Alternatives – NYSDOT Mapping

- Extending the export cable landfall HDDs at alternative A to approximately 5,000 ft (1,500 m) and including the Transco LNYBL crossing as part of the landfall; or
- Completing separate, shorter, water-to-water HDDs underneath the Transco LNYBL pipeline, with shorter (1,650 ft to 3,280 ft [500 m to 1000 m]) trenchless cable landfall segments exiting to the north of the Transco LNYBL crossing.

HDD crossings of the Transco LNYBL pipeline have the additional benefit of reducing the length of jetting impact to the seafloor along the submarine export cable route; however, both of these trenchless options were eliminated from consideration due to the risks associated with drilling underneath an active natural gas pipeline, length of the drill, cable rating and pull-in considerations. The length of the installation to extend the cable landfall past the pipeline crossing would be too great for the technical limitations of an HDD at this location, given geotechnical and ground conditions, environmental risk, cable rating, and other factors. Given the potential for sandy and mobile sediment in the vicinity of the export cable landfall, which increases the risk of inadvertent returns of drilling fluid, undermining of the sediments surrounding the pipeline, and uncertainty of the drill path, HDD crossings of the Transco LNYBL were deemed unreasonable.

A trenched crossing design was also evaluated at the Transco LNYBL crossing location, approaching cable landfall alternative A. The area of the crossing is expected to have medium to high fishing activity and water depths of approximately 31 ft (9.5 m). To reduce the potential conflict with fishing activities and ensure sufficient cover and protection over the submarine export cables at the Transco LNYBL crossing location, either rock berm or concrete mattress protection over the cables is required. Evaluation of crossing options indicated that up to approximately 7 ft (2 m) of shoaling will result from each pipeline crossing. Shoaling decreases the water depth above the seafloor, which may result in navigational impacts and reduce the accessibility of the area to deeper-draft vessels.

Utilizing the Northeast Ocean Data Portal (2021 dataset) and Automatic Identification System (AIS) data, an initial characterization of vessel traffic within the area of the Transco LNYBL pipeline crossing, which occurs less than 1 nm offshore cable landfall alternative A, identified the presence of pleasure craft, sailing vessels, passenger vessels, tug and tow vessels, and fishing vessels (listed in order of most frequent to lowest occurrence). Average vessel lengths are approximately 72 to 79 ft (22 to 24 m) with an average of approximately 12 ft (3.7m) draft. Traffic frequency crossing the area is one vessel approximately every one to two days. There were no identified cargo vessels or tanker vessels within the area of the crossing.

Pre-installation, localized dredging over the pipeline, either with mass flow excavation (MFE) or diver-assisted dredging operations, could reduce shoaling height to some extent, but the existing depth of the pipeline is uncertain due to seabed dynamics, and both methods carry potential safety risks to the pipeline that requires further evaluation to determine feasibility. This method also may not be feasible due to the prohibitions or limitations on dredging by the asset owner. Therefore, available information cannot confirm that it is technically feasible to install the Transco LNYBL crossing with less than 7 ft (2 m) of shoaling.

During evaluation of potential submarine export cable routes to the landfall alternatives, the Applicant also considered avoidance of a Sand Resource Area that is located offshore of Lido Beach (**Figure 3.5-1**). The submarine export cable route (centerline) to cable landfall alternative A is located approximately 1,991 ft (607 m) west of the closest edge of the Sand Resource Area. The Sand Resource Area is approximately 1, 534 ft (468 m) from the edge of the siting corridor. Existing infrastructure (the FLAG Atlantic Telecoms cable) is located between submarine export cable route alternative A and the Sand Resource Area; therefore, installation of the submarine export cables along this route is not expected to result in any impacts to or new limitations on the use of the Sand Resource Area.

Submarine export cable route alternative A was determined to be a reasonable alternative for offshore cable installation to cable landfall alternative A. This alternative minimizes the submarine export cable route length when compared with submarine export cable route alternative C3, alternative E and alternative A+E, while reducing potential impacts to the Sand Resource Area and associated regulatory challenges. Therefore, submarine export cable route alternative A and associated cable landfall alternative A (Section 3.6.3.1) were selected as the Applicant's proposed alternatives.

3.5.2.2 Submarine Export Cable Route Alternative B

The submarine export cable route to cable landfall alternative B would extend a total length of 7.3 nm (8.4 mi, 13.6 km) from cable landfall alternative B to the New York State boundary. The route begins the same as submarine export cable route alternative A, entering New York State due south of Jones Beach and heading northwest. However, this route turns due north approximately 0.5 mi (0.8 km) east of submarine export cable route alternative A and makes landfall at Monroe Boulevard in the City of Long Beach.

This route would require crossing a total of one existing, two planned, and two out-of-service utilities, including crossing the existing HVDC Neptune Power Transmission Cable approximately 9,630 ft (2,940 m) from shore (**Figure 3.5-1** and **Figure 3.5-2)**. The submarine export cable route turns north before crossing the FLAG Atlantic Telecoms cable. The planned utilities are the Wall, New Jersey to Long Island (Wall-LI) telecommunications cable and the Poseidon transmission cable. As the route continues north towards cable landfall alternative B, submarine export cable route alternative B and its associated corridor are constrained by the FLAG Atlantic Telecoms cable to the west and the Sand Resource Area that is located to the east (**Figure 3.5-2**). This route alternative would avoid the Sand Resource Area, with the route centerline located approximately 223 ft (68 m) west of the closest edge of the Sand Resource Area.

Submarine export cable alternative B would avoid the shallow water crossings of the Transco LNYBL associated with alternative A and alternative E (see Sections 3.5.2.1 and 3.5.2.6). However, this route is not reasonable for the NY Project since it is located in proximity to the Sand Resource Area, similar to submarine export cable route alternative C3 (Section 3.5.2.4), and its associated cable landfall alternative is not reasonable (see Section 3.6.3.2).

3.5.2.3 Submarine Export Cable Route Alternative C1

The submarine export cable route alternative C1 approaches cable landfall alternative C along the most direct path. This submarine export cable route from the cable landfall to the New York State boundary has a total length of approximately 5.9 nm (6.8 mi, 11.0 km). The route begins the same as submarine export cable route alternative A, entering New York State due south of Jones Beach and heading northwest. This route turns northwest south of Lido Beach and continues to a cable landfall alternative C at Lido Beach West Town Park. Submarine export cable route alternative C1 crosses the identified Sand Resource Area approximately perpendicularly. This route also requires crossing a total of one existing, one planned and one out-of-service submarine utility (**Figure 3.5-1** and **Figure 3.5-2**, including crossing the existing HVDC Neptune Power Transmission Cable. The planned utility is the Poseidon transmission cable.

Based on several stakeholder meetings with the USACE, the Applicant understands that a submarine export cable route alternative that crosses the Sand Resource Area would pose regulatory challenges. With a standard target submarine export cable burial depth of 6 ft (1.8 m), the presence of the cables and their operational requirements would restrict dredging/use of the Sand Resource Area within an approximately 240-ft (73-m)-wide corridor along the submarine export cable route, bisecting the Sand Resource Area.

To avoid or minimize restrictions on dredging and future use of the Sand Resource Area, the Applicant also investigated several other export cable installation options along route alternative C1. One installation alternative considered was deeper burial of the submarine export cable. The Applicant assessed burial depth of 30 to 40 ft across the Sand Resource Area, based on feedback from the USACE on the depths that would be required to avoid interference with dredging operations.

The Applicant determined that with no pre-dredging to remove cover along the submarine export cable route, installation below 30 ft is not technically feasible. Under ideal sediment conditions, the maximum depth of installation with a vertical injector, which provides the deepest installation of industry-standard tools available, would be 29 ft (9 m); however, even achieving this lesser depth consistently under realistic field conditions cannot be assumed. As such, the Applicant determined that deep burial without pre-dredging cannot achieve the required depths due to technical limitations of the available installation tools.

The Applicant also considered a deeper burial solution that would require dredging along the cable corridor to remove sand and lower the seafloor prior to the installation of the submarine export cables. The Applicant determined that pre-dredging prior to cable installation would be challenging; due to the seabed mobility of the area, keeping the dredged area from backfilling prior to installation would be difficult. This could be exacerbated if seasonal timing restrictions increase the time between dredging and cable installation, and would require significant over-dredging to counteract, producing large dredge volumes even if the deepest burial tool (vertical injector) is used. It is estimated that dredging an 87-ft (27-m)-wide corridor, an area of 103,653 yd^2 (86,667 m^2), for the installation across the Sand Resource Area would be extremely costly, generate 837,787 yd^3 (640,534 m^3) of dredged material, and add over a year of work activity to the NY Project. Moreover, the dredged material would need to be disposed of or temporarily stored unless an immediate use is identified, which would not be practicable for large volumes of dredge material. The Applicant determined that the cost of dredging so large an area before cable installation is not viable for the NY Project. Finally, the depth of cover along the submarine export cable route post-installation would still not allow dredging to occur over the cables, so an approximately 240-ft no-dredge corridor would need to be applied for both cables, which would be inconsistent with USACE's future use of the area. This alternative would result in greater aquatic and sediment transport impact within the marine environment due to the significant additional dredging activity.

Another alternative evaluated by the Applicant for a deep crossing of the Sand Resource Area was use of the HDD installation method to traverse the area. Two general concepts for HDD crossings of the Sand Resource Area are 1) to include the Sand Resource Area within the export cable landfall and start the trenchless installation of the cable landfall on the south side of the Sand Resource Area, or 2) to install a separate water-to-water HDD across the Sand Resource Area, and then begin the installation of the export cable landfall on the north side of the Sand Resource Area, as proposed. The Applicant determined that to install the submarine export cables deep enough across the Sand Resource Area, the length of the installation would be too great for the technical limitations of an HDD at this location, given geotechnical and ground conditions, environmental risk, cable rating, and other factors. A length of 3,300 ft (1,000 m) is the approximate limit considered for the HDD installations at this location, and this would be exceeded by either option, since the width of the Sand Resource Area is approximately 4,100 feet (1,250 m); however, the HDDs would need to extend even further to the south to be able to reach the required depth of installation (30 to 40 ft) across the Sand Resource Area. Moreover, the longer an HDD installation, the deeper it needs to be at the bottom depth, which risks derating the submarine export cables due to thermal constraints. Derating reduces the current the cable is able to carry, to prevent degradation of the cable insulation due to heat.

In summary, based upon evaluation of various methods of crossing the Sand Resource Area, the Applicant determined that submarine export cable route alternative C1 is not a reasonable solution for the NY Project due to its crossing of the Sand Resource Area. A standard target burial depth across the Sand Resource Area is expected to result in unacceptable restriction to the future use of the Sand Resource Area and present regulatory hurdles for the NY Project. Other installation methods, including deeper burial or HDD installations across the Sand Resource Area, are technically infeasible due to limitations on the available technology, or in the case of pre-dredging, unreasonable due to cost, logistical challenges and environmental impacts.

3.5.2.4 Submarine Export Cable Route Alternative C3

Submarine export cable route alternative C3 extends a total length of 8.3 nm (9.6 mi, 15.4 km) from the New York State boundary to cable landfall alternative C. This submarine export cable route alternative would require crossing a total of one existing, two planned and one out-of-service submarine utilities, including crossing the existing HVDC Neptune Power Transmission Cable approximately 10,990 ft (3,350 m) from shore (**Figure 3.5-1** and **Figure 3.5-2)**. The planned utilities are the Wall, New Jersey to Long Island (Wall-LI) telecommunications cable and the Poseidon transmission cable.

This alternative routes around the western side of the Sand Resource Area. The submarine export cable route and the trenchless landfall installation would also be constrained by the FLAG Atlantic Telecoms cable, located immediately to the west of this landfall alternative, but will be appropriately offset. Due to the constraints of routing between the Sand Resource Area and the FLAG Atlantic Telecoms cable, the centerline of this route is located approximately 176 ft (54 m) from the closest edge of the Sand Resource Area. Considering space requirements for installing two cables and the FLAG Atlantic Telecoms cable, the edge of the submarine export cable corridor required for installation is approximately 49 ft (15 m) from the Sand Resource Area at its closest point.

The Applicant determined that submarine export cable route C3 is a reasonable alternative, as it avoids the shoaling and potential navigational impacts associated with shallow waters at the Transco LNYBL crossing and minimizes potential onshore impacts to residents associated with the cable landfall alternative (see Section 3.6.3.3), such as noise and traffic impacts. However, submarine export cable route alternative C3 has additional regulatory challenges associated with proximity to the Sand Resource Area, as well as an overall longer submarine export cable route compared to the proposed alternative (submarine export cable route alternative A).

3.5.2.5 Submarine Export Cable Route Alternative D

The submarine export cable route to cable landfall Alternative D extends a total length of 5.7 nm (6.5 mi, 10.5 km) from the cable landfall to the New York State boundary. The route begins the same as that of submarine export cable route alternative C1, entering New York State due south of Jones Beach and heading northwest. However, this route turns to the northwest further east than submarine export cable route Alternative C1 and continues to a cable landfall at Lido Beach Town Park. Submarine export cable route alternative D crosses the identified Sand Resource Area approximately perpendicularly. This route requires crossing a total of one existing, one planned submarine and one out-of-service submarine utility, including crossing the existing HVDC Neptune Power Transmission Cable approximately 11,614 ft (3,540 m) from shore (**Figure 3.5-1** and **Figure 3.5-2)**. The planned utility is identified as the planned Poseidon transmission cable.

Installation and operational requirements would restrict future dredging/use of the Sand Resource Area within the submarine export cable corridor. Based on feedback from USACE, the Applicant understands that a submarine export cable route alternative that crosses the Sand Resource Area will pose regulatory challenges. Options to avoid or minimize impact to the Sand Resource Area are similar to those described for alternative C1 in Section 3.5.2.3.

In summary, based upon evaluation of various methods of crossing the Sand Resource Area, the Applicant determined that submarine export cable route alternative D is not a reasonable solution for the NY Project due to its crossing of the Sand Resource Area. A standard target burial depth across the Sand Resource Area is expected to result in unacceptable restriction to the future use of the Sand Resource Area and presents regulatory hurdles for the NY Project. Other installation methods, including deeper burial or HDD installations across the Sand Resource Area are technically infeasible due to limitations on the available technology, or in the case of pre-dredging, unreasonable due to cost, logistical challenges, and environmental impacts. Submarine export cable route alternative D also has disadvantages associated with being a longer onshore export cable route.

3.5.2.6 Submarine Export Cable Route Alternative E

The submarine export cable route to cable landfall alternative E extends a total length of 7.9 nm (9.1 mi, 14.6 km) from the New York State boundary to shore. The route begins the same as submarine export cable route Alternative A, entering New York State due south of Jones Beach and heading northwest. However, this route continues a little farther to the west, before turning north towards Laurelton Boulevard in the City of Long Beach. Similar to the submarine export cable route to landfall alternative A, this route requires crossing a total of three existing, two planned and one out-of-service submarine utilities, including crossing the existing Transco LNYBL approximately 4,593 ft (1.4 km) from shore, the HVDC Neptune Power Transmission Cable, and the FLAG Atlantic Telecoms cable (**Figure 3.5-1** and **Figure 3.5-2)**. The planned utilities are the Wall, New Jersey to Long Island (Wall-LI) telecommunications cable and the Poseidon transmission cable. These utility crossings are expected to involve the use of hard substrate cable protection measures on the seafloor (e.g., rock berm, concrete mattresses, etc.

As previously described for submarine export cable route alternative A (see Section 3.5.2.1), challenges exist for crossing the Transco LNYBL along the submarine export cable route approaching alternative E. However, for alternative E, the Transco LNYBL crossing is located farther offshore due to the alignment of the existing pipeline. As with the submarine export cable route to cable landfall alternative A, HDD crossings of the Transco LNYBL are impracticable due to the risks associated with drilling underneath an active natural gas pipeline, length of the drill, cable rating and pull-in considerations. A trenched crossing design could result in up to approximately 7 ft (2 m) of shoaling.

The Applicant also considered avoidance of the Sand Resource Area that is located offshore of Lido Beach (**Figure 3.5-1**). As the westernmost route evaluated, the centerline of the submarine export cable route approaching alternative E would be approximately 3,539 ft (1,079 m) from the closest edge of the Sand Resource Area. Existing infrastructure (the FLAG Atlantic Telecoms cable) is also located between Alternative E and the Sand Resource Area; therefore, installation of the submarine export cables along this route is not expected to result in any impacts to or new limitations on the use of the Sand Resource Area.

Similar to submarine export cable Alternative A, submarine export cable E was determined to be a reasonable alternative for offshore cable installation but has challenges associated with the nearshore and onshore characteristics and the potential impacts of the cable landfall, as described in Section 3.6.3.5. The route to cable landfall alternative E is longer than the proposed alternative route, and therefore results in a greater length of installation within the marine environment.

3.5.2.7 Submarine Export Cable Route Alternative A+E

Cable landfall alternative A+E is a combination that uses the cable landfall areas both at alternative A (as described in Section 3.6.3.1) and alternative E (as described in Section 3.6.3.5). Under this cable landfall alternative, one submarine export cable makes landfall at the alternative A location, and one submarine export cable makes landfall at the alternative E location.

For Alternative A+E, the submarine export cable routes are adjusted so that both submarine export cables cross the Transco NYLBL at one location in parallel, before splitting into separate routes to each of the respective cable landfalls (**Figure 3.5-1** and **Figure 3.5-2)**. North of where the route splits to the north of the Transco NYLBL crossing, the submarine export cable corridor to cable landfall alternative A is approximately 300 ft (91 m) wide, and the submarine export cable corridor to cable landfall alternative E is approximately 300 ft (91 m) wide.

The use of two separate submarine export cable routes/corridors spreads the impacted area within the marine environment over a greater area instead of aligning both submarine export cables in parallel along a single corridor. Co-locating cables along a single corridor and alignment is generally considered to minimize the extent of environmental impacts, and alternative A+E will have a slightly longer submarine export cable route than the proposed alternative. Because of this, as well as additional regulatory and commercial challenges with the use of two cable landfalls (see Section 3.6.3.6) for the NY Project, submarine export cable route alternative A+E is a reasonable alternative but is not preferred over the proposed alternative (Alternative A).

3.5.2.8 Barnum Island Submarine Export Cable Route Alternative

The Barnum Island submarine export cable route alternative avoids an export cable landfall on the Long Beach barrier island, and instead the submarine export cables continue in-water through Jones Inlet and traverse west along Reynolds Channel on the north side of the barrier island. The submarine export cable route to Barnum Island extends a total length of approximately 8.5 nm (9.7 mi, 15.7 km) from the New York State boundary to shore. Like the other evaluated submarine export cable route alternatives, this route crosses into New York State south of Jones Beach, heading northwest. However, it soon turns more sharply north, towards the southwestern tip of Jones Beach, before turning northeast into Jones Inlet. Past Jones Inlet, the route turns nearly due west parallel to the northern side of the Long Beach barrier island, towards Barnum Island, where it makes landfall at Shell Creek Park.

Similar to submarine export cable route alternative D, the Barnum Island submarine export cable route alternative requires crossing a total of one existing, one planned and one out-of-service submarine utility, including the existing HVDC Neptune Power Transmission Cable. The planned utility is the Poseidon transmission cable. The Applicant also considered avoidance of the Sand Resource Area that is located offshore of Lido Beach (**Figure 3.5-1**). Due to the proximity of the eastern end of the Sand Resource Area to the western tip of Jones Beach, the narrow entrance to Jones Inlet, and the need to avoid identified shipwrecks west of Jones Beach, siting in this area is constrained and the centerline of the submarine export cable route is approximately 253 ft (77 m) to the east of the closest edge of the Sand Resource Area.

Technical challenges for the submarine export cable route include shallow waters, several identified shipwrecks, and vessel traffic near the mouth of Jones Inlet. Jones Inlet and the north side of the Long Beach barrier island also may have limited barge access due to bridges and narrow clearance. Shallow waters between Jones Inlet and the export cable landfall would require special shallow draft construction vessels for the cable installation, increasing the cost and complexity of installation activities.

Moreover, Jones Inlet and Reynolds Channel are maintained by dredging and maintenance activity for navigation. As such, cable burial would need to take into consideration de-risking future dredging operations, requiring deeper burial and more extensive disturbance along this route. The mouth of Jones Inlet itself is subject to high seabed mobility and erosion, which present logistical challenges for cable burial and protection.

Marine traffic data shows that vessel traffic is relatively high through Jones Inlet and along the north side of the Long Beach barrier island, so interference with marine traffic during construction is also of concern.

The Barnum Island submarine export cable route alternative is also associated with greater impacts within the marine environment than other alternative routes evaluated. At Jones Inlet, the submarine export cable route enters mapped Significant Coastal Fish and Wildlife Habitat in Middle Hempstead Bay (see Section 4.7 of **Exhibit 4**), considered one of the largest undeveloped coastal wetland systems in New York State, with a significant nesting habitat for coastal shorebirds and colonial wading birds, as well as being a productive area for marine finfish, shellfish, and other wildlife (NYSDOS 2008 a, b).

The Applicant's evaluation concluded that a submarine export cable route extending to Barnum Island is not a reasonable alternative, as it would result in greater impacts to the marine environment than the proposed alternative, including impacts to a Significant Coastal Fish and Wildlife Habitat. The Barnum Island submarine export cable route alternative also has significant logistical and feasibility challenges associated with construction of the submarine export cable route through Jones Inlet and in an area of high marine traffic along Reynolds Channel.

