Empire Offshore Wind LLC and EW Offshore Wind Transport Corporation

Empire Wind 2 Project

Article VII Application

Appendix L
In-Air Acoustic Assessment

Prepared for:

equinor

Empire Offshore Wind LLC
600 Washington Boulevard, Suite 800
Stamford, Connecticut 06901

Prepared by:

TETRA TECH

10 Post Office Square, Suite 1100
Boston, Massachusetts 02109

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TABLE OF CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
BOEM	Bureau of Ocean Energy Management
dB	decibel
dBA	A-weighted decibel
dBL	linear decibel
Empire or the Applicant	Empire Offshore Wind LLC and EW Offshore Wind Transport Corporation
EW 2	Empire Wind 2
ft	foot
HDD	horizontal directional drilling
HVAC	high-voltage alternating current
Hz	Hertz
ISO	International Organization for Standardization
km	kilometer
kV	kilovolt
L_{10}	noise level exceeded 10 percent of the time (a measurement of intrusive noises)
L_{50}	noise level exceeded 50 percent of the time
L_{90}	noise level exceeded 90 percent of the time (quietest 10 percent of any time period)
L_{dn}	day-night sound level
Lease Area	designated Renewable Energy Lease Area OCS-A 0512
L_{eq}	equivalent sound level
L_P	sound pressure level
L_W	sound power level
LIPA	Long Island Power Authority
m	meter
mi	mile
NEMA	National Electrical Manufacturers Association
nm	nautical mile
NSA	noise sensitive area
NYISO	New York Independent System Operator, Inc.
NYSDPS	New York State Department of Public Service
NYSPSC	New York State Public Service Commission or Commission
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Health and Safety Act
POI	Point of Interconnection at the Hampton Road Substation
NY Project Area	Area that includes components of the NY Project within the borders of New York State, including submarine export cable corridor, onshore

	export cable, onshore substation facilities, interconnection cable corridors, Hampton Road substation facilities, and loop-in / loop-out line corridor within New York State jurisdiction
PSEG-LI	PSEG Long Island
PSL	New York Public Service Law
NY Project	EW 2 Project transmission facilities in New York

L.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, **Figure L-1**). 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.