3.5.2.9 Jones Beach Submarine Export Cable Route Alternative

The Jones Beach submarine export cable route alternative avoids an export cable landfall on the Long Beach barrier island. Instead, from where the submarine export cable route crosses the New York State boundary 3 nm (5.6 km) offshore, this route alternative travels north-northwest towards Jones Beach. The submarine export cable route to Jones Beach extends a total length of approximately 3.4 nm (3.9 mi, 6.2 km) from the New York State boundary to shore.

As depicted on the nautical chart, the sediment along this route is primarily composed of sand with some sediment samples including shells. Therefore, the seabed composition along this route should generally be conducive for successful cable burial depending on seabed depths as shallow water increases complexity.

Overall, the depths gradually become shallower as the cable route approaches the beach, with the steepest change of 0 to 15 ft (0 to 5 m) across 0.18 nm (0.3 km) of water adjacent to the shoreline. These shallowest portions of the route would potentially be traversed by trenchless shoreline crossing methods (e.g., HDD) to allow the cable to punch out in deeper water further from the shoreline, both to reduce installation complexity and to reduce the impact of nearshore mobile seabed and scour to the installed cable, especially due to storm wave base during severe weather events. However, due to the setback from the shoreline to the onshore end of the potential trenchless method work site and beach vault in the existing parking lot, a longer trenchless crossing is needed. Longer trenchless crossings come with additional complexity, risk, and cost, and may require increased depth of the bore trajectory below ground, which increases risks of thermal implications for the cable during operations.

In the offshore region near the New York State boundary, water depths range between 45 to 55 ft (13.7 to 16.7 m). Approximately 2000 ft (600 m) north of the New York State Boundary and 2460 ft (750 m) west of the export cable route, there is a ENC charted dangerous shipwreck with a depth of 50.9 ft (15.5 m) identified in data from 2016. Approximately 2640 ft (805 m) west of the submarine export cable route and 500 ft (153 m) north-northwest of the ENC charted shipwreck, there is a dangerous AWOIS wreck. The AWOIS wreck is at the approximate position of a reported stone barge with a depth of 51 ft (15.5 m); however, subsequent investigation revealed a rock pile near this location instead of a stone barge. Additionally, a possible crane or skeletal tower with a depth of 51 ft (15.5 m) was discovered 165 ft (50 m) northwest of the AWOIS wreck location, which may or may not be associated with the original reports of the stone barge. Due to the proximity of the charted ENC and AWOIS shipwrecks to the submarine export cable route, there is a potential for physical hazards to the anchoring corridor and installation process.

Continuing north from the shipwrecks towards Jones Beach, the submarine export cable route crosses a buried utility (**Figure 3.5-1**). The utility is the HVDC Neptune Regional Transmission System (Neptune cable) and is nearly perpendicular to the submarine export cable route. The crossing is located approximately 1.78 nm (3.3 km) from the cable landfall and is at a depth of 44 ft (13.5 m). This crossing is expected to involve the use of hard substrate cable protection measures on the seafloor (e.g., rock berm, concrete mattresses, etc.). The protection measures are likely to cause some shoaling due to application of mattresses and/or rock above the current seabed elevation. Approximately 0.1 nm (185 m) north of the Neptune cable crossing, the route crosses the location of the planned Poseidon cable.

As the Jones Beach submarine export cable route begins to approach Jones Beach, the route diverts northwest between two charted Fish Trap Areas. The northeast corner of the western Fish Trap Area is approximately 50 ft (15 m) from the cable route. The southwest corner of the eastern Fish Trap Area is approximately 175 ft (53 m) from the cable route. The eastern and western Fish Trap Areas include a warning to mariners that numerous uncharted duck blinds and fishing structures, some submerged, may exist in the fish trap areas. The depth ranges along the export cable route near the western Fish Trap Areas are 29.5 to 50 ft (9 to 14 m). The depth ranges along the export cable route near the eastern Fish Trap Areas area 0 to 29.5 ft (0 to 9 m). Following the diversion from the Fish Trap Areas, the route continues north until it makes landfall on Jones Beach. The Fish Trap Areas and the associated shallow depths increase the complexity of the installation process. The Fish Trap Areas may have physical hazards with varying permeance due to the transient nature of fishing activities. Areas of very shallow water also pose a challenge to the installation operations, because a cable vessel suitable to install this type of cable typically requires an adequate draft to safely maneuver. In addition to limiting the options for installation vessels, it may limit the type of associated burial tools. Technical challenges for the Jones Beach submarine export cable route include the potential limitation to installation vessels and burial tools due to shallow waters as well as physical hazards to the installation process from identified shipwrecks and fish traps. A longer trenchless crossing of the shoreline will reduce installation challenges and reduce the risks associated with a punchout area in shallower water, with increased risk of seabed scour and mobility. However the longer trenchless crossing increases cost, risk during construction, and the potential for thermal constraints on the cable due to depth below the ground. The Jones Beach submarine export cable route was eliminated from further evaluation because the Applicant determined that the Jones Beach cable landfall and associated onshore routing (Section 3.6.3.7) are unreasonable NY Project alternatives.

3.5.2.10 Submarine Export Cable Route Alternatives Summary

A summary comparison of the submarine export cable route alternatives for selected evaluation criteria is provided in **Table 3.5-1**. As described below, based on assessment of evaluation criteria, including physical route characteristics, the presence of seabed and human-constructed hazards, use conflicts, biological resources, cultural resources, and high-impact fishing areas, as well as the practicability of the associated cable landfall (see Section 3.6), the Applicant selected submarine export cable route alternative A and its associated landfall as the proposed alternative for the NY Project.

Table 3.5-1 Submarine Export Cable Route Alternative Comparison

Assessment Criteria	Alternative A (Applicant's Proposed)	Alternative B	Alternative C1	Alternative C3	Alternative D	Alternative E	Alternative A+E	Barnums Island	Jones Beach
Total Route Submarine Export Cable Route Length	29.1 mi (46.8 km)	28.7 (46.2 km)	27.1 mi (43.6 km)	29.8 mi (48.0 km)	26.8 mi (43.2 km)	29.3 mi (47.2 km)	30.4 mi (48.9 km)	30.0 mi (48.3 km)	23.8 mi (38.4 km)
Submarine Export Cable Route Length (New York boundary to cable landfall)	8.8 mi (14.2 km)	8.4 mi (13.6 km)	6.8 mi (11.0 km)	9.6 mi (15.4 km)	6.5 mi (10.5 km)	9.1 mi (14.6 km)	10.1 mi (16.3 km)	9.7 mi (15.7 km)	3.9 mi (6.2 km)
Maximum Water Depth, ft (m) a/	55.4 ft (16.9 m)	52.2 ft (15.9 m)	53.1 ft (16.2 m)	44 ft (13.4 m)	51.2 ft (15.6 m)	33.8 ft (10.3 m)	51.8 ft (15.8 m)	50.5 ft (15.4 m)	60.3 ft
Number of dredged/maintained channels crossed b/	0	0	0	0	0	0	0	1	0
Approximate length across Sand Resource Area c/	0	0	4,100 ft (1,250 m)	0	4,100 ft (1,250 m)	0	0	0	0
Centerline distance to Sand Resource Area c/	1,991 ft (607 m)	223 ft (68 m)	0 ft (0 m)	176 ft (54 m)	0 ft (0 m)	3,539 ft (1,079 m)	1,991 ft (607 m)	253 ft (77 m)	11,748 ft (3,580 m)
Number of existing and planned utility crossings within New York State waters	5	3	2	3	2	5	5	2	1
Wrecks and obstructions within the cable corridor d/	0	0	0	0	0	0	0	2	1

Notes:
a/ Bathymetry is measured for the submarine cable corridor where it enters state waters, from NOAA NCEI's U.S. Coastal Relief Model (CRM).
b/ Based on USACE Maintained Channel Quarter Reach (USACE 2007).
c/ Based on BOEM sand and gravel lease areas (BOEM 2020)
d/ Based on NOAA Automated Wrecks and Obstruction Information System (NOAA 2009) mapped locations within a 500-ft (152-m) corridor of the submarine cable route alternative.

3.6 Cable Landfall Alternatives Analysis

The transition from submarine export cables to the onshore export cables will occur at the export cable landfall location. To identify the proposed cable landfall, the Applicant conducted coastal and waterfront engineering analyses of the risks and benefits of potential cable landfall locations at multiple sites along the southern shore of Long Island, New York, as well as the submarine export cable routing and associated constraints approaching the cable landfall alternatives. The locations of potential cable landfalls evaluated were also informed by the submarine export cable routing analysis (Section 3.5), and the onshore substation site selection (Section 3.7).

Based on the location of the POI, the study area for a potential submarine export cable landfall included the southern shore of Long Island, from Jones Beach to the east to the western portion of the barrier island of Long Beach to the west. This area is generally characterized by barrier islands with wide, sandy beaches that are largely under public (municipal or state) control. Portions of the shoreline have natural and/or restored sand dunes on the landward side of the beach, while other areas, especially within the City of Long Beach, are densely developed landward of the beach.

Coastal erosion dynamics are a significant concern along much of the shoreline in this study area. Long Beach recently underwent a USACE renourishment project, which included the placement of new sand material and the repair of rock jetties. To the east, Jones Beach is a State Park, consisting of sand beaches and dunes along the shoreline. By contrast, most of the shoreline along Barnum Island in the back bay behind the Long Beach barrier island consists of bulkhead or seawall.

The offshore environment generally consists of sandy material with wave and current action typical to the region. Significant offshore constraints on the cable landfall include the presence of existing and proposed pipeline and cable assets along the shoreline, shoals and shallow water areas, the presence of known and potential shipwreck areas, and an active designated Sand Resource Area in the vicinity of the eastern shoreline of the Long Beach barrier island (see Section 3.5).

The evaluation of cable landfall, submarine export cable route, and onshore export cable route alternatives was conducted as an iterative process that involved multiple steps of evaluation of the offshore and onshore cable routes, constraints on potential landfall locations, and the feasibility of landfall installation methodologies at potentially suitable cable landfall sites.

3.6.1 Cable Landfall Evaluation Criteria

Cable landfall and associated submarine export route alternatives that were evaluated are shown in **Figure 3.5-3** and **Figure 3.5-4**. Each cable landfall alternative was evaluated relative to the following constructability and logistical, environmental resource, and stakeholder criteria:

- Proximity to the preferred POI (e.g., onshore route length);
- Prior subsea cable landfall success in nearby areas;
- Staging area size/options (e.g., preferably land without permanent structures, with a minimum size to allow for adequate staging);
- Hydrodynamics and sediment dynamics (e.g., erosion);
- Artificial interferences (e.g., fish trap area, pipelines, dredging);
- Environmental, wildlife habitat, and cultural considerations (e.g., eelgrass, dunes, wetlands, buried and/or submerged cultural resources);
- Constructability complexities (e.g., long additional water crossings); and
- Land use (consistency of existing uses, minimizing impacts to public lands).

Cable landfall alternatives were evaluated relative to the use of trenchless installation methodologies as well as open cut methodology. Since the cable landfall installation methodology informs the selection of the proposed cable landfall location, an evaluation of these methods is provided first in Section 3.6.2.

3.6.2 Cable Landfall Installation Method Alternatives

As further described in **Exhibit E-3: Underground Construction**, the Applicant is proposing to use the HDD installation method for the NY Project cable landfall. Cable landfall installation methods considered were assessed relative to technical feasibility, cost, logistics and minimization of environmental impacts.

Trenchless installation of the cable landfall consists of installation of the cables without direct disturbance between the exit and entry points, for example by either HDD or Direct Pipe® installation methodologies. Both methods allow for installing conduits or ducts beneath sensitive coastal and nearshore habitats, such as dunes, beaches, waterways, submerged aquatic vegetation, and other critical crossings. Trenchless installations can also be used to cross under major infrastructure, including railroads and highways. The NY Project will require two separate trenchless installations to complete the cable landfall, one for each of the submarine export cable circuits.

Typically, trenchless installation operations for an export cable landfall originate from an onshore landfall location and exit a certain distance offshore, determined by the water depth contour and total cable landfall length considerations. To support the installation, both onshore and offshore work areas are required.

Trenchless installation of the cable landfall is proposed due to the more extensive impacts to the marine and shoreline environments associated with installing an open cut cable landfall across the sandy beach (Section 3.6.2.3), which would include dredging and resuspension of sediment along the offshore portion of the submarine cables, excavation through the intertidal zone, and disturbance to beach and dune habitats on the upland side of the landfall that may include potential foraging and nesting areas for shorebirds. Seabed mobility and coastal shoreline erosion are also significant concerns in the vicinity of the cable landfall, and a trenchless installation will allow deeper installation across the shoreline than an open cut installation could, which will minimize the potential for cable exposure during erosion events. Engineering evaluation concluded that the Direct Pipe® installation method is not feasible at the Applicant's proposed cable landfall location (Alternative A, Section 3.6.3.1), due to deep foundation and sheet piles supporting the existing boardwalk and existing structures; therefore, HDD installation is proposed.

3.6.2.1 Horizontal Directional Drilling (HDD) (Applicant's Proposed)

The onshore work area for HDD installations is typically located within the upland cable landfall parcel(s) at the HDD entry point, supporting a drilling rig containment pit for drilling mud, a drill control cab, and staging of the drill stem and drilling mud production/recycling. The evaluated cable landfall alternatives in Section 3.6.3 were sited to avoid vegetation, natural habitats, beach and wetland areas. Once the onshore work area is set up, casings may be installed at the drill entry points and the HDD activities commence using a rig that drills a borehole underneath the surface. The drill begins with a pilot bore that consists of advancing a steerable, rotary drill bit along the design alignment from the drill rig entry location to the exit location. Once the pilot bore is completed, the pilot drilling assembly is removed and replaced with a reaming assembly. Reaming involves enlarging the pilot bore to a larger diameter to accommodate the conduits. Depending upon the required diameter, multiple passes with reamers of increasing diameter may be required to incrementally enlarge the pilot bore to its final diameter.

Upon completion of the reaming pass(es), the condition of the HDD bore is assessed by completing a swab pass through the bore. This pass consists of pushing or pulling a slightly smaller diameter barrel or ball reamer through the fully reamed bore from start to finish. When the reaming operation is completed, the conduit (steel or high-density polyethylene) in which the submarine cable will be installed is pulled back onshore within the drilled borehole from the offshore exit side. The process of drilling a borehole and conduit pull back will be completed two times for the NY Project, once for each submarine export cable circuit. The cable installation will be completed when both submarine export cables are pulled through the installed conduits.

The offshore exit location requires some seafloor preparation to collect any drilling fluids that localize during HDD completion. Preparation will include excavation of pits at each offshore exit location and may also include installation of temporary steel casings on the exit side from a jack-up barge to below the mudline. Casings may or may not be supported by goal posts. The jack-up barge will also house a drill rig. Seabed preparation may also be completed with installation of a cofferdam for each HDD and excavating to remove material from the cofferdam. The offshore work area for HDD installation requires approximately 10,000 square feet (930 square meters) per cable circuit.

Onshore, the entry side of the HDD installation requires a workspace of at least approximately 246 by 246 ft (75 by 75 m) per cable. The entry side workspace area is required to locate equipment necessary for the installation, which includes the drill rig, stacks of drill pipe, operator control cabin, tooling trailers, crane or excavator, separation plant, mud tanks, mud pumps, water storage tanks, office trailer, and support trailers.

In addition to the entry and exit workspace areas, a staging area is also required for fabricating each pipe or conduit string. Each conduit (pipe) string is fully fabricated into a single string with a length equivalent to the approximate length of the HDD installation (additional length may be necessary to account for geometry). This results in a pipe stringing area requirement for a single conduit string that is typically 20 to 25 ft (6.1 to 8.2 m) wide by the length of the pipe string (approximately 2,460 ft [750 m]). The conduit string is floated out to the offshore HDD exit point, where it will be installed by using the drill string to pull it back through the drill hole.

The Applicant is evaluating potential temporary offsite staging areas for fabricating the HDD conduit strings for the cable landfall. The Applicant is prioritizing potential temporary fabrication and conduit stringing areas that are existing paved or developed areas (e.g., parking areas or roadways) with existing access to the water. Once fabricated, each conduit string would be rolled across the shoreline on pipe rollers in an approximately one-day operation (per HDD/conduit). From there, it would be towed by boat to the offshore HDD exit point for installation. Preliminary areas under consideration for offshore conduit stringing areas include South Amboy and Monmouth, New Jersey. Additional sites may be identified by contractors as part of the commercial tendering and evaluation of this scope of work. Additional sites of similar size and composition may be identified, including the contractors' existing facilities or other suitable temporary facilities. It is not currently anticipated that the pipe stringing staging areas will require new temporary facilities within New York State. The Applicant will work with the appropriate regulatory bodies to obtain any authorizations necessary and to facilitate construction in accordance with applicable regulatory requirements.

Target depths of the cable landfall HDDs vary by length, down to approximately 100 ft (33 m). Longer HDD installations typically require greater depths of cover to allow for sufficient overlying strength to resist the drilling fluid pressures. Inadvertent drilling fluid returns occur when drilling fluid pressures exceed the strength of the overlying geotechnical material, and pressure causes the drilling fluids to follow a path that flows upwards and outwards until the pressure is relieved. Drilling fluids reaching the sediment surface may pond on the ground surface in uplands or be released on the seabed as inadvertent returns. All HDD installations carry some risk of an inadvertent drilling fluid return, especially during the exit curve and exit tangent, as the drill bit is steered upwards toward the ground surface. Inadvertent return risks can be reduced along the majority of an HDD alignment by selecting an appropriate depth of cover that provides sufficient overlying strength to resist the required fluid pressures.

Geotechnical conditions, HDD geometry, and bending radii dictate HDD installation depth, which may be driven by a combination of factors, including sediment characteristics, the required HDD entry angle, avoidance of existing shoreline infrastructure, limitations on the length of the drill, and potential impacts on maritime traffic at the location of the HDD exit point. Another consideration for some export cable landfall alternatives is the need to maintain required spacing between the submarine export cables (minimum 10 ft [3 m]), as well as offsets from other existing infrastructure.

3.6.2.2 Direct Pipe®

Direct Pipe® is a trenchless method that can be used when HDD methods present challenges for a particular crossing. Similar to HDD, Direct Pipe® operations will originate from an onshore cable landfall location and exit offshore, using both onshore and offshore work areas. The onshore work area is typically located within the export cable landfall parcel(s) and requires approximately 260 by 680 ft (79 by 207 m) of onshore workspace per cable circuit. Target depths of landfall paths vary by the length of the Direct Pipe, up to approximately 80 ft (24 m); however, one advantage of the Direct Pipe® method is that it may allow for a shallower installation than the equivalent length HDD, while still reaching sufficient depths to minimize potential cable exposures from erosion or storm events.

Once the onshore work area is set up and a shallow launch pit has been excavated, Direct Pipe® activities commence. This method involves using a pipe thruster to grip and push a steel pipe with a microtunnel boring machine (MTBM) attached to the leading edge through a seal attached to the pit wall and along the alignment. The MTBM travels along the installation path from onshore to offshore. Once the MTBM exits onto the seafloor and is removed, the duct used to house the electrical cable can be fabricated into a pipe string one joint at a time within the same onshore entry workspace area and pushed into the casing pipe that was previously installed using the Direct Pipe® method. As with the HDD method in Section 3.6.2.1, this process is repeated two times, once for each submarine export cable circuit.

The offshore exit locations require some seafloor preparation to retrieve the MTBM. Preparation may include completing a shallow excavation (wet) for the MTBM at each exit location. Marine support is needed (e.g., vessels, barges, divers) to excavate the exit pits and support retrieval of the MTBM.

The Direct Pipe® method avoids the need to fabricate a conduit string in a continuous length for each cable, as is required for the HDD installation method. As such, the Direct Pipe® installation does not require an offsite staging and fabrication area. The Direct Pipe® method also avoids the risk of inadvertent returns, since drilling fluids are not required to maintain the borehole pressure. However, because the duct is fabricated one joint at a time within the onshore workspace, a larger cable landfall workspace is needed onshore, with greater space constraints for the cable landfall siting. As such, the Direct Pipe® method is only a feasible installation method at certain cable landfall location alternatives, described further in Section 3.6.3. The proposed cable landfall alternative (Alternative A) does not have sufficient space for installation using the Direct Pipe® method, therefore the Applicant is proposing the HDD method for installation of the cable landfall.

3.6.2.3 Open Cut

An open cut alternative uses standard submarine cable installation methods to facilitate installation at the target burial depth along the approach to landside. Open cut methods may include open cut trenching/dredging or jetting to bury the cables up to the landfall conduits. Jetting involves the use of pressurized water jets into the seabed, creating a trench. As the trench is created, the submarine export cable sinks into the seabed/waterway. The displaced sediment then resettles, naturally backfilling the trench.

Dredging is then needed to excavate, remove, and/or relocate sediment across the shoreline and intertidal area to allow the cables to make landfall at the target installation depth. Dredging can be completed through clamshell dredging, suction hopper dredging, and/or hydraulic dredging. During dredging activities, the dredged material is collected in an appropriate manner for either re-use or disposal (depending on the nature of the material) and in accordance with applicable regulations.

A typical open cut method involves installation of one or more sheet pile cofferdams to isolate the area of the shoreline at the cable landfall, dewatering within the area of the cofferdam, and excavating a trench for each cable within the dry cofferdam(s). The cable conduits would then be installed within each trench and the trench would be backfilled. Following installation of the conduits across the shoreline, the cables would be pulled through the conduits for final installation. Traditional trenched installation then continues across the beach and dune area to the onshore export cable route.