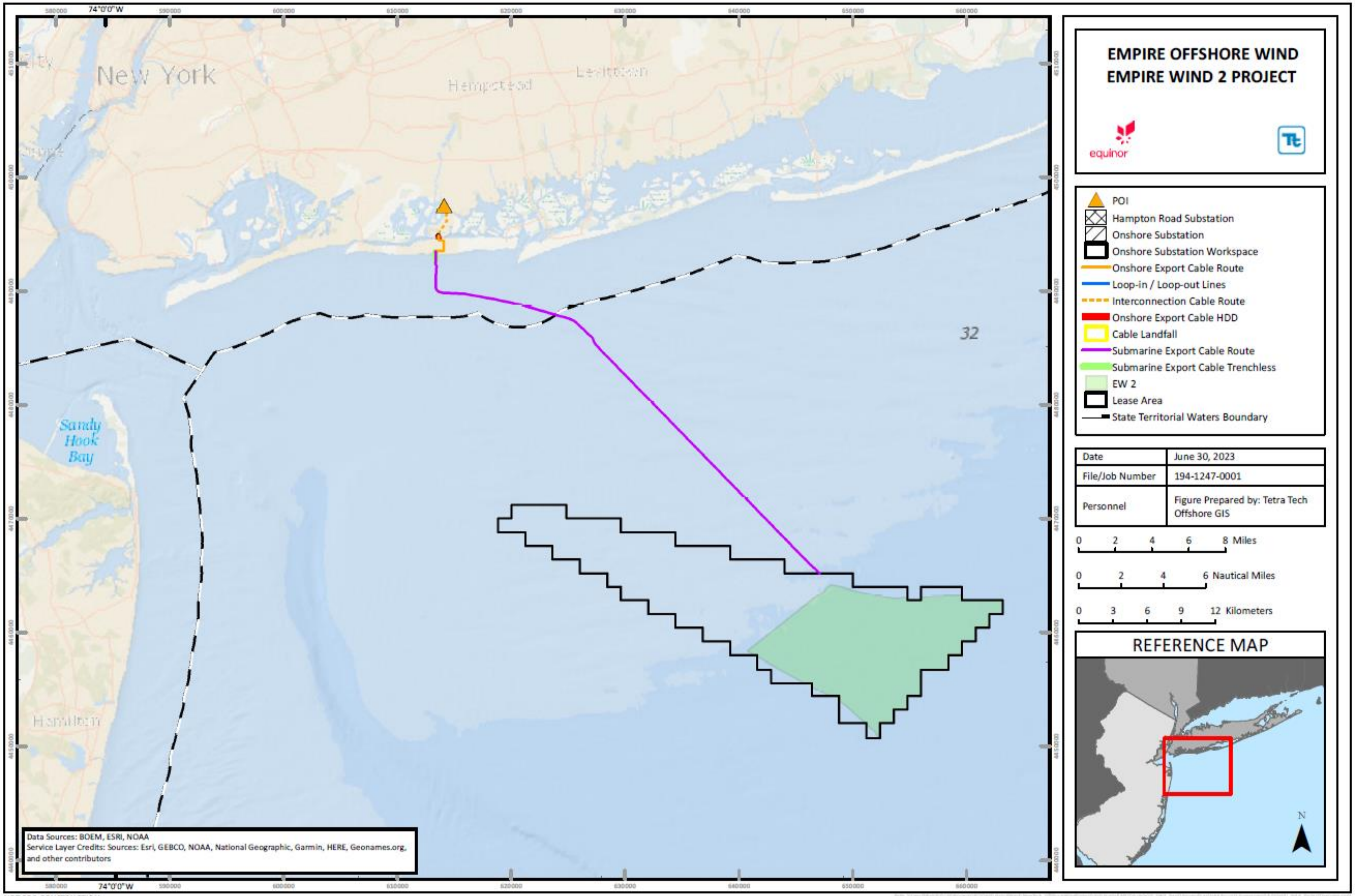

Figure L-1 Overview of the EW 2 Project

This In-Air Acoustic Assessment has been completed to document how the NY Project has been designed to minimize in-air sound impacts to the surrounding community and comply with state and local noise ordinances. The objectives of this In-Air Acoustic Assessment include identifying noise-sensitive land uses in the area that may be affected by the NY Project as well as describing the standards by which the NY Project will be assessed. Existing conditions were documented through ambient sound surveys, and NY Project compliance was evaluated through the use of predictive acoustic modeling for construction and operations. Practical measures were identified to minimize potential adverse effects associated with construction and operation of the NY Project. Mitigation measures are presented to show the feasibility of meeting the specific noise requirements. Final design may incorporate different mitigation measures to achieve the same objective as demonstrated in this analysis.

The construction and operational scenarios relevant to the analysis in this In-Air Acoustic Assessment include the following:

- Construction and operation of the onshore substation and Hampton Road substation;
- Specialized construction activities including:
    - Vibratory pile driving;
    - Impact pile driving of bulkhead and substation components; and
    - Vessel activity, including installation of the submarine export cables in the nearshore environment and operations and maintenance vessels.

Additional activities may be identified as the NY Project is further evaluated and refined. Additional sound modeling will be completed, as needed, once final NY Project components are selected.

L.1.1 Acoustic Concepts and Terminology

This section outlines some of the relevant concepts in acoustics to help the non-specialist reader understand the modeling assessment and results presented in this report.

Airborne sound is described as a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Sound energy is characterized by the properties of sound waves, which include frequency, wavelength, amplitude, and velocity. A sound source is defined by a sound power level (L_W), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts. Sound energy propagates through a medium where it is sensed and then interpreted by a receiver. A sound pressure level (L_P) is a measure of this fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. Sound power, however, cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source.

While the concept of sound is defined by the laws of physics, the term "noise" has further qualities of being excessive or loud. The perception of sound as noise is influenced by several technical factors such as loudness, sound quality, tonality, duration, and the existing background levels. Sound levels are presented on a logarithmic scale to account for the large range of acoustic pressures that the human ear is exposed to and is expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing, defined as 20 microPascals. Conversely, sound power is referenced to 1 picowatt.

Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves and typically the frequency analysis examines nine octave bands from 32 Hz to 8,000 Hz. Since the human ear does not perceive individual frequencies with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter (American National Standards Institute [ANSI] S1.42-2001, ANSI 2016) is applied to compensate for the frequency response of the human auditory system, and sound exposure in acoustic assessments is designated in A-weighted decibels (dBA). Unweighted sound levels are referred to as linear. Linear decibels (dBL) are used to determine a sound's tonality and to engineer solutions to reduce or control noise, as techniques are different for low and high frequency noise. Typical sound pressure levels associated with various in-air activities and environments are presented in **Table L-1**.

Table L-1 Sound Pressure Levels of Typical In-Air Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Jet aircraft takeoff from carrier (50 feet [ft, 15 meters {m}])	140	Threshold of pain
50-horsepower siren (100 ft [30 m])	130	
Loud rock concert near stage Jet takeoff (200 ft [61 m])	120	Uncomfortably loud
Float plane takeoff (100 ft) [30 m]	110	
Jet takeoff (2,000 ft [610 m])	100	Very loud
Heavy truck or motorcycle (25 ft [8 m])	90	
Garbage disposal Food blender (2 ft [<1 m]) Pneumatic drill (50 ft [15 m])	80	Loud
Vacuum cleaner (10 ft [3 m]) Passenger car at 65 mi per hour (25 ft [8 m]) Large store air-conditioning unit (20 ft [6 m])	70 65 60	Moderate
Light auto traffic (100 ft [30 m]) Quiet rural residential area with no activity	50 45	Quiet
Bedroom or quiet living room Bird calls Typical wilderness area	40 35	Faint
Quiet library, soft whisper (15 ft [5 m])	30	Very quiet
Wilderness with no wind or animal activity High-quality recording studio	25 20	Extremely quiet
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Source: Adapted from EPA 1971

To take into account sound fluctuations, environmental sound is commonly described in terms of equivalent sound level (L_{eq}). The L_{eq} value is the energy-averaged sound level over a given measurement period. It is further defined as the steady, continuous sound level, over a specified time, which has the same acoustic energy as the actual varying sound levels. Levels of many sounds change from moment to moment. Some sharp impulses last 1 second or less, while others rise and fall over much longer periods of time. There are various measures of sound pressure designed for different purposes. To describe the background ambient sound level, the L_{90} percentile metric is used, representing the quietest 10 percent of any time period. Conversely, the L_{10} is the sound level exceeded 10 percent of the time and is a measurement of intrusive noises, such as vehicular traffic or aircraft overflights, while the L_{50} metric is the sound level exceeded 50 percent of the time.

L.2 Regulatory Criteria

Applicable policies and regulations for the NY Project include regulations at the federal, state, and municipal levels. These requirements, which help assure that facilities (such as the NY Project) do not create adverse or nuisance impacts on the community, are discussed below.

L.2.1 Federal Noise Requirements

There are no federal community noise regulations applicable to the NY Project; however, the federal government has long recognized the potential hazards caused by noise to the health and safety of humans. NY Project noise during construction and operations are regulated, in a sense, through the Occupational Health and Safety Act of 1970 (OSHA). This regulation establishes standards for permissible sound exposure in the workplace to guard against the risk of hearing loss with sound exposure level of workers regulated at 90 dBA, over an 8-hour work shift. NY Project construction contractors will readily provide workers with OSHA-approved hearing protection devices and identify high noise areas and activities when hearing protection will be required (e.g., areas in close proximity to pile driving operations) and further ensuring that personnel and the general public are adequately protected from potential noise hazards and extended exposure to high noise levels.

L.2.2 New York State Noise Guidance

The New York State Department of Environmental Conservation (NYSDEC) guidelines are defined in the publication “Assessing and Mitigating Noise Impacts” (2001). This document states that sound pressure level increases from 0 to 3 dBA should have no appreciable effect on receivers; increases of 3 to 6 dBA may have the potential for adverse impact only in cases where the most sensitive of receptors are present; and increases of more than 6 dBA may require a closer analysis of impact potential depending on existing sound levels and character of surrounding land use. The NYSDEC guidance states that the 6 dBA increase is to be used as a general guideline. Although not explicitly stated in the policy, the 6 dBA increase has been applied to the minimum measured L_{eq} or alternatively the time averaged L_{90} sound level for the licensing of other projects in New York State. There are other guidelines that should also be considered. For example, in settings with low ambient sound levels, NYSDEC guidance has deemed an absolute limit of 40 dBA as adequately protective.