An open cut cable landfall for the NY Project is unlikely to be either feasible or permitted. The shoreline along much of the southern coast of Long Island, including the export cable landfall area, is regulated by New York State as a Coastal Erosion Hazard Area due to the area's exposure to wave action from the Atlantic Ocean, which would require the export cable landfall to be installed deep enough to avoid impacts from coastal processes. Deep installation of the export cables with an open cut, if feasible, would require extensive disturbance for dredging, excavation, and stockpiling across the shoreline and beach area. It would also result in direct disturbance to the beach and dune habitat for trench installation of the two export cables, and the associated potential wildlife impacts, including potential impacts to habitat for nesting shorebirds. Finally, direct disturbance and excavation of the shoreline and beach is likely to be viewed unfavorably by the local community and other stakeholders. The Applicant therefore determined that the open cut installation method is not a reasonable alternative for the NY Project and would result in greater environmental impacts than a trenchless installation.

3.6.3 Cable Landfall Alternatives

The Applicant selected a total of seven cable landfall alternatives within the study area for detailed evaluation. These included three export cable landfall alternatives within the City of Long Beach, three within the town of Town of Hempstead, and one on Jones Beach, New York. Of the three alternatives in the Town of Hempstead, two are within the area of unincorporated Lido Beach, and one is within unincorporated Barnum Island. Each of these cable landfall alternatives is shown in **Figure 3.5-3** and **Figure 3.5-4**. Submarine constraints associated with the submarine export cable route(s) to each cable landfall alternative are presented in **Figure 3.5-1** and **Figure 3.5-2**. Based on the evaluation of different installation methods (Section 3.6.2), this section only discusses trenchless installation solutions (e.g., HDD or Direct Pipe®) for these export cable landfalls given the nature and potential environmental sensitivity of the area, the need to avoid the sheet piling associated with existing infrastructure, environmental impact considerations, and the logistical and regulatory challenges of constructing an open cut landfall on the beach.

In the selection of export cable landfall alternatives, optimizing the combination of the submarine and onshore export cable routes was also a key priority due to the potential complexity of cable routing in this area.

3.6.3.1 Alternative A (Applicant's Proposed)

Cable landfall alternative A is located in the City of Long Beach and encompasses approximately 4.1 ac (1.6 ha). The cable landfall is located within Riverside Boulevard, and a mostly bare, privately owned, approximately 4.9-ac (2-ha) vacant parcel located to the west of Riverside Boulevard and to the south of East Broadway would be used for staging. This vacant parcel has been used for parking and equipment storage in the past and potential future development plans for this parcel are uncertain. The adjacent parcel to the east of Riverside Boulevard is under redevelopment as part of the Long Beach Superblock Project[2]. Immediately to the north of cable landfall alternative A across East Broadway there are various high-rise buildings. To the south of the cable landfall, the export cable route traverses the end of Riverside Boulevard, in close proximity to or underneath an existing small commercial building and underneath the raised oceanfront boardwalk adjacent to Long Beach/Ocean Beach Park. The conceptual export cable landfall alignment is designed so that the two cable circuits are within Riverside Boulevard. The onshore export cable route alternatives (Section 3.8.2) from export cable landfall alternative A are approximately 1.3 to 1.5 mi (2.0 to 2.4 km) long and offer some of the shortest routes to the proposed onshore substation (Onshore Substation C).

The Riverside Boulevard corridor is narrow and constrained by utility congestion, allowing limited space for siting of the transition joint bays and duct banks within the roadway. Cable landfall alternative A has sufficient space for a cable landfall of both export cables circuits and the temporary workspace for cable landfall activities, if the necessary land rights can be obtained.

The export cable landfall at alternative A traverses Ocean Beach Park and the Long Beach boardwalk. The HDDs will need to be installed deep enough to allow sufficient clearance between the export cable conduits and the bottom of the boardwalk piles. As part of the Applicant's conceptual design, casing pipes may be installed on the onshore entry side of each HDD below the existing commercial building and the boardwalk.

Due to the limited space available and the presence of shoreline obstructions, the Applicant determined that the Direct Pipe® installation method is not feasible for alternative A; therefore, the HDD installation method is proposed. Direct Pipe® installation is not suitable because it requires a fabricated steel pipe behind the launch pit that would extend 400 to 500 ft (122 to 152 m) for the extent of the operations. The Direct Pipe® installation also requires the onshore entry pit to be much further north than for the HDD installations, since the angle of installation for Direct Pipe® is less steep. Onshore impacts from Direct Pipe® installation at this location would be significant, requiring more street closures, heavy equipment (side booms) to support the steel pipe behind the entry pit, a larger footprint from additional equipment, and noise impacts for a greater duration. Therefore, Direct Pipe® was not considered further at this location.

If the cable landfall is limited to public right-of-way, one potential limitation at cable landfall alternative A is that there may not be sufficient space for contingency in the case of an HDD failure along one or more of the export cable alignments. Typically, if an initial HDD attempt fails, another attempt may be made along a parallel alignment immediately adjacent; however, for cable landfall alternative A, a separate contingency landfall may be required due to the highly constrained spacing of the two cables.

The onshore workspace at cable landfall alternative A is in close proximity to sensitive noise and air quality receptors, including residences adjacent to Riverside Boulevard. The cable landfall installation would occupy space at the intersection of East Broadway and Riverside Boulevard, which would likely require road closure, traffic impacts and disruption of access to residential buildings for a prolonged period (approximately 6 to 24 months). Due to the space constraints, limited mitigation options exist for these potential noise and traffic impacts.

Since Long Beach is municipal parkland, State legislation may be required for the underground crossing of the beach for the underground cables. According to correspondence received from the New York State Office of Parks, Recreation and Historic Preservation (NYOPRHP) dated December 9, 2021, the City of Long Beach received three Land and Water Conservation Fund (LWCF) grants in the 1980s for the development of the Long Beach boardwalk, dunes, and swimming facilities. NYOPRHP indicated that the use of Landfall A could

[2] The Superblock Project is located along Shore Road between Riverside Boulevard and Long Beach Boulevard.

impact these LWCF areas, and additional coordination with NYOPRHP and National Park Service (NPS) is required. Crossing underneath a LWCF area may result in additional regulatory challenges if a federal conversion process is required. A federal conversion process requires the provision of replacement property that is of equal or greater fair market value and of reasonably equivalent usefulness and location as the lands being removed from outdoor recreation use.

As one of the three westernmost export cable landfalls (which include alternatives E, A and B) the export cable landfall would cross through the proposed Bayside Development, a potential project listed in the City of Long Beach's comprehensive plan, "Creating Resilience: A Planning Initiative," which was updated in January 2018 (City of Long Beach 2018). The Bayside Development is not discussed in the City of Long Beach's draft Comprehensive Plan 2022-2023 (City of Long Beach 2023); however, the 2023 Draft Comprehensive Plan does address Bayside Redevelopment Areas. The Foundation Block, adjacent to alternative A, is included as a soft site opportunity area.

Considering the nearshore environment, the alternative A cable landfall has a relatively short distance to deeper waters suitable for setting up the offshore portion of the HDD installations. Water depths at the exit pits offshore are expected to be approximately 30 ft to 33 ft (9 m to 10 m) below mean lower low water (MLLW) for HDD installation lengths of 1,650 ft (500 m) to 3,280 ft (1000 m).

In summary, alternative A is a potentially reasonable alternative for an export cable landfall of both circuits, in the event that land rights can be obtained. Cable landfall alternative A results in submarine export cable routing that avoids close proximity to the Sand Resource Area (see Section 3.5.2) and minimizes the submarine export cable route length relative to the other reasonable alternatives (alternative E, alternative C3 and alternative A+E). Alternative A was therefore selected as the Applicant's proposed alternative.

3.6.3.2 Alternative B

Cable landfall alternative B is in the City of Long Beach and consists of only approximately 0.7 ac (0.3 ha) of workspace within Monroe Boulevard. The onshore workspace for the export cable landfall is bounded to the west by apartments and to the east by an apartment building and a parking area. To the north, the cable landfall traverses the intersection of Monroe Boulevard and East Broadway. To the south, the cable landfall is bounded by Shore Road, and the HDD installation path would traverse the end of Monroe Boulevard and a raised oceanfront boardwalk, adjacent to Ocean Beach Park. Compared to other sites considered, the onshore side of alternative B is relatively far from the shoreline along the beach, which increases the length of the required trenchless installation segment. Potential onshore export cable routes from alternative B (Section 3.8.2) are approximately 1.4 mi (2.2 km) long and offer some of the shortest routes to the onshore substation.

The available cable landfall workspace at alternative B is small for export cable landfall installation. Similar to alternative E (see Section 3.6.3.5), activities would be directly adjacent to noise and air quality receptors, including high-rise and residential buildings; however, this cable landfall alternative is surrounded by buildings and residences and does not have the adjacent vacant parcels that are present at cable landfall alternatives A and E. The cable landfall installation requires space at the intersection of East Broadway and Monroe Boulevard, which would likely require road closure and traffic impacts for a prolonged period of time. Due to the extremely constrained space availability, limited mitigation options exist for these potential noise and traffic impacts.

This cable landfall also has a relatively short distance to deeper waters suitable for setting up the offshore portion of the trenchless installation. Access from offshore is not unobstructed, however. Similar to alternative A, the route would need to traverse the raised oceanfront boardwalk in addition to the narrow corridor at the end of Monroe Boulevard between two buildings.

Since Ocean Beach Park in the City of Long Beach is municipal parkland, State legislation may be required for the underground cables to cross the beach. According to correspondence received from the NYOPRHP dated December 9, 2021, the City of Long Beach received three LWCF grants in the 1980s for the development of the Long Beach boardwalk, dunes, and swimming facilities. NYOPRHP indicated that the use of Landfall B could impact LWCF areas, and additional coordination with NYOPRHP and/or National Park Service (NPS) will be required. A crossing of the LWCF area may result in additional regulatory challenges in the case a federal conversion process is required. A federal conversion process requires the provision of replacement property that is of equal or greater fair market value and of reasonably equivalent usefulness and location as the lands being removed from outdoor recreation use.

Alternative B is a not considered a reasonable alternative due to the limited availability of workspace and adjacency of buildings and residences, combined with the potential regulatory challenges of installing the submarine export cable route in proximity to the Sand Resource Area (Section 3.5.2.2).

3.6.3.3 Alternative C

Cable landfall alternative C is located at Lido Beach West Town Park in the Town of Hempstead and consists of an existing large, paved parking lot used for beach access. The overall parcel is approximately 34 ac (14 ha) and includes beach, dune, and adjacent beach shrubs; however, the portion of the parking lot to be used for cable landfall activities includes approximately 4.9 ac (2.0 ha) of the overall site. The site extends to the north as a parking area, not quite reaching Lido Boulevard. Access to the area is from the west, off of Regent Drive. The Park extends further to the west with tennis courts and overflow parking areas. Immediately to the south is the beach access, a protective dune area, and a wide, sandy beach. The beach is open daily with lifeguards in the summertime. Potential onshore export cable routes (Section 3.8.2) from alternative C to the onshore substation are approximately 2.0 to 2.3 mi (3.3 to 3.6 km) long.

Due to the size of the parcel and the Lido Beach West Town Park, cable landfall alternative C has abundant available space for the cable landfall for both export cable circuits and the associated onshore workspace for the trenchless installation. This parcel has a somewhat longer distance to deeper waters for setting up the offshore portion of the trenchless landfall installation, compared to other alternatives evaluated. However, due to the ample potential onshore workspace for setup and transition to the onshore export cables, either HDD or Direct Pipe® methods may be used for cable landfall installation at this location. Cable landfall alternative C also has sufficient space for a contingency to attempt to re-drill in an immediately adjacent, parallel alignment, in the case of an initial HDD failure along one or more of the export cable alignments.

According to correspondence received from the NYOPRHP dated December 9, 2021, Lido Beach West Town Park has not received LWCF grants and is not encumbered by a potential federal parkland conversion process and coordination with the National Park Service. Since Lido Beach West is municipal parkland, State legislation may be required to cross the beach and parking area, similar to most of the other alternatives considered.

As existing open space, the parking lot at cable landfall alternative C is significantly further from residences and other noise and air quality receptors than alternatives A, B and E. The nearest residential areas to the cable landfall onshore entry points are approximately 450 ft (137 m) to the east along Allevard Street in Lido Beach. There are also residential areas on the north side of Lido Boulevard (approximately 670 ft [204 m] north) and Eva Drive (660 ft [201 m] northwest). Impacts to adjacent residences, therefore, are expected to be relatively low compared to other cable landfall alternatives.

A variety of protected migratory shorebirds, including federally listed Piping Plovers, are known to nest in the restored dune area along Lido Beach; however, the restored dune habitat is mostly located to the west of the alternative C export cable landfall. Impacts to habitat would be avoided by the trenchless installation of the export cable landfall segment to the parking lot beyond the dunes, and indirect impacts to dune-nesting birds could be mitigated with appropriate seasonal timing of the installation, as appropriate.

Cable landfall alternative C is a reasonable alternative based on the assessment of the space, logistical and technical requirements for a trenchless landfall installation of two cables. However, significant regulatory challenges exist for this alternative, due to the proximity of the associated submarine export cable route alternative C3 to an existing Sand Resource Area (see Section 3.5.2.4). Cable landfall alternative A reduces the regulatory risk relative to cable landfall alternative C and was therefore selected as the Applicant's proposed alternative.

3.6.3.4 Alternative D

Alternative D is located at Lido Beach Town Park in the Town of Hempstead, in an area consisting of a paved parking lot, which is used for beach access and a ball field. The site extends to the north as a parking area, not quite reaching Lido Boulevard. The overall parcel is approximately 57 ac (23 ha) and includes beach, dune, and adjacent beach shrubs. Access to the area is from the north, off Lido Boulevard. Immediately to the south of the parking lot is the beach access, a protective dune area, and a wide, sandy beach. The beach is open daily, with lifeguards in the summertime. Potential onshore export cable routes (Section 3.8.2) from this export cable landfall to the onshore substation are approximately 3.4 mi (5.5 km) long. Alternative D extends the length of the onshore export cable route by approximately one mile compared to alternative C.

Similar to alternative C (Section 3.6.3.3), cable landfall alternative D offers ample potential workspace for trenchless installation, transition joint bays, and separation distance for two export cable circuits. Due to the presence of shallower water nearshore, the distance to deeper offshore contours for the trenchless landfall installation is the farthest of the alternatives evaluated, so this site is expected to require a longer trenchless landfall segment than other alternatives evaluated. Either HDD or Direct Pipe® methods may be used for cable landfall installation at this location and cable landfall alternative D also has sufficient space for a contingency to attempt to re-drill in an immediately adjacent, parallel alignment, in the case of an initial HDD failure along one or more of the export cable alignments. This alternative also provides an opportunity for cable landfall installation that is spatially separated from adjacent residential neighborhoods and potential noise and air quality receptors.

Since Lido Beach is municipal parkland, State legislation may be required for the underground cables to cross the beach and parking area, similar to most other cable landfall alternatives evaluated. According to correspondence received from the NYOPRHP dated December 9, 2021, Lido Beach Town Park received two LWCF grants in the 1970s; NYOPRHP indicated that any action that would remove any part of this LWCF park from public outdoor recreational use for longer than 12 months or that would entail the permanent conveyance of surface land rights may trigger a conversion process with the NPS. This process requires the provision of replacement property that is of equal or greater fair market value and of reasonably equivalent usefulness and location as the lands being removed from outdoor recreation use.

A variety of protected migratory shorebirds, including federally listed Piping Plovers, are known to nest in the restored dune area along Lido Beach. Considerations for work in proximity to the dune area are similar to those described for cable landfall alternative C (Section 3.6.3.3).

Cable landfall alternative D has similar space and constructability advantages as alternative C and is feasible but requires longer onshore export cable routing. Alternative D is considered not reasonable due to the likelihood of additional regulatory challenges associated with a federal conversion process with the National Park Service in combination with the regulatory challenges of submarine export cable routing that crosses the Sand Resource Area, closer proximity to the restored dunes along Lido Beach, and a longer onshore export cable route. The

Applicant has eliminated alternative D as a reasonable alternative because the associated submarine export cable route is not reasonable (see Section 3.5.2.5).

3.6.3.5 Alternative E

Cable landfall alternative E is located in the City of Long Beach and is the farthest west of the sites evaluated along Long Beach. The onshore workspace for the cable landfall is approximately 1.6 ac (0.6 ha) within Laurelton Boulevard and adjacent privately owned parcels to the west of Laurelton Boulevard on both sides (north and south) of West Broadway. According to the Nassau County Land Records online viewer[3], there are three parcels to the south of West Broadway totaling approximately 1.7 acres and categorized as ocean waterfront land. The parcel to the north of West Broadway is a 0.2-ac (0.1 ha) privately owned parcel that is categorized as vacant commercial land. The onshore export cable route alternatives (Section 3.8.2) from cable landfall alternative E are approximately 1.5 to 2.1 mi (2.4 to 3.4 km) long and offer some of the shortest routes to the proposed onshore substation.

Alternative E is bounded to the south by the raised oceanfront boardwalk adjacent to the City of Long Beach Ocean Beach Park. There is a high-rise residential complex called Lafayette Terrace along Lafayette Boulevard to the west of the cable landfall. Immediately across Laurelton Boulevard to the east, there is a high-rise assisted living facility at 274 West Broadway. To the north, the cable landfall area is bounded by high-rises and residences along W Broadway and Laurelton Boulevard. The private parcels to the south of W Broadway at the alternative E cable landfall site have housed construction trailers and been used for parking in the past, but potential future development plans for these parcels are uncertain.

The landfall cable alignment is designed so that two cables are within Laurelton Boulevard, to minimize the limitation on potentially developable space. To the south of the cable landfall, along the export cable landfall alignment, the route traverses the end of Laurelton Boulevard, and the export cables need to be installed underneath the Long Beach boardwalk. A temporary police trailer sits at the end of Laurelton Boulevard, which will likely need to be relocated for use of alternative E as an export cable landfall.

The Laurelton Boulevard corridor is narrow and constrained by utility congestion, allowing limited space for siting of the transition joint bays and duct banks within the roadway. Cable landfall alternative E has sufficient space for a cable landfall of both export cables and the temporary workspace for cable landfall activities, if the necessary land rights can be obtained. Due to the limited space availability, Empire determined that the Direct Pipe® installation method is not feasible for alternative E (see discussion for cable landfall alternative A, Section 3.6.3.1); therefore, the HDD installation method is required. Another potential limitation at cable landfall alternative E is there may not be sufficient space for contingency in the case of an HDD failure along one or more of the export cable alignments, in the event that the export cables and cable landfall workspace is limited to the public right-of-way. Typically, if an initial HDD attempt fails, another attempt may be made along a parallel alignment immediately adjacent; however, for cable landfall alternative E, a separate contingency location may be required due to the highly constrained spacing of the two cables.

The onshore workspace at cable landfall alternative E is in close proximity to sensitive noise and air quality receptors, including residences adjacent to Laurelton Boulevard and along W Broadway and an assisted living facility directly adjacent to the site. The cable landfall installation would occupy space at the intersection of these two roadways, which would likely require road closure, traffic impacts and disruption of access to residential buildings for a prolonged period (at least 6 months). Due to the space constraints, limited mitigation options exist for these potential noise and traffic impacts.

[3] https://lrv.nassaucountyny.gov/

The export cable landfall at alternative E traverses the City of Long Beach Ocean Beach Park and the Long Beach boardwalk. The HDDs will need to be installed deep enough to allow sufficient clearance between the export cable conduits and the bottom of the boardwalk piles. As part of the Applicant's conceptual design, casing pipes may be installed on the onshore entry side of each HDD below the existing commercial building and the boardwalk, to minimize the potential to impact the structures above.

Since Ocean Beach Park is municipal parkland, State legislation may be required for an agreement to cross the beach for the underground cables. According to correspondence received from the NYOPRHP dated December 9, 2021, the City of Long Beach received three LWCF grants in the 1980s for the development of the Long Beach boardwalk, dunes, and swimming facilities. Additional coordination with NYOPRHP and/or National Park Service (NPS) is required. Crossing an LWCF area may result in additional regulatory challenges if a federal conversion process is required. A federal conversion process requires the provision of replacement property that is of equal or greater fair market value and of reasonably equivalent usefulness and location as the lands being removed from outdoor recreation use.

As one of the three westernmost export cable landfalls (which include alternatives E, A and B) the cable landfall also crosses through the proposed Bayside Development, a potential project listed in the City of Long Beach's comprehensive plan, "Creating Resilience: A Planning Initiative," which was updated in January 2018 (City of Long Beach 2018).

Considering the nearshore environment, alternative E has the shortest distance to deeper water suitable for setting up the offshore portion of the HDD installations. Water depths at the exit pit offshore are expected to be approximately 30 ft to 33 ft (9 m to 10 m) below MLLW for HDD installation lengths of 1,650 ft (500 m) to 3,280 ft (1000 m).

In summary, alternative E is a potentially reasonable alternative for an export cable landfall of two circuits, in the event that land rights can be obtained. Due to the proximity of cable landfall alternative E to sensitive noise and air quality receptors, as well as potential onshore traffic impacts, this cable landfall alternative is anticipated to have greater potential onshore environmental and stakeholder impacts compared to the proposed alternative (alternative A), as well as having a longer submarine export cable route; therefore, alternative E was not selected as the proposed alternative. See also Section 3.8.2 for discussion of onshore export cable routing alternatives associated with cable landfall alternative E.

3.6.3.6 Alternative A+E

Cable landfall alternative A+E is a combination that uses the cable landfall areas both at alternative A (as described in Section 3.6.3.1) and alternative E (as described in Section 3.6.3.5). Under this cable landfall alternative, one submarine export cable would make landfall at the alternative A location, and one submarine export cable would make landfall at the alternative E location. Cable landfall alternative A and alternative E are located approximately 0.6 mi (1 km) apart. Up to the full available workspace acreage at each location (2.4 ac [1.0 ha]at alternative A and 1.6 ac [0.6 ha] at alternative E) is used under this alternative.