The NYSDEC policy further states that the United States Environmental Protection Agency “Protective Noise Levels” guidance (EPA 1978) found that an annual day-night sound level (L_{dn}) of 55 dBA was sufficient to protect the public health and welfare, and in most cases, did not create an annoyance. A 55 dBA L_{dn} would be equivalent to a daytime sound level of 55 dBA L_{eq}, and a nighttime sound level of 45 dBA L_{eq}, or a continuous level of approximately 49 dBA L_{eq}. In terms of absolute threshold values, the introduction of any new sound source should not raise ambient levels above 65 dBA L_{eq} in non-industrial settings to protect against speech disturbance or above approximately 79 dBA L_{eq} for industrial environments for associated noise-related health and safety reasons. In most cases, NYSDEC recommends that projects exceeding either of these threshold levels or resulting in an increase of 10 dBA consider avoidance and mitigation measures.

L.2.2.1 New York Department of Public Service Recommendations

In March 2021, the New York State Department of Public Service (NYSDPS) shared “General Recommendations for Applications for Substations, Stations, and Converter Stations under Article VII” with Empire, which detailed what type of information the application should include such as design goals for operation, sound power level information for mechanical and electrical equipment and proposed buildings, sound levels generated by project operation, and evaluation of minimization of environmental noise impacts and conformance with project goals and local regulations, if any. It also recommended that sound produced during construction be analyzed as well as plans for minimization of noise impacts during construction. Lastly, it recommended an evaluation of ambient pre-construction baseline noise conditions using the L_{90} statistical and the L_{eq} energy-based noise descriptors, and following the recommendations included in ANSI/ASA S3/SC 1.100 -2014-ANSI/ASA S12.100-2014 American National Standard entitled "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas." The guidance detailed specifications for computer noise modeling, tonality assessment and specific design goals including the following:

1. 35 dBA $L_{eq\text{-}1\text{-}hour}$ maximum equivalent continuous average sound level from the station, outside any residence within the 35 dBA noise contour from any tonal noise sources, (e.g., transformers), on the presumption that a 5 dBA prominent tone penalty applies to a basic design goal of 40 dBA.

2. 40 dBA $L_{eq\text{-}1\text{-}hour}$ maximum equivalent continuous average sound level from the station outside any residence from any other operational sound sources associated with the station not included in (1). If the sound emissions from these sources are found to contain a prominent discrete tone at any residence whether through modeling, calculation, or pre-construction field testing, then the sound levels at the receptors will be subject to a 5 dBA penalty; thus, a reduction in the permissible sound level to 35 dBA Leq-1- hour. Tonality evaluation should follow the recommendations included in APPENDIX B of the NYSDPS Recommendations. If no manufacturer's information or pre-construction field tests are available, sounds should be assumed to be tonal for those noise sources.

3. 45 dBA $L_{eq\text{-}1\text{-}hour}$ maximum equivalent continuous average sound level from the station across all properties, except for delineated wetlands and utility rights of way. This should be demonstrated with modeled sound contours and discrete sound levels at worst-case locations. No penalties for prominent tones should be added in this assessment.

On March 30, 2021, Empire consulted with NYSDPS regarding their recommendations. During that consultation, NYSDPS also recommended that Empire consider the Section 94-C regulations issued by the New York Office of Renewable Energy Siting in March 2021 to support their new renewable energy siting process, which replaced the previous Public Service Law Article 10 process. Section 900-2.8 of those regulations details requirements of Exhibit 7, which relate to noise and vibration for renewable energy generating projects. The Section 94-C regulations technically do not apply to projects like the Empire Wind 2 Project, which is subject to the Article VII process, but the design goals described in Section 94-C are relatively consistent with those identified above. In addition, NYSDPS suggested that certain appropriate aspects of the Section 94-C noise regulations such as modeling standards, input parameters, assumptions, and results presentation should be considered in the NY Project's Article VII application.

L.2.3 Local Noise Requirements

The onshore NY Project facilities are located in Nassau County, New York, within the City of Long Beach and/or the Town of Hempstead, including the incorporated Village of Island Park and Oceanside. This section describes the local noise requirements potentially applicable to the NY Project Area. These restrictions will be followed unless waived or authorized by the appropriate regulatory authority.

L.2.3.1 Town of Hempstead

Portions of the NY Project are located in the Town of Hempstead, in Nassau County, New York. Portions of the onshore export cable route (the north side of the Reynolds Channel HDD), portions of the interconnection cable route, the he onshore substation, the Hampton Road substation and loop-in / loop-out lines are located in the Town of Hempstead. The north side of the Reynolds Channel HDD, onshore substation, and the majority of the interconnection cable route are located within the incorporated Village of Island Park (Section M.2.3.3) in the Town of Hempstead, while the northern end of the interconnection cable route, Hampton Road substation and loop-in / loop-out lines are in Oceanside. The Applicant also assessed noise associated with one cable landfall alternative in Lido Beach in the Town of Hempstead (Cable Landfall Alternative C3).