The cable landfall alternative A+E alleviates some of the space constraints associated with either alternative A or alternative E. In particular, it would provide space for a contingency in the right-of-way in the case of an HDD failure. If an initial HDD attempt fails, another attempt could be made along a parallel alignment immediately adjacent at either cable landfall alternative A or alternative E.

For alternative A+E, the submarine export cable routes are adjusted so that both submarine export cables cross the Transco NYLBL at one location in parallel, before splitting into separate routes to each of the respective cable landfalls. North of where the route splits to the north of the NYLBL crossing, the submarine export cable corridor to cable landfall alternative A would be approximately 300 ft (91 m) wide, and the submarine export cable corridor to cable landfall alternative E would be approximately 300 ft (91 m) wide.

The use of two separate submarine export cable routes/corridors spreads the impacted area within the marine environment over a greater area instead of aligning the two submarine export cables in parallel along a single corridor. Co-locating cables along a single corridor and alignment is generally considered to minimize the extent of environmental impacts, and alternative A+E will have a slightly longer submarine export cable route than the proposed alternative.

As described above, the City of Long Beach received LWCF grants in the 1980s for the development of the Long Beach boardwalk, dunes, and swimming facilities, and crossing the boardwalk and LCWF area will require additional coordination with NYOPRHP and/or NPS. If a federal conversion process is required, this process could pose additional regulatory challenges for alternative A+E, since the federal conversion process would be required in disjunct locations. As described above, a federal conversion process requires the provision of replacement property that is of equal or greater fair market value and of reasonably equivalent usefulness and location as the lands being removed from outdoor recreation use. Since both locations may also require State legislation, alternative A+E additionally has the potential challenge of obtaining alienation legislation at both locations.

Additionally, alternative A+E will require additional onshore export cable routes north of the export cable landfalls at the two locations. The use of two separate cable landfalls for installation will somewhat reduce the duration of potential environmental, traffic and stakeholder impacts at each location (alternative A and alternative E) relative to installing both circuits at the same locations. However, use of two cable landfalls will also disperse the potential impacts over a broader area. Because the two cable landfall locations are less than 1 mi (1.6 km) apart and both located along the E/W Broadway corridor, construction activities at multiple locations associated with alternative A+E likely would increase the potential traffic impacts and logistical challenges of road closures.

Alternative A+E is a practicable alternative for an export cable landfall, and it provides a contingency in the right-of-way in the case of an HDD failure. However, due to the additional regulatory challenges of potential parkland alienation and conversion processes in two separate locations, as well as the potential for noise, traffic, air quality impacts and marine cable installation impacts over a broader area, the Applicant selected alternative A, with both submarine export cables making landfall in the same location, as the proposed alternative.

3.6.3.7 Jones Beach Alternative

As an alternative to landfall on the Long Beach barrier island, the Applicant also considered routing the submarine export cables further to the east and installing the export cable landfall at Jones Beach (Jones Beach cable landfall alternative, **Figure 3.5-3**). This landfall alternative is located along the open coast at Jones Beach State Park off of Bay Parkway, near Meadowbrook State Parkway. The Jones Beach cable landfall alternative is sited within an approximately 3.5-ac (1.4 ha) paved parking area located near the west end of Jones Beach. The site is bounded to the south by approximately 1,800 feet (549 m) of dunes and wide sandy beach, with beach dune habitat to the east and west. Bay Parkway lies immediately to the north of the site.

A submarine export cable route to the Jones Beach Landfall crosses the existing HVDC Neptune Power Transmission Cable offshore, similar to alternatives C and D. As the easternmost route, the Jones Beach landfall alternative would avoid the Sand Resource Area that is located offshore of Lido Beach (**Figure 3.5-1** and **Figure 3.5-2**). Since the cable landfall at Jones Beach is far from the shoreline and because of the gradual sloping of the shoreline, it is a longer distance to deep water for HDD installation than at other assessed locations. The minimum HDD length assessed was 2,625 ft (800 m), where water depth off of Jones Beach is only approximately 20 ft (6 m) below MLLW. Water depths of approximately 33 ft (10 m) depth are typically required for the submarine export cable installation vessel. To reach 33 ft depth (10 m) a length of approximately 6,890 (2,100 m) would be needed, which is beyond the practicable length for HDD installation.

Jones Beach is a popular state park for summer recreation and swimming, but open year-round, with programs including concerts and fireworks displays. The Jones Beach cable landfall alternative would require obtaining an agreement with NYOPRHP to cross state park lands.

The most challenging aspect of a Jones Beach landfall is the onshore export cable routing. Two routing options were considered from Jones Beach:

1. After landfall at Jones Beach, completing a second HDD from the Jones Beach parking lot to the Long Beach barrier island in the vicinity of Point Lookout, and routing onshore through Jones Beach and Barnum Island from there; and
2. Routing onshore along Meadowbrook State Parkway towards Freeport and Sunrise Highway, traversing densely developed areas from Freeport west to Oceanside.

An HDD from a Jones Beach landfall to the Long Beach barrier island was determined to be infeasible, due to a combination of HDD length, angle, and space availability in the vicinity of Point Lookout. HDD lengths required to reach a suitable staging area at Point Lookout, and avoid houses and other existing structures, would be 6,000 to 8,000 ft, which is beyond the technical limitations for installation. Other options (such as entering the water) would result in greater environmental impacts than the proposed alternative (also see Section 3.5.2).

Onshore routing from Jones Beach through Freeport would be approximately 11 miles (17.7 km), which is more than double the length of the onshore route from the Long Beach barrier island and is expected to be significantly greater in technical and logistical complexity due to development and infrastructure density. Meadowbrook State Parkway is one of the only two roads that connects the Jones Beach barrier island to mainland Long Island. The road shoulder, which is elevated above adjacent wetlands, is flat, but construction along the shoulder would require obtaining approval for accommodation of utilities within a state highway right-of-way from the NYSDOT. There are three bridges on the Meadowbrook State Parkway between the barrier island and mainland Long Island (traversing from Jones Beach to Jones Island, Petit Marsh and finally the Long Island mainland). These crossings would require HDD or open cut construction across the tidal channels. Estuarine and marine wetlands are adjacent to the length of Meadowbrook State Parkway from the Jones Beach barrier island to Sunrise Highway. For most of the length, there appears to be sufficient space for installation of onshore export cables between the parkway and the wetlands; however, HDD crossings of the tidal channels may require impacts to tidal wetlands for staging and pullback. Empire also understands there are weight restrictions along the Meadowbrook Parkway bridges, which may pose an additional challenge for construction access.

Additionally, Jones Beach State Park Causeway and Park System is a historic district listed on the National Register of Historic Places (NRHP), which includes the Wantagh, Ocean, Meadowbrook, and Loop State Parkways. Installation along the Meadowbrook State Parkway has the potential to result in direct impacts to an NRHP-listed property.

The Jones Beach landfall is not reasonable due to the length and significant complexity of the onshore export cable routing and potential cultural resource impacts. This route is also expected to be associated with impacts to the tidal wetlands along the onshore export cable route. Construction challenges and logistical constraints for the onshore export cable route also include vehicular traffic, construction vehicle access restrictions, pedestrian foot traffic, residential and commercial development density, noise impacts, business impacts, constructability, and workspace constraints due to existing infrastructure.

3.6.3.8 Shell Creek Park (Barnum Island) Alternative

A cable landfall alternative on Barnum Island avoids an export cable landfall on the Long Beach barrier island, and instead the submarine export cables continue in-water through Jones Inlet and traverse west along Reynolds Channel on the north side of the barrier island. The evaluated cable landfall is located at Shell Creek Park, an approximately 8-ac (3.2 ha) municipal park in the unincorporated portion of Barnum Island in the Town of Hempstead. The Shell Creek Park consists predominantly of playing fields and ball fields, with a walkway built along the seawall at the shoreline. The park is bounded by water to the south and east, and residential neighborhoods to the west and north.

The onshore export cable route to the onshore substation from Shell Creek Park is only 1.0 mi (1.6 km) long; however, it requires routing along the relatively constrained Vanderbilt Avenue, through a residential neighborhood. Since Shell Creek Park is a municipal parkland, State legislation may also be required for the grant of an easement for underground cables.

The Applicant's evaluation of the submarine export cable route (Section 3.5.2.8) concluded that a cable landfall at Barnum Island results in greater impacts to the marine environment, including Significant Coastal Fish and Wildlife Habitat, than the proposed route, and has significantly more logistical challenge associated with construction through Jones Inlet and in an area of high marine traffic. The submarine export cable route to the Shell Creek Park alternative is also located in proximity to the east side of the Sand Resource Area (Section 3.5.2). Since the submarine export cable route is not reasonable, the cable landfall at Shell Creek Park is also not reasonable.

3.7 Onshore Substation Alternatives

The onshore substation will facilitate the connection, in accordance with electric grid interconnection standards, of the power generated by the offshore wind farm into the Oceanside POI at the Hampton Road substation. The onshore substation functionality includes voltage regulation, reactive power compensation, and harmonic filtering, and the onshore substation will house the major control components for the electrical system. A discussion of cable voltage alternatives is provided in Section 3.10.1.

The Applicant assessed three potential parcels in the area of Oceanside or the Village of Island Park, New York for their feasibility and suitability for the development of a new onshore substation. Parcels for a potential onshore substation site were initially screened based on sufficient size for substation development, location to the south and west of the POI (to minimize the combined length of the submarine export and onshore export cable routes), possible commercial availability, and consistency with existing land uses (i.e., eliminating public open space). The three sites considered for onshore substation development are depicted in **Figure 3.5-1** and **Figure 3.5-2.** The Applicant assessed suitability of these parcels based on the following criteria:

- Availability (i.e., on the market for lease or sale);
- Distance from the POI;
- Flood hazard elevations;
- Zoning compatibility;
- Setback requirements;
- Existing land use;
- Available space;

- Proximity to environmental and cultural resources;
- Constructability factors (e.g., extent of site grading needed, access);
- Existing redevelopment plans; and
- Proximity to a suitable cable landfall (see Section 3.6).

3.7.1 Onshore Substation A

Onshore substation A is located at a property at the corner of Daly Boulevard and Hampton Road (3645 Hampton Road), in Oceanside, New York, and would occupy an up to 6.4-ac (2.6 ha) site. The site is bounded by Hampton Road to the west, Daly Boulevard to the south, and the LIRR and a residential development to the east (see **Figure 3.5-2**). North of the site is predominately used as an industrial area. The site does not contain any existing structures that need to be removed for the construction of the onshore substation. There is no planned remediation; however, potentially impacted soils and groundwater will be further assessed and/or managed as appropriate prior to and/or during construction. Onshore substation A is adjacent to NWI- and NYSDEC-mapped tidal waters to the west, but no direct impact to wetlands is expected for use of the site for the onshore substation.

The onshore export cable route to onshore substation A crosses Barnums Channel along the same route as the interconnection cable route from onshore substation C (see further discussion in Section 3.8). The combined length of the onshore export and interconnection cables (approximately 3.4 mi [5.5 km]) with the onshore substation A is approximately the same as the route for the proposed NY Project.

The Hampton Road substation is proposed to be located on the same property as the onshore substation A alternative. The Hampton Road substation is necessary to support the POI facilities, including the 345-kV to 138-kV step down, and 138-kV facilities. The construction of the Hampton Road substation on the same property reduces the available space for the onshore substation A alternative, such that there may not be sufficient space available for the Applicant's onshore substation facility. Based on the space limitations and future plans onshore substation A is not considered a reasonable alternative for the NY Project at this time, although the Applicant continues to conduct analysis based on the design requirements of the Hampton Road substation. To the extent this determination changes, the Applicant will prepare and submit any supplements necessary to effect such changes in this application.

3.7.2 Onshore Substation B

Onshore substation B is an approximately 7.4-ac (3.0-ha) site located at 4005 Daly Boulevard, in Oceanside, New York (see **Figure 3.7-2)**. The site is bordered by Daly Boulevard and a residential development to the north, Long Beach Road to the east, and an existing power station to the west and south. The parcel is owned by National Grid and currently contains an existing power station. The portion of the parcel evaluated for the proposed onshore substation is undeveloped and contains vegetation. It is immediately adjacent to mapped NWI wetlands and is located within NYSDEC-mapped tidal wetland adjacent areas. The Applicant has not conducted a formal wetland delineation of the site, but it is suspected that tidal wetlands may also extend within the site boundary. Onshore substation B does not contain any existing structures that need to be removed for the construction of the onshore substation.

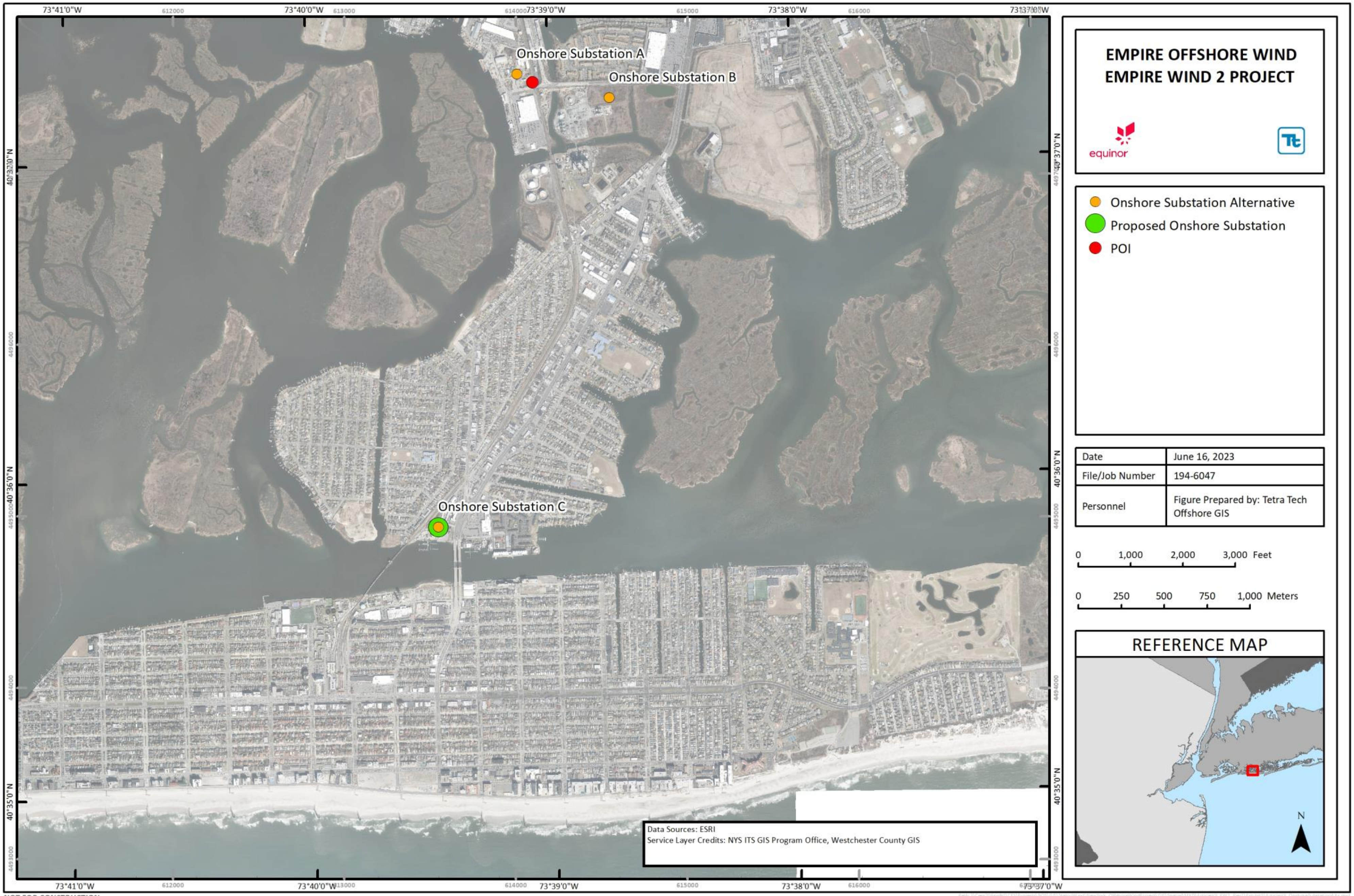


Figure 3.7-1 Onshore Substation Alternatives

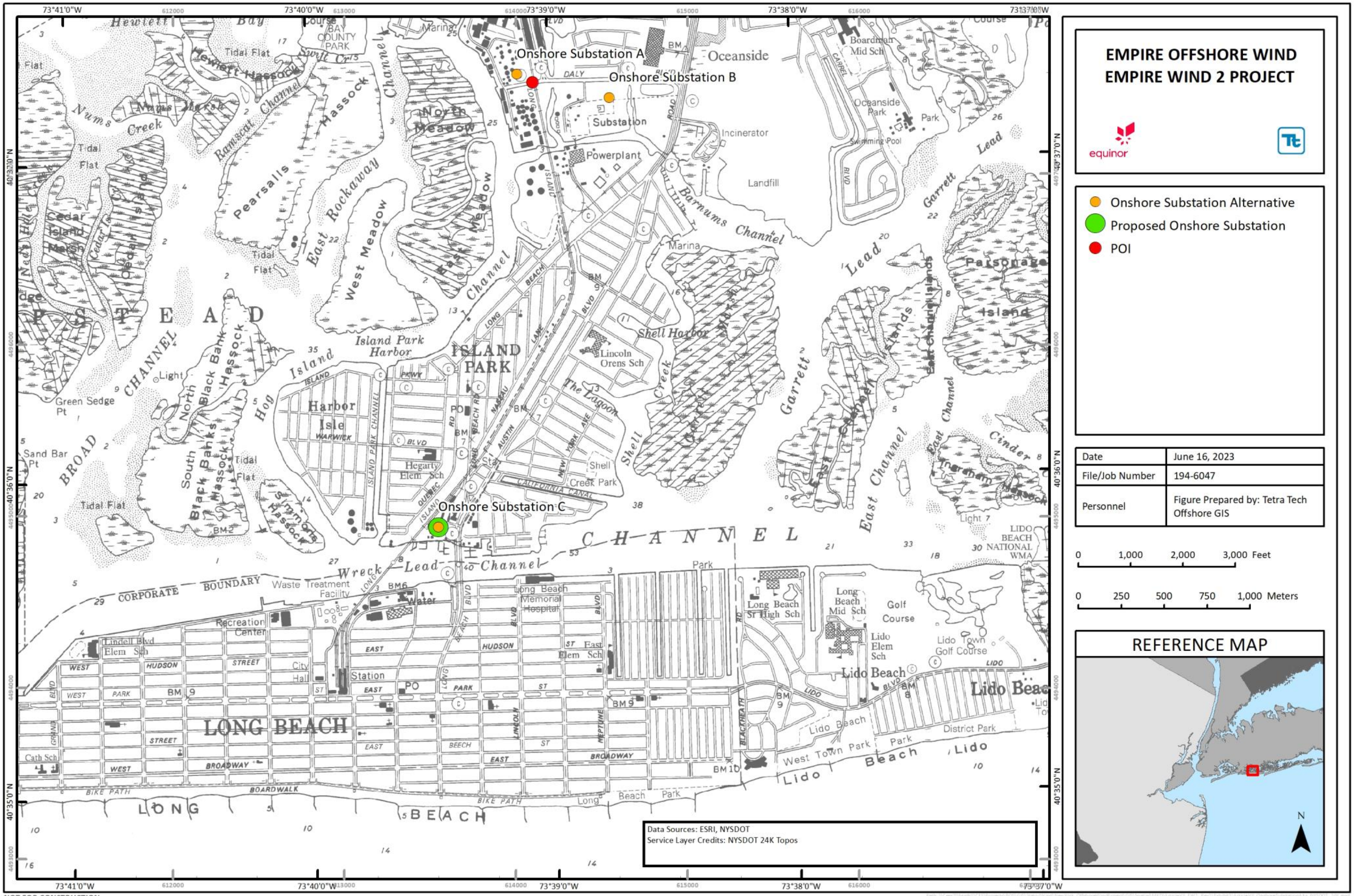


Figure 3.7-2 Onshore Substation Alternatives – NYSDOT Mapping

The onshore export cable route from the landfall to onshore substation B is approximately 4.0 mi (6.4 km). The interconnection cable route from Onshore Substation B to the POI is approximately 0.1 mi (0.2 km), for a total onshore cable route length of 4.1 mi (6.6 km). The onshore export cable route to onshore substation B crosses Barnums Channel to the east of the proposed route and is expected to require an open cut crossing solution (Section 3.10.3.2) resulting in a greater net impact to wetland areas than the proposed onshore substation (onshore substation C) and its associated interconnection cable route.

Onshore substation B is not a reasonable alternative, because the Applicant has determined that it is not commercially available for the NY Project. Moreover, construction and operation of onshore substation B, as well as the onshore export cable route to onshore substation B, may result in direct and indirect impacts to tidal wetlands and associated regulatory challenges.

3.7.3 Onshore Substation C

Onshore Substation C is a 5.2-ac (2.1-ha) site located at 15 Railroad Place, in Island Park, New York. The site is bordered by the LIRR to the west, Reynolds Channel to the south, and Long Beach Road to the east (see **Figure 3.7-2)**. The parcels are privately owned and contain existing commercial uses. Onshore substation C requires the demolition and removal of existing structures for the construction of the onshore substation. Construction of the onshore substation and associated access will require site grading and elevation, including potential refurbishment of existing bulkheads and shoreline stabilization (including filling within three existing boat slips). The Applicant is also currently evaluating the removal of floating and pile structures associated with the existing marina.

A small acreage (<0.1 ac [<0.04 ha]) of mapped NWI and NYSDEC-mapped tidal wetland is present within the onshore substation site boundary. However, based on the Applicant's field survey (**Exhibit 4: Environmental Impact**), wetlands onsite are associated with open water areas of the tidal Reynolds Channel; the mapped wetland areas within the site boundaries do not represent vegetated tidal wetlands or mudflats. Impacts to mapped wetland areas will be minimal and predominantly within an area of existing bulkheaded shoreline and existing boat slips. Based on review and discussion with the NYSDEC, onshore substation C is located partially within NYSDEC-mapped tidal wetland adjacent areas. The Applicant may remove the floating and pile structures associated with the existing marina. Removal of floating and pile structures associated with the existing marina, if conducted, would remove shading impacts and artificial structures within the marine environment.

The onshore export cable route from the cable landfall to onshore substation C is approximately 1.5 mi (2.4 km). The interconnection cable route from onshore substation C to the POI is approximately 1.7 mi (2.2 km), for a total onshore cable route length of 3.2 mi (5.2 km). Based on the available space, commercial availability and ability to achieve the NY Project purpose, onshore substation C is reasonable and proposed as the onshore substation site alternative for the NY Project.

3.8 Onshore Export and Interconnection Cable Route Alternatives Analysis

The goal of the onshore export cable and interconnection cable routing alternatives analysis was to develop a constructible route that is largely sited within public rights-of-way and minimizes impacts to the environment and the public. Conceptual routes developed for further analysis incorporate the following objectives, to the extent practicable: maximize use of public rights-of-way; minimize in-street work; avoid existing utilities; allow sufficient space for construction by routing in wider corridors; and maintain construction flexibility.

Siting the onshore export and interconnection cable routes to use public rights-of-way, including roadways, medians and adjacent areas, and railroads, where possible, is advantageous because the area is congested and highly developed, and is generally made up of small, privately owned lots with insufficient space for constructing the NY Project. Public rights-of-way limit the number of stakeholders directly impacted and the number of new landowner easements that must be acquired for the onshore export and interconnection cable routes.

Minimizing in-street work within the public right-of-way reduces impacts on traffic, enhances safety during construction, and typically shortens the duration of installation. It is also preferable to avoid roadways where possible because they typically contain gas, sewer, water, telecommunications, and electric utilities, which add routing and workspace constraints, construction logistics and complexity.

During conceptual routing, route alternatives that had some construction flexibility for siting refinement were preferred. For example, roadway corridors with available shoulders or space on both sides of the roadway were preferred. Wide corridors are needed to allow for adequate construction workspace and access for installation of the NY Project and to minimize the potential need for road closures. By routing the NY Project along wider rights-of-way corridors, constraints during the route assessment and development process can more easily be avoided with minor modification of the route alignment and/or construction workspace.

None of the onshore export and interconnection cable routing alternatives evaluated for the NY Project involve expansion of an existing right-of-way. Based on the location of the onshore NY Project within a densely developed area, options for co-location of onshore export and interconnection cable route alternatives along existing rights-of-way predominantly consist of existing public road and railroad rights-of-way. These rights-of-way are constrained by existing development and infrastructure such that expansion of the rights-of-way in these areas is not possible or practicable. As such, onshore export and interconnection cable route alternatives along rights-of-way were evaluated on the basis of the available space within the existing right-of-way, without right-of-way expansion. However, new rights-of-way within municipal lands and/or within private properties would be required for certain cable routing alternatives.

3.8.1 Onshore Export and Interconnection Cable Route Evaluation Criteria

The evaluation of onshore export and interconnection cable route alternatives was conducted as an iterative process that involved multiple steps of evaluation of the offshore and onshore cables routes, constraints on potential landfall locations, and the feasibility of landfall installation methodologies at potentially suitable landfall sites. Each of these NY Project components, although described as separate evaluations, were considered in concert for the selection of the overall preferred solution for the NY Project.

Onshore export and interconnection cable route alternatives from each of the reasonable cable landfall alternatives are shown in **Figure 3.8-1** and **Figure 3.8-2**. To identify the preferred cable route, the Applicant conducted a comparative analysis to assess the benefits and risks of several route options. The analysis considered the following criteria:

- Route length;
- Land use;
- Constructability;
- Presence of utilities;
- Prioritizing existing rights-of-way;
- Easement acquisition; and
- Environmental aspects such as wetlands and water bodies, historic and cultural resources, sensitive species habitat, potential for contamination, community impacts, and potential community opposition, among others.

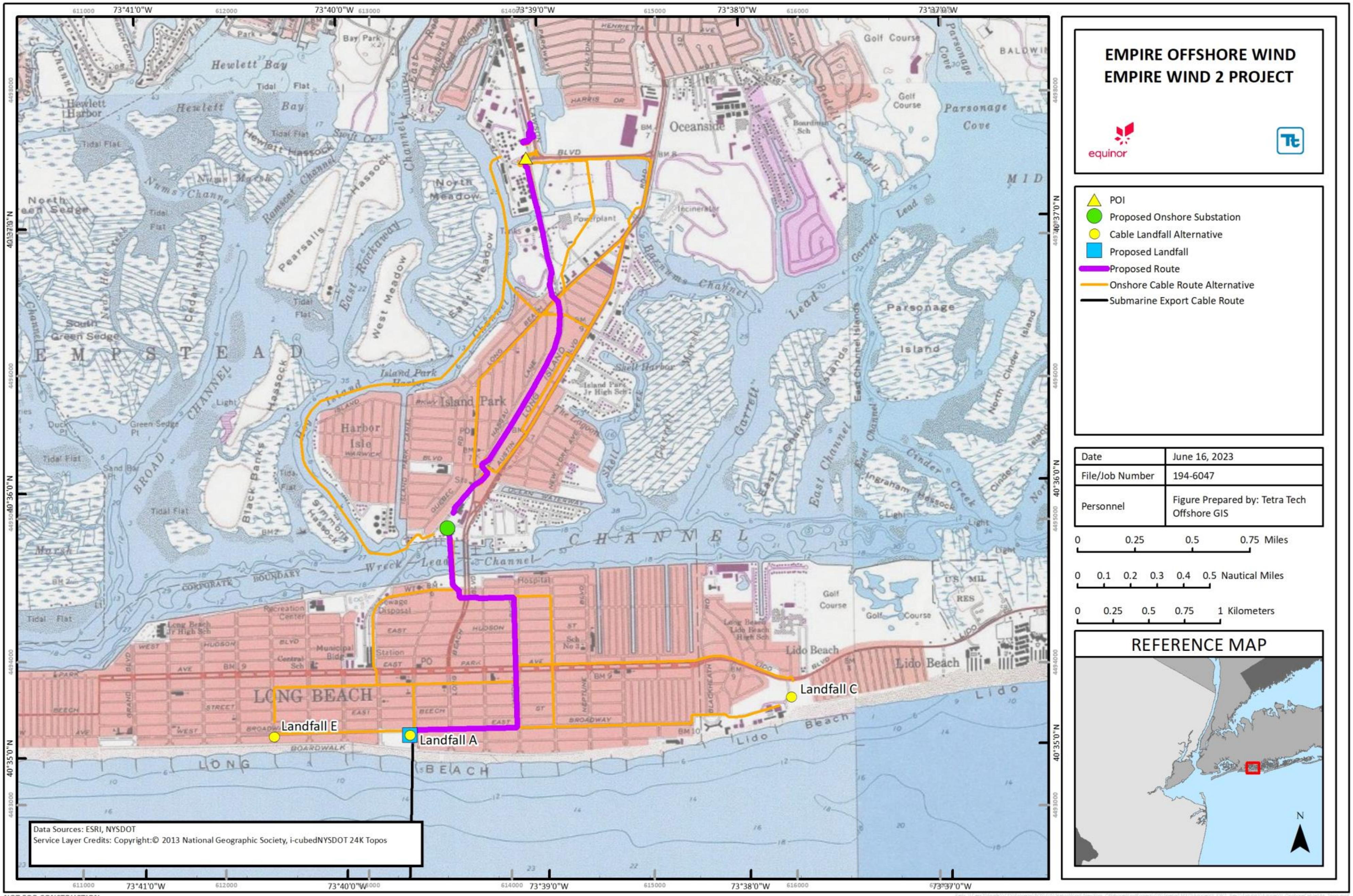


Figure 3.8-1 Onshore Export and Interconnection Cable Route Alternatives

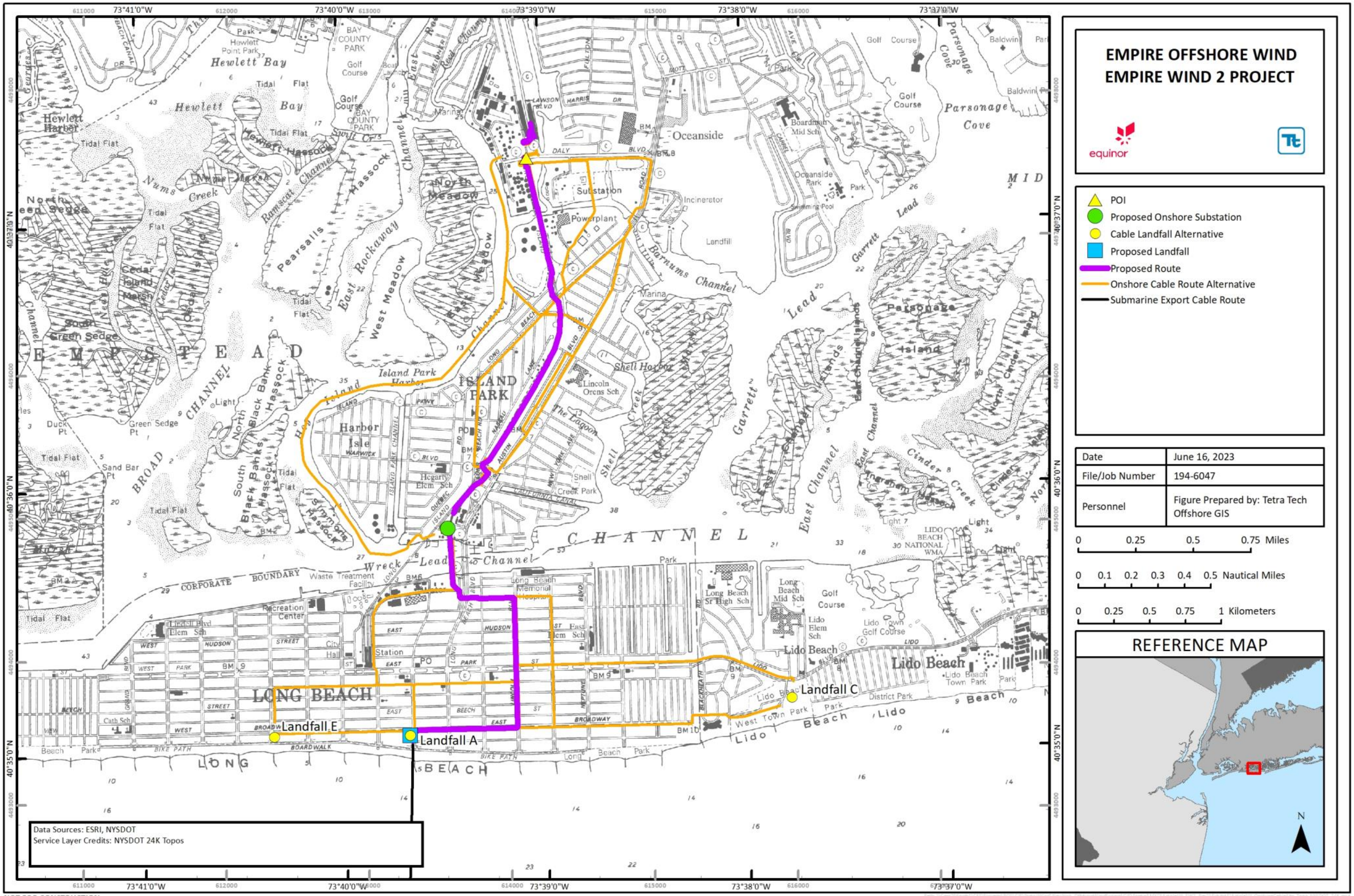


Figure 3.8-2 Onshore Export and Interconnection Cable Route Alternatives – NYSDOT Mapping

3.8.2 Onshore Export Cable Route Alternatives

The Applicant assessed eight onshore export cable route alternatives as depicted in **Figure 3.8-3.** Detailed assessment of onshore export cable route alternatives is limited to routes from the potentially reasonable onshore export cable landfall alternatives (Section 3.6) to the proposed onshore substation.

All of the evaluated onshore export cable routes south of Reynolds Channel are located along existing roadway corridors and avoid significant environmental impacts. The Applicant is proposing HDD installations to cross Reynolds Channel (see Section 3.10.3.1 for crossing alternatives) for any of the onshore export cable route alternatives considered; therefore, this crossing is not discussed in detail in each subsection. Although the Applicant has selected the E Broadway alternative from cable landfall alternative A as the proposed alternative, based on constructability characteristics, all of these routes are considered reasonable alternatives that minimize environmental impacts.

3.8.2.1 Landfall A: E Broadway Alternative (Applicant's Proposed)

The E Broadway alternative for the onshore export cable route from cable landfall alternative A is approximately 1.6 mi (2.5 km) long. From the export cable landfall at alternative A (Riverside Boulevard/E Broadway), the onshore export cables will turn east on E Broadway to Lincoln Boulevard and turn north (**Figure 3.8-3**). This route will continue north across E Park Ave to E Harrison Street and turn west, traversing across Long Beach Boulevard to Long Beach Road. The onshore export cable route then turns north along Long Beach Road to Park Place and a City of Long Beach property, where it continues north across Reynolds Channel to the onshore substation site.

E Broadway and Lincoln Boulevard are wide (approximately 90 ft [27 m] and 75 ft [23 m], respectively) roads with relatively low traffic compared to other roadways in the vicinity. Both have large parking medians in the middle of the road, which helps alleviate space congestion and impacts of cable installation.

The Applicant is proposing HDD installations to cross Reynolds Channel (see Section 3.10.3 for crossing alternatives) and evaluated alternative alignments for the HDDs across Reynolds Channel; however, other HDD crossing alignments in this vicinity generally require longer distances and/or curved HDD installation, which add time, cost, and complexity to the installation. In addition to the proposed HDD alignment, Empire considers an alternative HDD alignment from the intersection of Park Place and Riverside Boulevard on the south side of Reynolds Channel, to the north end of the onshore substation, along the LIRR, to be a reasonable alternative. This alignment can likely support up to two export cable circuits and requires an extra approximately 600 ft (183 m) of installation along Park Place, which is narrow and has existing utility congestion. However, the preferred solution is to install both onshore export cable circuits along the proposed HDD alignment, to the west of and roughly parallel to the Long Beach Bridge.

Based on the selection of cable landfall alternative A as the proposed cable landfall and the Applicant's assessment, which suggests reduced construction complexity, space constraints, and cost along the E Broadway alternative, this alternative is proposed for the onshore export cable route.

3.8.2.2 Landfall A: E Walnut Connector Alternative

The E Walnut Connector alternative for the onshore export cable route is approximately 1.5 mi (2.4 km) long. From the export cable landfall at alternative A (Riverside Boulevard/E Broadway), the onshore export cables traverse north up Riverside Boulevard and turn east on E Walnut Street (**Figure 3.8-3**). The onshore export cables then turn north on Lincoln Boulevard, continuing north across E Park Ave to E Harrison Street where the route turns west, traversing across Long Beach Boulevard to Long Beach Road. The onshore export cable route then turns north along Long Beach Road to Park Place and a City of Long Beach property, where it continues north across Reynolds Channel to the onshore substation site.

E Walnut Street is not as wide (approximately 50 ft [15 m]) as E Broadway. However, this alignment would allow the transition vaults at the cable landfall to be placed further to the north without a tight bend to turn onto E Broadway. Based on the selection of cable landfall alternative A as the proposed cable landfall and the Applicant's assessment, the E Walnut Connector alternative has reasonable construction complexity, space for installation, and cost; however, it was not selected as the proposed for the onshore export cable route due to the advantages installation along the wider corridor of E Broadway, and the cable landfall configuration, which allows the turn onto E Broadway along the proposed alternative route.

3.8.2.3 Landfall A: Riverside Boulevard Alternative

The Riverside Boulevard alternative for the onshore export cable route is approximately 1.3 mi (2.0 km). From the export cable landfall at alternative A (Riverside Boulevard/E Broadway), the onshore export cables traverse north up Riverside Boulevard to E Walnut Street. The onshore export cables then turn west to Edwards Boulevard, where the cables turn north, cross E Park Ave, and continue onto Reverend JJ Evans Boulevard (**Figure 3.8-3**). Reverend JJ Evans Boulevard turns into Park Place. The onshore export cables turn north onto a City of Long Beach property just before the eastern end of Park Place, and then the route crosses Reynolds Channel.

This route alternative is relatively short, which minimizes traffic and noise disruptions. However, the road corridor along Reverend JJ Evans Boulevard is narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the onshore export cables and joint bay siting, and potentially increases conflicts with existing utility congestion. Park Place is also narrow and has significant congestion with existing utility infrastructure (water and wastewater) associated with the adjacent water treatment plant. This route also has more extensive routing within NYSDEC-mapped potential environmental justice areas. This onshore export cable route represents a reasonable alternative from cable landfall alternative A but is not the proposed route for these reasons.

3.8.2.4 Landfall C: Lincoln Boulevard Alternative

The Lincoln Boulevard alternative for the onshore export cable route is approximately 2.4 mi (3.6 km) long. From the export cable landfall at alternative C (Lido Beach West Park), the onshore export cables traverse west through the park to Richmond Road (**Figure 3.8-3**). The onshore export cables continue west on Richmond Road until turning south on Maple Boulevard and then immediately west on East Broadway. The onshore export cables then turn north onto Lincoln Boulevard. From Lincoln Boulevard, the onshore export cables will continue north until turning west onto East Harrison Street. The onshore export cables then cross perpendicular to Long Beach Boulevard and turn north onto Long Beach Road, to the crossing at Reynolds Channel.

This onshore export cable route alternative offers relatively wide road corridors (approximately 85 ft [26 m] along East Broadway, and approximately 75 ft [23 m] along Lincoln Boulevard). Wider road corridors reduce the construction complexity of the installation by minimizing potential conflicts with existing utility infrastructure and potential need for utility relocations. The Lincoln Boulevard Alternative is predominantly along local roads (Town of Hempstead and City of Long Beach) with two county road crossings. Compared to other east-west road corridors (such as East Park Avenue), East Broadway has a relatively lower traffic volume (6,447 average daily traffic volume compared to 30,071).

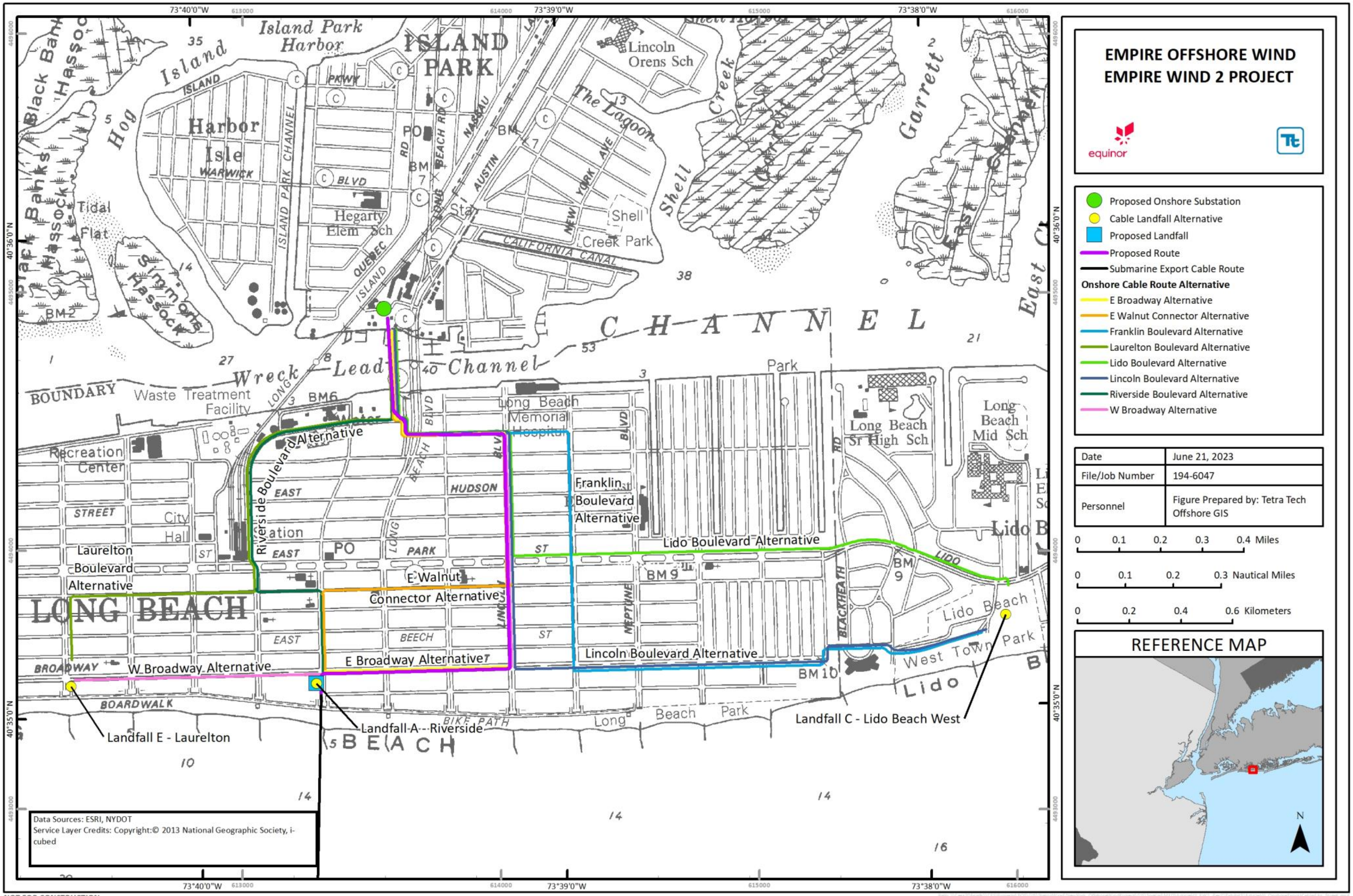


Figure 3.8-3 Onshore Export Cable Route Alternatives

Based on the Applicant's assessment, this onshore export cable route offers reasonable construction complexity, space constraints, and costs among the route alternatives considered from cable landfall Alternative C. Based on the selection of cable landfall Alternative A as the Applicant's proposed alternative, this onshore export cable route represents a reasonable alternative but is not proposed.

3.8.2.5 Landfall C: Franklin Boulevard Alternative

The Franklin Boulevard Alternative for the onshore export cable route is approximately 2.3 mi (3.6 km). From the export cable landfall alternative C (Lido Beach West Park), the onshore export cables traverse west through the park to Richmond Road. The onshore export cables continue west on Richmond Road until turning south on Maple Boulevard and then immediately west on East Broadway (**Figure 3.8-3**). The onshore export cables then turn north onto Franklin Boulevard. From Franklin Boulevard, the onshore export cables will continue north until turning west onto East Harrison Street. The onshore export cables then cross perpendicular to Long Beach Boulevard and turn north onto Long Beach Road, to the crossing at Reynolds Channel.

This onshore export cable route alternative offers relatively wide road corridors (approximately 85 ft [26 m] along East Broadway, and approximately 75 ft [23 m] along Franklin Boulevard). Wider road corridors reduce the construction complexity of the installation by minimizing potential conflicts with existing utility infrastructure and potential need for utility relocations. The Franklin Boulevard Alternative is predominantly along local roads (Town of Hempstead and City of Long Beach) with two county road crossings. Compared to other east-west road corridors (such as East Park Avenue), East Broadway has a relatively lower traffic volume (6,447 average daily traffic volume compared to 30,071; see also **Exhibit E-6**).

Based on the Applicant's assessment, this onshore export cable route offers reduced construction complexity, space constraints, and costs among the route alternatives considered from cable landfall Alternative C. Based on the selection of cable landfall alternative A as the Applicant's proposed alternative, this onshore export cable route represents a reasonable alternative but is not proposed.

3.8.2.6 Landfall C: Lido Boulevard Alternative

The Lido Boulevard Alternative for the onshore export cable route is approximately 2.0 mi (3.3 km). From the export cable landfall at Alternative C (Lido Beach West Park), the onshore export cables connect north into Lido Boulevard and traverse west, as Lido Boulevard turns into East Park Avenue (**Figure 3.8-3)**. The onshore export cables turn north Lincoln Boulevard, until turning west onto E Harrison Street. The onshore export cables then cross perpendicular to Long Beach Boulevard and turn north onto Long Beach Road, to the crossing at Reynolds Channel.

This route alternative is sited predominantly along county roads. Compared to other east-west road corridors East Broadway, East Park Avenue has a significantly higher traffic volume (30,071 average daily traffic volume compared to 6,447; see also **Exhibit E-6**). Along this route, it is anticipated that East Park Avenue would require the closure of two to three lanes of traffic for an extended period of time.

Based on the selection of cable landfall alternative A as the Applicant's proposed alternative, this onshore export cable route represents a reasonable alternative but is not proposed. Moreover, compared to other alternatives from cable landfall alternative C, this route has potential increased traffic impacts.

3.8.2.7 Landfall E: W Broadway Alternative

The W Broadway alternative for the onshore export cable route is approximately 2.1 mi (3.4 km) long. From the export cable landfall at alternative E (Laurelton Boulevard) in the City of Long Beach, the proposed onshore export cable route will turn east on W Broadway, continuing on to E Broadway (**Figure 3.8-3**). From E

Broadway, the onshore export cable route will continue to Lincoln Boulevard and turn north. This route will continue north across E Park Ave to E Harrison Street and turn west, traversing across Long Beach Boulevard to Long Beach Road. The onshore export cable route then turns north along Long Beach Road to Park Place and a City of Long Beach property, where it continues north across Reynolds Channel to the onshore substation site.

Based on the selection of cable landfall alternative A as the Applicant's proposed alternative, this onshore export cable route represents a reasonable alternative but is not proposed. Moreover, compared to other onshore export cable route alternatives this route is relatively long, increasing construction complexity, cost and duration of potential impacts.

3.8.2.8 Landfall E: Laurelton Boulevard Alternative

The Laurelton Boulevard Alternative for the onshore export cable route is approximately 1.5 mi (2.4 km) long. From the export cable landfall at alternative E (Laurelton Boulevard) the onshore export cables continue north along Laurelton Boulevard to West Park Avenue and turn east (**Figure 3.8-3)**. The onshore export cables continue until Reverend JJ Evans Boulevard, where the cables turn north. The onshore export cables then continue along Reverend JJ Evans Boulevard, which turns into Park Place, until the crossing at Reynolds Channel.

Similar to the Riverside Boulevard alternative, this route alternative is relatively short, which minimizes traffic and noise disruptions. However, the road corridor along Reverend JJ Evans Boulevard is relatively narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the onshore export cables and joint bay siting, and potentially increases conflicts with existing utility congestion. Park Place is also narrow and has significant congestion with existing utility infrastructure (water and wastewater) associated with the adjacent water treatment plant. This route also has more extensive routing within NYSDEC-mapped potential environmental justice areas. Based on the selection of cable landfall alternative A as the proposed alternative, this onshore export cable route represents a reasonable alternative but is not proposed.

3.8.3 Interconnection Cable Route Alternatives

The Applicant also considered interconnection cable route alternatives through Barnum Island and/or the Village of Island Park from the proposed onshore substation (onshore substation C) to the POI at the Hampton Road substation (**Figure 3.8-4**). The Applicant assessed ten interconnection cable route alternatives. Onshore interconnection cable route alternatives from the onshore substation follow one of three general north/south corridors: 1) the Long Island Railroad (LIRR) corridor, 2) the Long Beach Road corridor, or 3) the Austin Boulevard/Industrial Place corridor. These routes follow existing developed road or railroad rights-of-way corridors in upland areas until the northern portion of the route, in the vicinity of Barnums Channel. From there, each of the route corridors can connect to one of three Barnums Channel crossing locations, either along the LIRR, across the E.F. Barrett Generating Station property, or along Long Beach Road.

The Applicant also considered two routes with a submarine cable route portion for the interconnection cables from the onshore substation to the POI.

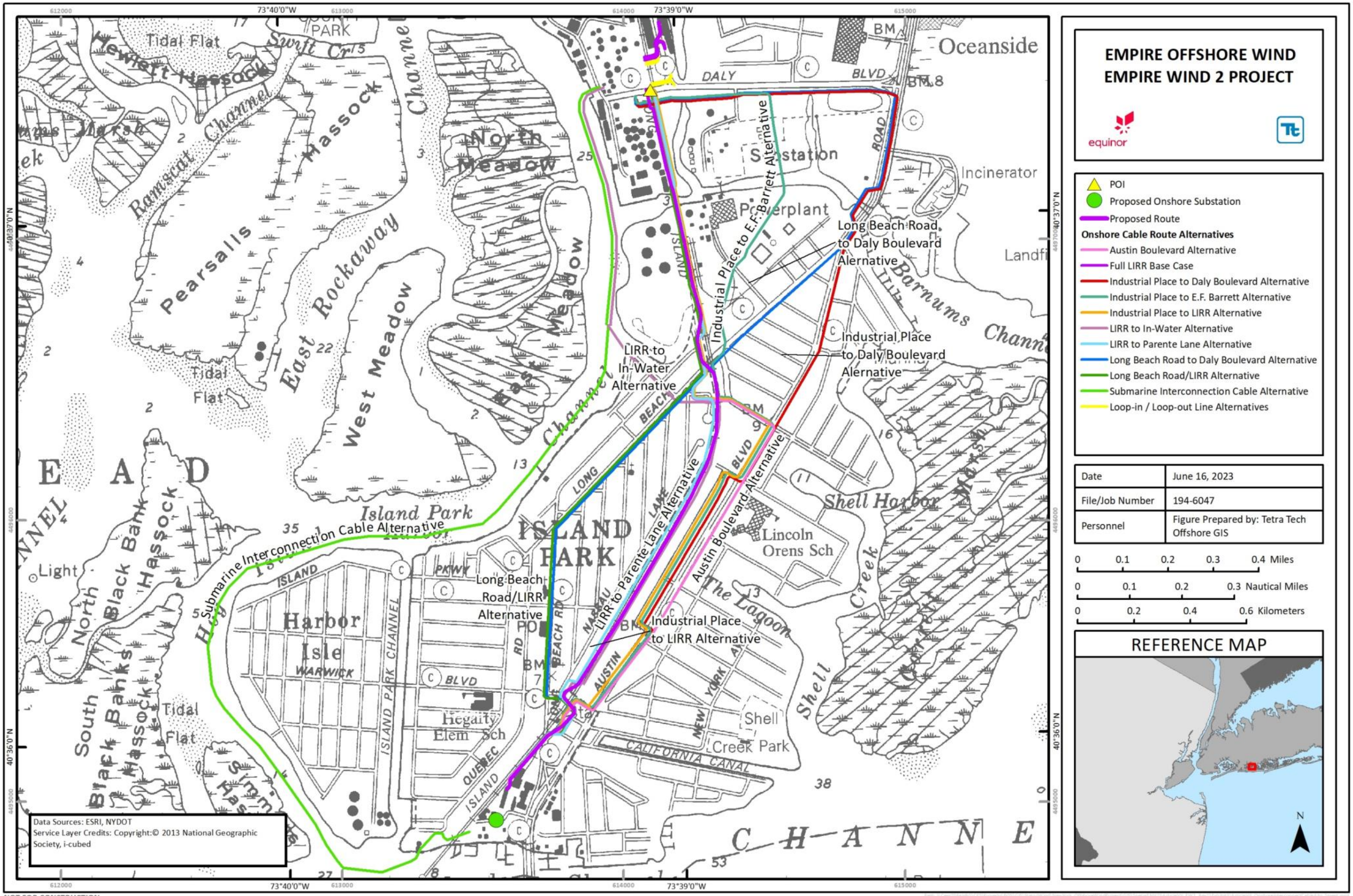


Figure 3.8-4 Interconnection Cable Route Alternatives

3.8.3.1 LIRR to Parente Lane Alternative

The LIRR to Parente Lane Alternative for the interconnection cable route is approximately 1.8 mi (2.9 km). From the onshore substation site, the route travels north, crossing the LIRR with horizontal auger bores in the parking lots of LIRR Island Park Station. The route continues in the west side of the LIRR right-of-way until turning west onto Parente Lane (**Figure 3.8-4**). The route connects to Long Beach Road, heads north onto North Nassau Lane, then parallels the west side of the railroad, adjacent to an existing tank farm. Along the LIRR corridor, the interconnection cable route crosses Barnums Channel for approximately 300 ft (91 m) on the west side of the LIRR bridge. From the north side of Barnums Channel this alternative continues within the LIRR right-of-way north across Daly Boulevard until it enters the Hampton Road substation.

This route is sited predominantly within the LIRR right-of-way, which has the advantage of reducing in-street construction and associated disruption to the community from traffic impacts and street closures. The LIRR right-of-way has sufficient space for joint bay siting and reduces cable bends. It also reduces the conflicts with utility congesting along roadway rights-of-way, and potential need for utility relocations, which reduces the duration of construction activities. The LIRR right-of-way is also one of the most direct and shortest routes from the onshore substation to the POI. This route avoids a narrow area of the LIRR right-of-way between Parente Lane and the E.F. Barrett Station property, by routing into public rights-of-way along Parente Lane, Kildare Road, and Long Beach Road, as well as private property.

Crossing Barnums Channel adjacent to the LIRR bridge provides the best alternative for minimizing impacts to tidal wetlands and within the tidal channel itself. The Applicant is proposing a cable bridge crossing, which will require installation of supports/footings within the channel; however, this will occur along a corridor already containing both the railroad bridge, and another utility bridge on the east side of the railroad crossing (Section 3.10.3.2). Since the north and south sides of the crossing comprise an existing parking lot and a tank farm, respectively, impacts to wetlands and natural habitats on either side of the crossing are minimized. Even in the case of an open cut crossing, crossing adjacent to the existing LIRR crossing is expected to result in a smaller footprint of disturbance to tidal wetlands than the open cut for the other routes evaluated.

Based on the Applicant’s assessment, which indicates that this route reduces construction complexity and space constraints and largely avoids the traffic impacts of construction activities and road closures along heavily-trafficked public roadways, the LIRR to Parente Lane alternative is reasonable for the interconnection cable route. Due to logistical considerations of routing along Parente Lane, traffic along Long Beach Road, and additional tight cable bends, this route is not proposed.

3.8.3.2 Full LIRR Alternative (Applicant’s Proposed)

The full LIRR Alternative for the interconnection cable route is approximately 1.7 mi (2.8 km). This route is similar to the LIRR to Parente Lane route alternative (**Figure 3.8-4)**. Between the end of Parente Lane and Long Beach Road to the north, this route stays parallel to the LIRR traversing D’Amato Drive. Along the LIRR corridor, the proposed interconnection cable route crosses Barnums Channel for approximately 300 ft (91 m) on the west side of the LIRR bridge, and then continues north across Daly Boulevard until it enters the POI.

The considerations for the full LIRR alternative are similar to the LIRR to Parente Lane alternative described in Section 3.8.3.1. This route is sited predominantly within the LIRR right-of-way, which has the advantage of reducing in-street construction and associated disruption to the community from traffic impacts and street closures. The LIRR right-of-way has sufficient space for joint bay siting and reduces cable bends. It also reduces the conflicts with utility congesting along roadway rights-of-way, and potential need for utility relocations, which reduces the duration of construction activities. The LIRR right-of-way is also one of the most direct and shortest routes from the onshore substation to the POI.

Crossing Barnums Channel via a cable bridge adjacent to the LIRR bridge provides the best alternative for minimizing impacts to tidal wetlands and within the tidal channel itself (see Section 3.10.3.2). Since the north and south sides of the crossing comprise an existing parking lot and a tank farm, respectively, impacts to wetlands and natural habitats on either side of the crossing are minimized. Even in the case of an open cut crossing, crossing adjacent to the existing LIRR crossing is expected to result in a smaller footprint of disturbance to tidal wetlands than the open cut for other routes evaluated.

Based on the Empire's assessment, which indicates that this route reduces construction complexity and space constraints and largely avoids the traffic impacts of construction activities and road closures along heavily-trafficked public roadways, the Full LIRR alternative is practicable and the proposed alternative for the interconnection cable route. Construction along the LIRR corridor will require close coordination with the railroad on requirements within the right-of-way.

3.8.3.3 Long Beach Road/LIRR Alternative

The Long Beach Road/LIRR alternative for the interconnection cable route is approximately 1.8 mi (2.9 km) (**Figure 3.8-4**). The route leaves the onshore substation site heading northeast within the parking lot adjacent to the LIRR tracks then crossing the LIRR with horizontal auger bores in the parking lot of LIRR Island Park Station. The route continues up Long Beach Road to North Nassau Lane, then parallels the west side of the railroad, adjacent to an existing tank farm. Along the LIRR corridor, the proposed interconnection cable route crosses Barnums Channel for approximately 300 ft (91 m) on the west side of the LIRR bridge (similar to the proposed alternative see Section 3.8.3.1), and then continues north across Daly Boulevard until it enters the POI.

The Long Beach Road/LIRR alternative is relatively narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the interconnection cables and joint bay siting, and potentially increases conflicts with existing utility congestion. Installation of the interconnection cables within Long Beach Road is challenging because Long Beach Road represents the only access to Barnum Island from the Long Island mainland and is one of only three routes to the Long Beach barrier island in general. It is the main route serving the central portion of the barrier island, including densely developed areas of the City of Long Beach. In this area, the average annual daily traffic is 45,688. As such, road closures and/or traffic impacts along this corridor for construction of the NY Project are likely to result in significant impacts. Additionally, existing transmission lines are already present along Long Beach Road, which limits potential space for the installation of the interconnection cables.

The Long Beach Road/LIRR alternative is a reasonable alternative for the interconnection cable route, but has additional construction complexity, environmental and traffic impacts associated with construction along Long Beach Road compared to the proposed alternative.

3.8.3.4 Long Beach Road to Daly Boulevard Alternative

The Long Beach Road to Daly Boulevard alternative for the interconnection cable route is approximately 2.5 mi (4.1 km). This interconnection cable route alternative leaves the onshore substation site heading northeast within the parking lot adjacent to the LIRR tracks then crosses the LIRR with horizontal auger bores in the parking lot of the LIRR Island Park Station. The route connects to Long Beach Road and continues on Long Beach Road all the way to the Austin Boulevard intersection (**Figure 3.8-4**). It then continues across Barnums Channel in the vicinity of the bridge along Long Beach Road and turns west onto Daly Boulevard. The route then crosses the LIRR with horizontal auger bores and into the POI.

This route alternative involves several challenging crossings of the LIRR right-of-way: north of Island Park Station, along Long Beach Road between D'Amato Drive and Sherman Road, and along Daly Boulevard approaching the POI. Installation of the interconnection cables within Long Beach Road is challenging because the Long Beach Road bridge represents the only access to Barnum Island from the Long Island mainland and is one of only three routes to the Long Beach barrier island in general. It is the main route serving the central portion of the barrier island, including densely developed areas of the City of Long Beach. In this area, the average annual daily traffic is 45,688. The workspace needed for the LIRR crossing between D'Amato Drive and Sherman Road has the potential to result in temporary impacts to the egress/ingress to Barnums Island and the Village of Island Park for a more extended time. As such, road closures and/or significant traffic impacts along this corridor for construction of the NY Project are likely to result in unacceptable impacts.

This route alternative also crosses Barnums Channel along Long Beach Road. In this area, Barnums Channel is narrowed by the Long Beach Road bridge abutments to only approximately 100 ft (30 m). The Long Beach Road corridor approaching either side of the bridge is elevated, with tidal wetlands on either side. Cable installation within the existing road bridge is not expected to be technically feasible. The Applicant therefore assumes that the Barnums Channel crossing along this corridor will need to occur alongside the Long Beach Road bridge. Since NYSDEC-mapped tidal wetlands are present to both the east and west of Long Beach Road in the vicinity of the bridge, any crossing solution (whether open cut, HDD or cable bridge) results in greater impacts to tidal wetlands than the proposed alternative. However, due to existing infrastructure, such as the bridge and bridge abutments, sufficient space for HDD is likely not available. A cable bridge solution in this location is expected to have greater impact to wetlands and visual impact than along the proposed route, since the surroundings along Long Beach Road lack the existing industrial infrastructure that is present along the proposed route. An open cut crossing could avoid impacts of new aboveground infrastructure along this corridor, and is assumed for this route, but will result in greater impacts to tidal wetlands than the proposed alternative.

Long Beach Road is relatively narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the interconnection cables and joint bay siting, and potentially increases conflicts with existing utility congestion. There are also several tight bends for the interconnection cables along this route which add construction cost and complexity. Additionally, Austin Boulevard is currently being redeveloped by Nassau County. In general, impacting recently restored roadways is discouraged by municipal and county agencies.

The Long Beach Road to Daly Boulevard Alternative is a reasonable alternative for the interconnection cable route but is not proposed due to logistical complexity and environmental and traffic impacts associated with construction along Long Beach Road and the crossing of Barnums Channel.

3.8.3.5 Industrial Place to LIRR Alternative

The Industrial Place to LIRR alternative for the interconnection cable route is approximately 2.0 mi (3.2 km). The route leaves the onshore substation site heading northeast within the parking lot adjacent to the LIRR tracks. The route crosses Long Beach Road, travelling through the LIRR Island Park Station parking lot. The route enters Austin Boulevard, turns west onto Sagamore Road, then north onto Industrial Place (**Figure 3.8-4**). Industrial Place is taken until the end of the road, and then the route reconnects to Austin Boulevard. The route continues west onto Saratoga Boulevard and horizontal auger bores would be required to cross underneath the LIRR tracks to Parente Lane. The route continues up Kildare Road to Long Beach Road to North Nassau Lane. From there the route heads north crossing Barnums Channel for approximately 300 ft (91 m) on the west side of the LIRR bridge, and then continues north across Daly Boulevard until it enters the POI.

The Industrial Place to LIRR Alternative is routed partially along Austin Boulevard, which has significantly higher traffic volumes (38,078 average annual daily traffic) than Long Beach Road (11,684 average annual daily traffic). Industrial Place is relatively narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the interconnection cables and joint bay siting, and potentially increases conflicts with existing utility congestion. There are also several tight bends for the interconnection cables along this route. Additionally, Austin Boulevard is currently being redeveloped by Nassau County. In general, impacting recently restored roadways is discouraged by municipal and county agencies.

Based on the Applicant's assessment, the Industrial Place to LIRR alternative is a reasonable alternative for the interconnection cable route but results in greater impact to heavily trafficked public roadways and additional construction complexity due to utility congestion and cable bends compared to the preferred route alternative.

3.8.3.6 Austin Boulevard Alternative

The Austin Boulevard alternative for the interconnection cable route is approximately 1.9 mi (3.1 km). This route is similar to the Industrial Place to LIRR alternative, except that it does not deviate along Industrial Place but instead stays along Austin Boulevard until it reaches Saratoga Boulevard (**Figure 3.8-4**). From there, horizontal auger bores are required to cross underneath the LIRR tracks to Parente Lane. The route continues up Kildare Road to Long Beach Road to North Nassau Lane. From there, the route heads north crossing Barnums Channel for approximately 300 ft (91 m) on the west side of the LIRR bridge, and then continues north across Daly Boulevard until it enters the POI.

Routing along Austin Boulevard is challenging due to the high traffic volumes and logistical challenges for installation of the interconnection cables, joint bay siting, and conflicts with existing utility congestion. There are also several tight bends for the interconnection cables along this route. Austin Boulevard is currently being redeveloped by Nassau County, and general, impacting recently restored roadways is discouraged by municipal and county agencies.

The Austin Boulevard alternative is a reasonable alternative for the interconnection cable route but results in greater impact to heavily trafficked public roadways and additional construction complexity due to utility congestion and cable bends compared to the proposed route.

3.8.3.7 Industrial Place to Daly Boulevard Alternative

The Industrial Place to Daly Boulevard alternative for the interconnection cable route is approximately 2.5 mi (4.0 km). The Industrial Place to Daly Boulevard alternative exits the onshore substation routing northeast, crossing Long Beach Road and travelling through the LIRR parking lot. The route exits onto Austin Boulevard, turns west onto Sagamore Road, then onto Industrial Place (**Figure 3.8-4**). Industrial Place is taken until the end of the road, and then the route reconnects to Austin Boulevard. The route continues north to Long Beach Road and crosses Barnums Channel (see Section 3.10.3.2 for discussion of the Barnums Channel crossing along this route), turns west onto Daly Boulevard, crosses the LIRR with horizontal auger bores and into the POI.

As described in Section 3.8.3.4 for the Long Beach Road to Daly Boulevard alternative, this route also crosses Barnums Channel along Long Beach Road. In this area, Barnums Channel is narrowed by the Long Beach Road bridge abutments to only approximately 100 ft (30 m). The Long Beach Road corridor approaching either side of the bridge is elevated, with tidal wetlands on either side. Cable installation within the existing road bridge may not be technically feasible, and results in closure of the main ingress/egress to Barnum Island, which is considered impracticable. Empire therefore assumes that the Barnums Channel crossing along this corridor will need to occur alongside the Long Beach Road bridge. Since NYSDEC-mapped tidal wetlands are present to both the east and west of Long Beach Road in the vicinity of the bridge, any crossing solution (whether open cut, HDD or cable bridge) results in greater impacts to tidal wetlands than the proposed alternative. However, due to existing infrastructure, such as the bridge and bridge abutments, sufficient space for HDD is likely not available. A cable bridge solution in this location is expected to have greater impact to wetlands and visual impact than along the proposed route, since the surroundings along Long Beach Road lack the existing industrial infrastructure that is present along the proposed route. An open cut crossing could avoid impacts of new aboveground infrastructure along this corridor, and is assumed for this route, but will result in greater impacts to tidal wetlands than the proposed alternative.

Long Beach Road and Industrial Place are each relatively narrow (approximately 35 ft [11 m]), which poses logistical challenges for installation of the interconnection cables and joint bay siting, and potentially increases conflicts with existing utility congestion. There are also several tight bends for the interconnection cables along this route, which add construction cost and complexity. This route is also partially located along Austin Boulevard, which has significantly higher traffic volumes than Long Beach Road. Additionally, Austin Boulevard is currently being redeveloped by Nassau County. In general, impacting recently restored roadways is discouraged by municipal and county agencies.

The Industrial Place to Daly Boulevard alternative is a reasonable alternative for the interconnection cable route, but has additional construction complexity, environmental and traffic impacts associated with construction along Long Beach Road and the crossing of Barnums Channel compared to the proposed alternative.

3.8.3.8 Industrial Place to E.F. Barrett Alternative

The Industrial Place to E.F. Barrett alternative for the interconnection cable route is approximately 2.2 mi (3.6 km) long. The route leaves the onshore substation site heading northeast within the parking lot adjacent to the LIRR tracks. The route crosses Long Beach Road, travelling through the LIRR Island Park Station parking lot. The route enters Austin Boulevard, turns west onto Sagamore Road, then north onto Industrial Place (**Figure 3.8-4**). Industrial Place is taken until the end of the road, and then the route reconnects to Austin Boulevard. The route continues west onto Saratoga Boulevard and horizontal auger bores are required to cross underneath the LIRR tracks to Parente Lane. From there, the Industrial Place to E.F. Barrett goes north along D'Amato Drive to Long Beach Road, and crosses back to the east across the LIRR tracks. The route then immediately turns northwest onto Ladomus Ave, continuing across private property to the east of the E.F. Barrett Power Station. From there, the interconnection cable route crosses Barnums Channel for approximately 300 ft (91 m). Although unmapped, tidal wetlands are expected to be present on both the south and north side of Barnums Channel, approaching Daly Boulevard, before it turns west along Daly Boulevard to the POI. NYSDEC-mapped tidal wetlands are present immediately to the east of the crossing location, south of Daly Boulevard.

This route alternative involves several challenging crossings of the LIRR right-of-way: between Saratoga Boulvard and Parente Lane, along Long Beach Road between D'Amato Drive and Sherman Road, and along Daly Boulevard approaching the POI. Installation of the interconnection cables within Long Beach Road is challenging because the Long Beach Road bridge represents the only access to Barnum Island from the Long Island mainland and is one of only three routes to the Long Beach barrier island in general. It is the main route serving the central portion of the barrier island, including densely developed areas of the City of Long Beach. In this area, the average annual daily traffic is 45,688. The workspace needed for the LIRR crossing between D'Amato Drive and Sherman Road has the potential to result in temporary impacts to the egress/ingress to Barnums Island and the Village of Island Park for a more extended time. As such, road closures and/or significant traffic impacts along this corridor for construction of the Project are likely to result in unacceptable impacts.

Crossing Barnums Channel within the private property to the east of the E.F. Barrett Power Station is expected to result in the greatest impact to tidal wetlands. Tidal wetland may be located adjacent to either side of the crossing in this area. Moreover, construction of an HDD crossing of Barnums Channel is constrained by the presence of the existing power station infrastructure and may not be feasible; if determined possible, such a crossing is expected to require HDD workspace and pull back area within the mapped tidal wetlands south of Daly Boulevard. An open cut crossing is practicable and assumed for this crossing location. Empire also anticipates commercial challenges for obtaining an easement across the property in this area and the potential for routing conflicts with existing infrastructure on the E.F. Barrett property.

Based on the logistical challenges and increased cost and complexity due to the LIRR crossings, the potential challenge of obtaining easements, and impacts along highly-trafficked roadways, the Applicant determined the Industrial Place to E.F Barrett alternative is not a reasonable alternative for the NY Project. This route is also expected to result in greater impacts to tidal wetlands than the proposed alternative and associated regulatory challenges.

3.8.3.9 Submarine Interconnection Cable Alternative

The Submarine Interconnection Cable Alternative is a 2.4-nm (2.7-mi, 4.4-km) submarine route that exits the onshore substation to the west within Reynolds Channel, continuing north around Harbor Island and north through Hog Island Channel to directly enter the POI (**Figure 3.8-4**). The onshore interconnection cables transition to submarine cable via transition vaults prior to entering the waterway of Reynolds Channel by either open cut or HDD.

A submarine alternative would increase impacts within the marine environment compared to other alternatives evaluated. The majority of the submarine cable route alternative is located within the mapped Significant Coastal Fish and Wildlife Habitat in West Hempstead Bay, considered one of the largest undeveloped coastal wetland systems in New York State, with a significant nesting habitat for coastal shorebirds and colonial wading birds, and a productive area for marine finfish, shellfish, and other wildlife (NYSDOS 2008 a, b). Moreover, construction of a submarine export cable route through Hog Island Channel has significant challenges for constructability, associated with shallow waters, charted wrecks, special construction techniques required, specialized shallow draft vessels required to operate in the shallow and narrow channel, and existing marine traffic. Initial evaluation also suggests that trenchless construction of the onshore-to-offshore transitions at both the onshore substation and the POI may not be feasible, resulting in trenching across the shoreline for an open cut installation.

Based on the construction complexity and additional environmental impacts associated with a submarine cable alternative for the interconnection cable route, the Applicant determined this is not a reasonable alternative for the NY Project.

3.8.3.10 LIRR to In-Water Alternative

The LIRR to In-Water Alternative for the interconnection cable route is approximately 1.9 mi (3.1 km) long. This alternative incorporates a shorter in-water segment to avoid challenges along the northern end of the LIRR right-of-way and the crossing of Barnums Channel. From the onshore substation site, the route travels north, crossing the LIRR with horizontal auger bores in the parking lots of LIRR Island Park Station. The route continues in the west side of the LIRR right-of-way until turning west onto Parente Lane. Travelling west across Long Beach Road, all the way down Redfield Road and exiting into the northern section of Hog Island Channel (**Figure 3.8-4**). The route follows the Hog Island Channel northward where it makes landfall into the POI.

This alternative reduces the length of the in-water route, but still results in increased impacts within the marine environment compared to the proposed alternative, and would be located within mapped Significant Coastal Fish and Wildlife Habitat in West Hempstead Bay, considered one of the largest undeveloped coastal wetland systems in New York State, with a significant nesting habitat for coastal shorebirds and colonial wading birds, and a productive area for marine finfish, shellfish, and other wildlife (NYSDOS 2008 a, b). Based on the construction complexity and additional environmental impacts associated with a submarine cable alternative for the interconnection cable route, the Applicant determined this is not a reasonable alternative for the NY Project, similar to the submarine cable alternative described in Section 3.8.3.9.

3.8.4 Summary of Onshore Export and Interconnection Cable Route Alternatives

Table 3.8-1 and **Table 3.8-2** provide a summary comparison of the onshore export cable route and interconnection cable alternatives, respectively.

Table 3.8-1 Comparison of Onshore Export Cable Route Alternatives

Assessment Criteria	Cable Landfall Alternative A			Cable Landfall Alternative C			Cable Landfall Alternative E	
	E Broadway (Applicant's Proposed)	E Walnut Connector	Riverside Boulevard	Lincoln Boulevard	Franklin Boulevard	Lido Boulevard	W Broadway	Laurelton Boulevard
Onshore Export Cable Route Length	1.6 mi (2.5 km)	1.5 mi (2.4 km)	1.3 mi (2.0 km)	2.2 mi (3.6 km)	2.3 mi (3.6 km)	2.0 mi (3.3 km)	2.1 mi (3.4 km)	1.5 mi (2.4 km)
Landfall construction complexity	High	High	High	Moderate	Moderate	Moderate	High	High
Number of railroad crossings	0	0	0	0	0	0	0	0
Cable landfall easement/permit risk	Moderate	Moderate	Moderate	High	High	High	Moderate	Moderate
Cable route easement/permit risk	Low	Low	Low	Low	Low	Low	Low	Low
Expected stakeholder considerations	High	High	High	Moderate	Moderate	Moderate	High	High
Coastal erosion concern	High	High	High	High	High	High	High	High
Potential onshore threatened & endangered species habitat	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noise impacts	High	High	High	Moderate	Moderate	Moderate	High	High
Traffic impacts	High	High	High	Moderate	Moderate	Moderate	High	High
Areas of potential cultural significance crossed	No	No	No	No	No	No	No	No
Approximate length in existing right-of-way	1.3 mi (2.1 km)	1.3 mi (2.1 km)	1.1 mi (1.7 km)	1.8 mi (3.0 km)	1.8 mi (3.0 km)	1.8 mi (3.0 km)	1.9 mi (3.1 km)	1.3 mi (2.1 km)
Length of existing right-of-way expansion	0	0	0	0	0	0	0	0
Approximate length across private parcels	0.01 mi (0.02 km)	0.01 mi (0.02 km)	0.01 mi (0.02 km)	0.01 mi (0.02)	0.01 mi (0.02 km)	0.01 mi (0.02 km)	0.01 mi (0.02 km)	0.01 mi (0.02 km)
Approximate length across public lands	0.04 mi (0.06 km)	0.04 mi (0.06 km)	0.04 mi (0.06 km)	0.3 mi (0.4 km)	0.3 mi (0.4 km)	0.04 mi (0.06 km)	0.04 mi (0.06 km)	0.04 mi (0.06 km)
Potential crossing LWCF grant	Yes	Yes	Yes	No	No	No	Yes	Yes
Land Use, Percent Developed Land	93%	93%	91%	95%	95%	94%	95%	93%
Open Water	7%	7%	9%	5%	5%	6%	5%	7%

Table 3.8-2 Comparison of Interconnection Cable Route Alternatives

Assessment Criteria	LIRR to Parente Lane Alternative	Full LIRR Alternative (Applicant's Proposed)	Long Beach Road/LIRR Alternative	Long Beach Road to Daly Boulevard Alternative	Industrial Place to LIRR Alternative	Austin Boulevard Alternative	Industrial Place to Daly Boulevard Route Alternative	Industrial Place to E.F. Barrett Alternative	Submarine Interconnection Cable Route Alternative	LIRR to In-Water Route Alternative
Interconnection Cable Route Length	1.8 mi (2.9 km)	1.7 mi (2.8 km)	1.8 mi (2.8 km)	2.5 mi (4.1 km)	2.0 mi (3.2 km)	1.9 mi (3.1 km)	2.5 mi (4.0 mi)	2.2 mi (3.6 km)	2.7 mi (4.4 km)	1.9 mi (3.1 km)
Expected onshore infrastructure congestion	Moderate	Moderate	High	High	High	High	High	Moderate	Low	Low
Number of railroad crossings	1	1	1	3	1	1	1	3	1 a/	1
Cable route easement/permit risk	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	High	High	High
Number of abutters	Moderate	Moderate	High	High	High	High	High	Moderate	Low	Low
Expected stakeholder considerations	Moderate	Moderate	High	High	High	High	High	Moderate	Low	Low
Noise impacts	Moderate	Moderate	High	High	High	High	High	Moderate	Low	Low
Traffic impacts	Moderate	Moderate	High	High	High	High	High	Moderate	Low	Low
Areas of potential cultural sensitivity crossed	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
Approximate length in existing right-of-way	1.2 mi (1.9 km)	1.1 mi (1.7 km)	1.2 mi (2.0 km)	2.4 mi (3.9 km)	1.4 mi (2.3 km)	1.4 mi (2.2 km)	2.4 mi (3.8 km)	1.8 mi (2.9 km)	0.1 mi (0.1 km)	1.2 mi (1.9 km)
Length of existing right-of-way expansion	0	0	0	0	0	0	0	0	0	0
Approximate length across private parcels	0.4 mi (0.7 km)	0.4 mi (0.7 km)	0.4 mi (0.7 km)	0.1 mi (0.2 km)	0.4 mi (0.7 km)	0.4 mi (0.7 km)	0.1 mi (0.2 km)	0.5 mi (0.7 km)	0.1 mi (0.1 km)	0.03 mi (0.04 km)
Approximate length across public lands	0.2 mi (0.3 km)	0.2 mi (0.4 km)	0.1 mi (0.2 km)	0.02 mi (0.03 km)	0.1 mi (0.2 km)	0.1 mi (0.2 km)	<0.01 mi (0.01 km)	<0.01 mi (0.01 km)	0	0.3 mi (0.4 km)
Approximate submarine cable length	0	0	0	0	0	0	0	0	2.3 mi (3.7 km)	0.6 mi (1.0 km)
Land Use, Percent Developed Land	99%	99%	99%	97%	99%	99%	97%	88%	6%	67%
Land Use, Percent Emergent Herbaceous Wetlands	0%	0%	0%	3%	0%	0%	3%	4%	3%	1%
Land Use, Percent Open Water	1%	1%	1%	0%	1%	1%	0%	2%	92%	31%
Land Use, Barren Land (Rock/Sand/Clay)	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%
Land Use, Percent Developed Open Space	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Land Use, Grassland/Herbaceous	0%	0%	0%	0%	0%	0%	0%	<1%	0%	0%
Land Use, Deciduous Forest	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%

Assessment Criteria	LIRR to Parente Lane Alternative	Full LIRR Alternative (Applicant's Proposed)	Long Beach Road/LIRR Alternative	Long Beach Road to Daly Boulevard Alternative	Industrial Place to LIRR Alternative	Austin Boulevard Alternative	Industrial Place to Daly Boulevard Route Alternative	Industrial Place to E.F. Barrett Alternative	Submarine Interconnection Cable Route Alternative	LIRR to In-Water Route Alternative
Land Use, Woody Wetlands	0%	0%	0%	0%	0%	0%	0%	<1%	0%	0%

3.9 Hampton Road Substation and Loop-in / Loop-out Line Alternatives

The Hampton Road substation will facilitate the step-down voltage from 345-kV to 138-kV. The loop-in / loop-out lines will connect from the 138-kV substation facilities within the Hampton Road substation to LIPA's existing 138-kV transmission lines under Lawson Boulevard.

As the location of the POI and LIPA's facilities for the NY Project were accepted by LIPA and NYISO in the interconnection Facilities Study process, the POI and the Hampton Road substation are not part of the alternatives analysis. The Hampton Road substation facilities and loop-in / loop-out lines will be around or downstream of the Oceanside POI.

3.9.1 Loop-in / Loop-out Line Alternatives Analysis

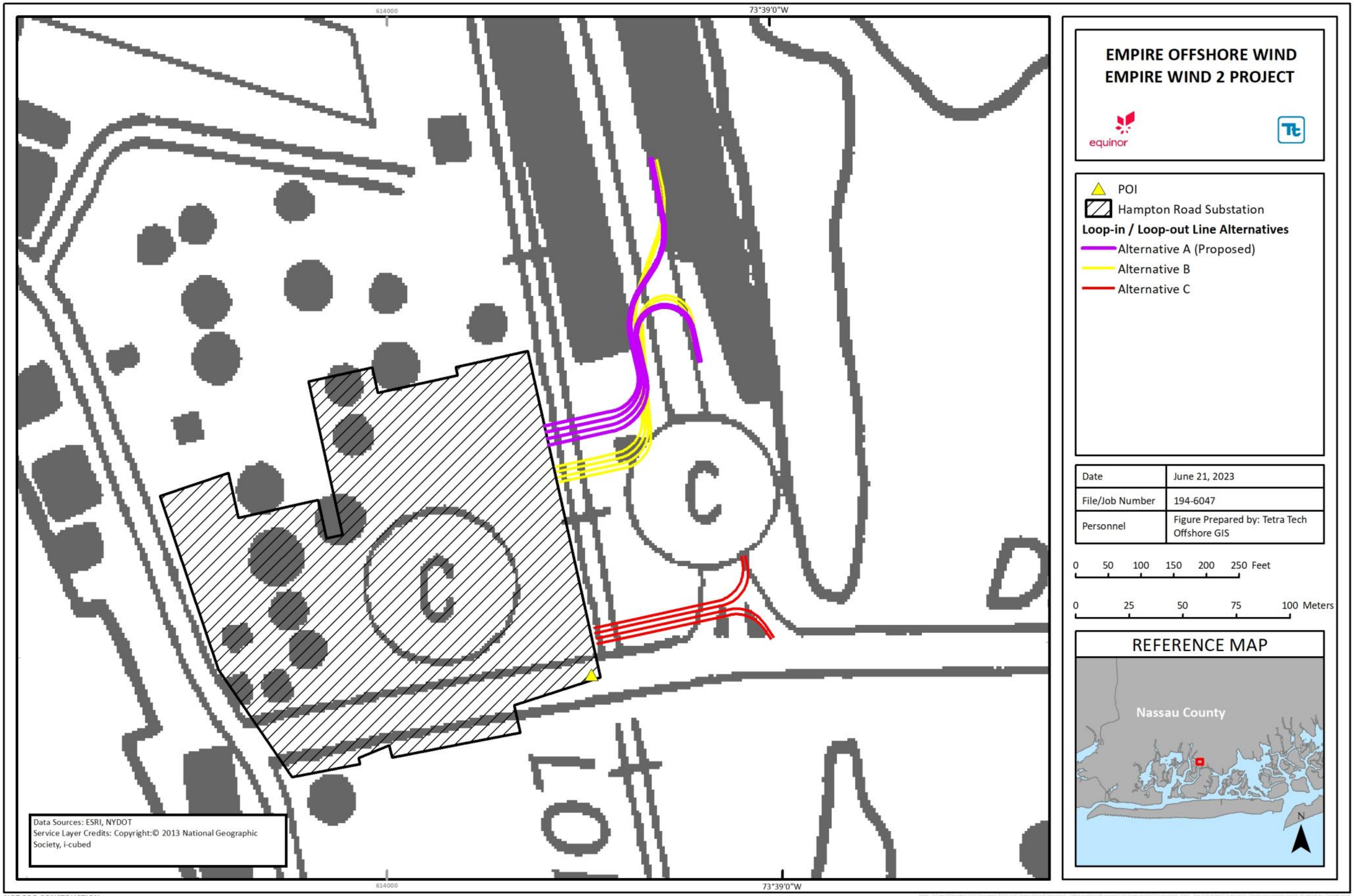
The Applicant has evaluated loop-in / loop-out line route alternatives to connect from the Hampton Road substation to LIPA's existing 138-kV transmission lines under Lawson Boulevard (**Figure 3.9-1**). The Applicant assessed three loop-in / loop-out line crossing alternatives under LIRR right-of-way to connect the loop-in / loop-out lines from the eastern boundary of the Hampton Road substation to the 138-kV transmission lines under Lawson Boulevard. Although the Applicant indicates a proposed alternative for the purposes of this Application, the loop-in / loop-out line route will be determined as developed through the NYISO interconnection process.

3.9.1.1 Loop-in / Loop-out Line Route A (Applicant's proposed)

The loop-in / loop-out line route A alternative is approximately 0.1 mi (0.2 km). It is the northernmost proposed crossing of the LIRR right-of-way east of the Hampton Road substation. For all of the evaluated alternatives, the LIRR right-of-way would be crossed by a jack-and-bore or similar trenchless method to avoid impacts to the railroad. For loop-in / loop-out route A, this would mean that the proposed sending pit for the bores would be located on private property east of LIRR right-of-way, and the receiving pit would be located within the Hampton Road substation parcel. The considerations in favor of this alternative include ease of accessibility to the route, coordination required with only one private landowner east of the LIRR crossing, and an upland routing for the LIRR crossing that is anticipated to avoid impacts to wetlands and other jurisdictional areas. Loop-in / loop-out line route A would also have less elevational change, and fewer utility interference/constraints than other evaluated alternatives. Based on these factors, loop-in / loop-out line A alternative is reasonable and the proposed alternative for the loop-in / loop-out line route.

3.9.1.2 Loop-in / Loop-out Line Route B

The loop-in / loop-out line route B alternative is approximately 0.1 mi (0.2 km). It is located just south of loop-in / loop-out line A route alternative. For loop-in / loop-out line route B, the receiving pit for the jack-and-bore under the LIRR right-of-way, as well as new conduit and cable installation, would be located within the northern yard of an existing LIRR power station. There is only a 30-ft (9-m) separation of space between the LIRR power station and the facility fence line to the north, which would make siting the bore hole on the receiving side more difficult than for the proposed alternative. The loop-in / loop-out line route B alternative therefore is a reasonable alternative but has additional construction complexity/constraints compared to the proposed alternative.



NOT FOR CONSTRUCTION

Figure 3.9-1 Loop-in / Loop-out Line Route Alternatives

3.9.1.3 Loop-in / Loop-out Line Route C

The loop-in / loop-out line route C alternative is less than 0.1 mi (0.2 km). This alternative would have the southernmost location for the crossing of the LIRR right-of-way of the evaluated alternatives. The loop-in / loop-out line route C alternative requires a jack-and-bore receiving pit south of the LIRR power station, within an area among several existing 69-kV power poles. The receiving pit location is more constrained than other alternatives considered, by the power poles, steep topography, a bridge to the south, and the LIRR power station to the north, which results in challenging construction for the LIRR crossing. Based on the logistical challenges of construction, steep topography, and landowner permissions required, the Applicant determined the loop-in / loop-out line C route alternative is a reasonable alternative but has additional construction complexity/constraints compared to the proposed alternative.

3.10 Alternative Technologies

In addition to the siting and routing alternatives evaluated above, the Applicant also assessed a variety of alternative facility designs, installation methods, and technologies to fulfill its energy requirements. A summary of the options evaluated is provided in this section.

3.10.1 Submarine Export Cable Transmission Technology Alternatives

The Applicant evaluated different transmission technologies for the submarine export cables against the following criteria:

- Transmission distances;
- Economic considerations; and
- Land required to support onshore electrical facilities.

The submarine export cables are designed to use HVAC rather than HVDC due to the considerably lower costs to interconnect HVAC into the alternating current terrestrial grid at the Hampton Road Substation. HVDC requires a considerably larger investment with greater complexity, significantly larger offshore and onshore space requirements, and higher maintenance needs than HVAC due to the need for converter stations onshore and offshore. HVDC becomes more cost-effective for wind farms with a larger nameplate capacity than is planned for the EW 2 Project, in part because HVDC may allow a reduction in the number of export cables for larger projects. This may also be preferable for long transmission lines carrying very large power capacities where HVDC reduces transmission losses relative to HVAC. The transmission distance and power rating of the EW 2 Project submarine export cables make it suitable and more cost-effective to employ an HVAC system.

3.10.2 Submarine Export Cable Installation Alternatives

The Applicant also evaluated several alternative methods for cable installation offshore, including cable burial and direct placement on the seafloor. Empire is proposing to bury the submarine export cables using jetting, mechanical plow and trenching/cutting. Dredging or mass flow excavation are not proposed for cable burial in general, but may be required in certain locations, such as for pre-sweeping and seabed preparation activities prior to cable lay, and at certain asset crossings.

Placement of the submarine export cables directly on the seafloor as the primary installation method was determined to be not practicable due to the heightened risk of third-party damage to the cables and increased maintenance requirements from anchor or fishing gear snagging. Although direct seafloor disturbance from jetting or trenching during construction would be avoided with this method, the additional cable protection measures required to minimize third-party damage would result in a much larger footprint alteration of the seabed surface and long-term impact to the benthos. Additional cable protection requirements would also likely offset the installation time savings from placing cables on the seafloor instead of burying them. As such, the Applicant has retained placement of the cables directly on the seafloor, with cable protection (such as rock berm or matting) only for limited areas where sufficient burial depths cannot be achieved due to seabed conditions.

For cable burial, the Applicant assessed a variety of methods including jet plow, mechanical plow, trenching/cutting, and dredging. Both jetting and mechanical plowing may create a trench and lay the cable in a single pass. Jetting may be conducted via a towed device that travels along the seafloor surface. Jetting may also be conducted with a vertical injector fixed to the side of a vessel or barge. These methods inject high pressure water into the sediment through a blade that is inserted into the seafloor to create a trench. The water sufficiently liquifies the sediments such that the cable can then settle down through the suspended sediments to the desired burial depth. Mechanical plowing uses a cable plow that is pulled along the seabed, creating a narrow trench. Simultaneously, the cable is fed from the cable ship down to the plow, with the cable laid into the trench by the plow device. Due to gravity, the displaced sediment returns to the furrow, covering the cable.

Jetting methods (including capjet, jet sled, jet plow and vertical injector equipment) are considered the Applicant's primary proposed method for cable installation. Jetting is the most efficient method of submarine cable installation, and it minimizes the extent and duration of bottom disturbance for the significant length and water depths along the submarine export cable route. The majority of suspended sediments from jetting settle back in the trench naturally, reducing sedimentation impacts.

The Applicant also considered trenching, or cutting, which may be used on seabed containing hard materials not suitable for mechanical plowing or jetting, as the trenching machine is able to mechanically cut through the material using a chain or wheel cutter fitted with picks or teeth. Once the cutter creates a trench, the submarine export cable is laid into it, and typically backfill is mechanically returned to the trench using a backfill plow. This method is less preferred due to lower efficiency, longer installation duration, and greater potential impacts from the additional step of backfilling the trench. However, both mechanical plowing and trenching (cutting) are proposed as potential installation methods to be used in the event that the Applicant encounters seabed or depth conditions where jet plowing is not practicable or efficient. Pre-sweeping or pre-trenching may be associated with any of the considered cable burial methodologies.

Mechanical dredging was also assessed as a potential method for submarine cable installation. Dredging is used to excavate, remove, and/or relocate sediment from the seabed in order to increase water depth and alter existing conditions; this can be completed through clamshell dredging, suction dredging, and/or hydraulic dredging. Because of the greater duration and extent of sediment disturbance associated with dredging, this method is not practicable for the majority of the cable installation. Dredging, however, may be proposed for certain locations such as the potential use of a suction dredge or mass flow excavation in limited locations for pre-sweeping, seabed preparation activities, and utility asset crossings.

3.10.3 Inland Waterway Crossing Alternatives

3.10.3.1 Reynolds Channel Crossing Alternatives

The Applicant evaluated crossing methods and alignments for the onshore export cable installation across Reynolds Channel between the Long Beach barrier island and Barnum Island. Alternative methods considered include:

- HDD Alternative; and

- Open Cut Alternative.

The HDD alternative involves the installation of the two land-to-land HDDs, one for each of the onshore export cables, for approximately 1,014 ft (309 m) across Reynolds Channel. HDDs are frequently used to install cables in ducts under sensitive coastal and nearshore habitats, such as dunes, beaches, waterways, and submerged aquatic vegetation The method for HDD installation on land is similar to that described for the export cable landfall in Section 3.6.2, except that both workspaces are onshore, with the environmental resource crossing in between. Onshore crossings via HDD utilize a rig that drills a borehole underneath the waterway or other environmental resource. Once the rig exits onshore, the ducts in which the cable will be installed are then pulled back within the drilled borehole. Onshore crossings require two onshore work areas (approximately 246 ft by 246 ft [75 m by 75 m] on each side) to support the activities. For the Reynolds Channel crossing, both workspaces are located on previously developed commercial/industrial lands adjacent to the waterbody.

An open cut crossing of Reynolds Channel requires an approximately 72-ft (22-m) wide trench per cable, within an approximately 300 ft (91 m) wide installation corridor and requires excavation of the shoreline on both sides of the crossing. Water depths reach 30 ft (9.1 m) or more in the deepest portions of the Reynolds Channel crossing. In addition to requiring extensive dredging/in-water impact to the tidal channel to install both cable circuits, Reynolds Channel is used by boats and the installation of the open cut crossing would occur alongside the Long Beach Bridge twin drawbridge that connects the Long Beach barrier island to Barnum Island and the Village of Island Park. Construction of an open cut installation across Reynolds Channel in this location, adjacent to the drawbridge, could result in impacts to marine traffic in this area during construction activities. Immediately upstream and downstream of the crossing area, Reynolds Channel also contains Significant Coastal Fish and Wildlife Habitat designated by the New York Department of State, including potential habitat for winter flounder, a managed species.

Based on the Applicant's evaluation, an open cut installation is a practicable alternative for constructing the Reynolds Channel crossing, but it would result in greater environmental impacts than the proposed HDD crossings. Although all HDD installations carry some risk of an inadvertent drilling fluid return (see Section 3.6.2), the Applicant will minimize and mitigate risks by implementing an Inadvertent Return Plan. HDD installation of the two export cable circuits is a practicable solution that minimizes the potential environmental impacts of the Reynolds Channel crossing.

The Applicant evaluated alternative alignments for the HDDs; however, other HDD crossing alignments in this vicinity require longer distances and/or curved HDD installation, which add time, cost and complexity to the installation. In addition to the proposed HDD alignment, the Applicant considered an alternative HDD alignment from the intersection of Park Place and Riverside Boulevard on the south side of Reynolds Channel, to the north end of the onshore substation along the LIRR, to be a practicable alternative. However, this alignment requires an extra approximately 600 ft (183 m) of installation along Park Place, which is narrow and has existing utility congestion. Therefore, the preferred solution is to install both export cable circuits along the proposed alignment, to the west of and roughly parallel to the Long Beach Bridge along Long Beach Boulevard.

Availability of alternative parcels for HDD workspace is constrained along Reynolds Channel. Since in-water impacts are avoided with the proposed HDD alignment and other alternatives would result in an equal or greater environmental impact, alternative HDD installation alignments are not discussed further.

3.10.3.2 Barnums Channel Crossing Alternatives

The Applicant evaluated three different crossing methods for Barnums Channel, including:

- An HDD installation of the cables belowground;
- And open cut installation of the cables belowground; and
- An aboveground cable bridge.

These alternatives are discussed in this section.

HDD

An HDD solution at Barnums Channel would involve twoland-to-land HDDs similar to those described for the proposed Reynolds Channel crossing (see Section 3.10.3.1) but over a shorter crossing distance. The Applicant determined that use of the HDD installation method is not practicable along the LIRR corridor, due to the lack of sufficient space on the south side of the crossing (at the tank farm) to stage HDDs for both cable circuits, and the lack of an alignment that would allow a sufficient separation distance between each of the two HDDs. Foundations of unknown depth associated with the tank farm, retaining walls on either side of Barnums Channel, and the bridge footings also pose space and alignment constraints, adding risk to the feasibility and safety of completing the HDDs in this area. Moreover, both sides of the crossing are areas that historically housed fuel oil storage facilities; therefore, there is the potential that HDDs would involve drilling through contaminated soils and/or groundwater on either side of the crossing, as well as a previously remediated area on the north side of the crossing.

Open Cut

As described in Section 3.6.2.3 for the export cable landfall, an open cut requires the Applicant to excavate, remove, and/or relocate sediment to install the interconnection cables in a trench across the tidal channel at the target burial depth. For a waterway crossing, an open cut is typically constructed using excavators working from both banks and/or within the channel, as necessary. Excavated material is collected in an appropriate manner for either re-use or disposal (depending on the nature of the material) and in accordance with applicable regulations.

An open cut crossing allows the cable to be buried below the waterway, with no aboveground structures or permanent fill within Barnums Channel. However, installation via an open cut will require more extensive disturbance to the channel for dredging, excavation, and stockpiling, within an approximately 120 ft (37 m) construction corridor across the channel. Sediments within Barnums Channel may have existing contamination, due to the location near industrial properties and known discharges in the vicinity.

An open cut installation would result in greater disturbance to Barnums Channel; therefore, the Applicant is proposing the aboveground cable bridge solution at this location. In the case that further feasibility evaluation reveals that a cable bridge is not feasible for this crossing, the Applicant would evaluate installation of the interconnection cables via an open cut with a dry crossing method. A dry crossing method involves isolating the work area from the flow of water (with sandbags, bladderdam, cofferdam, or other measures) prior to trenching, and using a dam-and-pump, flume, or similar design to transport water from one side of the work area to the other. Dry crossings minimize the transport of sediment during an open cut by preventing water from flowing across the disturbance area until the bed and backs have been restored. In the case that a dry crossing is also not feasible, a wet crossing would be used, and the Applicant would consider the potential efficacy of alternative best management practices to minimize sediment transport (e.g., silt curtains).

Cable Bridge

The proposed crossing of Barnums Channel will consist of two cable tray transition areas to elevate the cables to the height of the proposed bridge superstructure. The total structure, inclusive of the two transition areas and the bridge superstructure, will be supported by approximately thirty-one piles at seven locations (e.g., pile caps). The proposed piles to support the transition areas and bridge superstructure consist of steel H-piles installed within 2-ft (0.61-m) diameter steel pipe piles. Multiple piles will be required at each pile cap location along the bridge.

Within the crossed waterway there are planned to be up to five bent caps consisting of approximately twenty-three piles. These supports may be installed by hammer or other installation methods, up to 100 ft (30 m) below the seabed, with final design subject to geotechnical investigation. The cable bridge superstructure will be constructed from a prefabricated steel truss system assembled offsite and set in place and the superstructure will measure up to 25 ft (7.6 m) wide and 10 ft (3.05 m) tall and span a length of approximately 200 ft (64 m). The cable tray transition areas will measure up to 15 ft (2.13 m) wide and each span approximately 50 ft (15.3 m). The crossing will be located adjacent to the existing LIRR railway bridge. The bridge superstructure is anticipated to have a low chord elevation up to 16.0 ft NAVD88, with a maximum total height of 30 ft (9.1 m) NAVD88. The Applicant is also further evaluating whether it is practicable to design the cable bridge without footings.

Since the north and south sides of the crossing comprise an existing parking lot and a tank farm, respectively, impacts to wetlands and natural habitats on either side of the crossing are minimized. The above ground cable bridge presents the best solution to span the waterway and avoid trenching or drilling through the existing bulkheads and potentially contaminated soils/groundwater that may exist to the north and south of the crossing. As such, the Applicant selected the aboveground cable bridge solution as the practicable alternative that minimizes environmental impacts.

3.10.4 Cable Voltage Alternatives

The Applicant assessed a voltage alternative for installation of 230-kV submarine and onshore export cables. Installation of three 230-kV export cables is a reasonable alternative for the NY Project, but requires installation of three export cable circuits, rather than two, which increases the footprint of marine disturbance for the submarine export cable installation and associated cable protection measures and existing utility crossings. It also increases the duration of construction activities and the disturbance within the marine environment. The 230-kV export cable circuits would require three HDDs each at the cable landfall and Reynolds Channel, which would also increase the duration of onshore noise and construction disturbance for the HDD installations at those locations.

With either the proposed 345-kV export cables, or the 230-kV export cable alternative, the Applicant could step down the onshore export cables directly to 138-kV interconnection cables via 345-kV/138-kV or 230-kV/138-kV transformers at the onshore substation site. However, 138-kV interconnection cable circuits require additional space, especially for the joint bays. Spacing with the existing public roadways and/or LIRR rights-of-way is constrained, such that limited space is available for the 138-kV joint bays, and traffic and road closure impacts would be expected. The 138-kV circuits also would result in greater electric and magnetic fields along an 138-kV interconnection cable route.

As such, the Applicant is proposing to maintain the 345-kV for the interconnection cables from the onshore substation to the POI. Although the proposed onshore substation will not step up or step down the voltage from 345-kV, the reactive power created along the export cable route still requires an onshore substation for control equipment. Otherwise, the reactive power would limit the amount of energy and capacity that could be delivered from the offshore wind farm to the POI. For these reasons, an onshore substation is required. Further, the Applicant understands that LIPA prefers the transmission system entering the POI substation to be at either 138-kV or 345-kV, consistent with existing equipment in the LIPA system. As described in Section

3.7.1, space availability on the site adjacent to the Hampton Road substation (which is required for the voltage transformation from 345-kV to 138-kV, POI, and 138-kV substation facilities) is limited to also house the onshore substation equipment for control and reactive power compensation functions. The use of 345-kV interconnection cables mitigates space and generally reduces electric- and magnetic-fields relative to 138-kV cables. The NYISO Public Power Transmission Needs (PPTN) process seeks to strengthen the Long Island grid and is expected to bring 345-kV connections closer to the Barrett 138-kV Substation, resulting in potential future synergies.

3.10.5 Cable and Pipeline Crossing Method Alternatives

The submarine export cable route will cross existing in-service and out-of-service assets including existing transmission cables and/or natural gas pipelines. The proposed methods for installing the submarine export cables across third-party assets are using concrete or rock-filled mattresses or rock berm protection. As described in Section 3.6.2.1, a water-to-water HDD was determined to be impracticable for crossing the Transco LNYLBL. Other asset crossing methods considered are evaluated in this section.

The Applicant evaluated an artificial reef concept that would use an artificial reef structure as cable protection in lieu of the mattress or rock protection that would be employed for a traditional trenched asset crossing. However, the Applicant did not find examples of artificial reefs having been previously used for cable protection at asset crossings; therefore, the effectiveness of these structures is unknown. Because of the soft soils present at the locations of the existing cable and pipeline crossings, it was determined that a mattress foundation would likely need to be employed in combination with the artificial reef structures for sufficient support. The reef units also carry the risk of creating anchor snag points. Therefore, the Applicant determined that the use of an artificial reef in conjunction with asset crossings is not a practicable solution for the NY Project.

A pile-supported bridging crossing would require driving piles to either side of the asset crossing, and significant trench dredging. Seabed impacts, as well as potential underwater noise impacts, would be greater than with the preferred solutions. This method is also more labor-intensive and costly than traditional crossing methods. It was therefore determined that a pile-supported bridge crossing is not a practicable solution for the NY Project.

Rock filled mattresses, concrete articulated mats and rock berm protection were determined to be practicable options for asset crossings, considering concerns such as hydraulics, scour, and anchor drag/impact. These methods therefore have been retained for case-by-case use at the cable and pipeline crossings along the submarine export cable route.

As described in **Exhibit E-3**, rock filled mattresses, concrete articulated mats and rock berm protection were determined to be reasonable options for asset crossings, considering concerns such as river hydraulics, scour, and anchor drag/impact. These methods therefore have been retained for case-by-case use at the cable and pipeline crossings along the submarine export cable route.

3.10.6 Onshore Substation and Hampton Road Substation Alternatives

The Applicant evaluated gas-insulated and air-insulated options for the design of both the onshore substation and Hampton Road substation. A gas-insulated substation design was selected for both, due to the limited space available on each site. The main reason for using gas-insulated switchgear is that it enables the Applicant to design a compact substation with as small a footprint as possible, and to minimize visual impacts in this urban area. Gas-insulated switchgear can be designed as either indoor or outdoor. The difference in noise output between indoor and outdoor switchgear is not significant compared to noise generated by other substation components. Indoor switchgear would be visually shielded by buildings, while outdoor switchgear and other main components would employ visual screening to minimize visual impacts. The Applicant is planning to use indoor switchgears for the 345-kV and 138-kV voltage levels at both substations; however, outdoor air-insulated equipment may be used for lower voltage level equipment at both substations.

3.10.7 Aboveground Installation Alternative

The Applicant compared underground installation of the onshore cables for the NY Project with aboveground installation of overhead transmission lines. Based on the proposed location of the onshore cable route within a highly developed area, underground installation of the onshore export and interconnection cables is preferred due to the reduction in visual impacts and the ability to use the existing roadway corridors for installation. The use of overhead cables would likely require additional negotiation for property rights and would be space-limited for the corridors under consideration. Additionally, although the initial installation cost and duration for overhead transmission lines is typically lower than installing underground cables, overhead transmission lines and associated transmission structures are more vulnerable to impacts during storms and flood events, reducing system reliability and requiring more frequent maintenance than underground cables. For these reasons, an underground transmission system is proposed for the NY Project.

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