The Town of Hempstead regulates sound through its ordinance (Chapter 144, Ord. No. 25 amended in its entirety 11-1-1983 by L.L. No. 99-1983, effective 11-7-1983). Generally, construction is limited to the hours of 7:00 am and 6:00 pm on weekdays.

The Town prescribes limits by octave band frequency for transient (**Table L-2**) and steady-state sound sources (**Table L-3**) given in linear or unweighted decibels. During daytime hours (7:00 am to 7:00 pm) the limits in **Table L-2** would apply to a transient noise having a duration of more than 12 seconds. During nighttime hours, the limits in **Table L-2** would apply to a transient noise having a duration of more than six seconds.

Table L-2 Town of Hempstead Transient Noise Limits (dB)

Octave Band Center Frequency (Hz)	Octave Band Sound Pressure Level (dB)
63	92
125	87
250	79
500	72
1,000	66
2,000	60
4,000	54
8,000	52

Table L-3 Town of Hempstead Steady Noise Limits (dB)

Octave Band Center Frequency (Hz)	Octave Band Sound Pressure Level (dB)
63	72
125	67
250	59
500	52
1,000	46
2,000	40
4,000	34
8,000	32

L.2.3.2 City of Long Beach

The cable landfall, onshore export cable route and south side of the Reynold Channel HDD are located in the City of Long Beach in Nassau County, New York. The Applicant also assessed noise associated with one cable landfall alternative in the City of Long Beach (Cable Landfall Alternative E, see **Exhibit 3: Alternatives)**. The City of Long Beach regulates sound through the City of Long Beach Noise Control Ordinance. Chapter 16, Section 16-6 lists the following as a violation of the Ordinance and are applicable to the NY Project:

- No person shall operate or permit to be operated any tools or equipment used in construction, drilling, excavations, or demolition work, between the hours of 8:00 p.m. and 8:00 a.m. the following day or any time on Sunday or legal holidays prior to noon, except the provisions of this section shall not apply to emergency work.
- No person shall cause or permit the operation of any device, vehicle, construction equipment or lawn maintenance equipment, including but not limited to any diesel engine, internal combustion engine or turbine engine, without a properly functioning muffler, in good working order and in constant operation regardless of sound level produced.
- Any excessive or unusually loud sound which either annoys, disturbs, injures, or endangers the comfort, repose, health, peace, or safety of a reasonable person of normal sensibilities.

In addition to those specific prohibitions set forth in Ordinance Section 16-6, the following general prohibitions regarding continuous sound levels shall apply in determining unreasonable noise:

- No person shall make, cause, allow, or permit the operation of any source of sound on a particular category of property or any public space or right-of-way in such a manner as to create a sound level that exceeds the particular continuous A-weighted decibel limits set forth in **Table L-4** below when measured at or within the real property line of the receiving property except as provided in subsections (B) and (C).
- When measuring sound within a dwelling unit of a multi-dwelling-unit building, all exterior doors and windows shall be closed and measurements shall be taken in the center of the room.
- When measuring on Ocean Beach Park sound shall be measured at the center of the boardwalk at a point directly perpendicular to the source.

Section 16-8 of the Ordinance describes general prohibitions regarding impulsive sound levels:

- No person shall make, cause, allow or permit the operation of any impulsive source of sound within any and all property in the city which has a peak sound pressure level in excess of eighty (80) dBA. If an impulsive sound is the result of the normal operation of an industrial or commercial facility and occurs more frequently than four (4) times in any hour the levels set forth in **Table L-4** shall apply.

Table L-4. City of Long Beach Permissible Continuous Sound Levels by Receiving Property Category, in dBA

<table>
<tr><th rowspan="2">Sound Source Property Category</th><th colspan="2">Another Dwelling Within a Multi Dwelling Unit Building</th><th colspan="2">Residential</th><th>Commercial or Public Service or Community Service Facility</th><th>Industrial or Public Service Industrial Facility</th><th>Ocean Beach Park or Parks</th></tr>
<tr><th>(7am - 10pm)</th><th>(10pm-7am)</th><th>(7am-10pm)</th><th>(10pm-7am)</th><th>(All times)</th><th>(All times)</th><th>(6am-11pm)</th></tr>
<tr><td>Any location within a multi-dwelling unit building</td><td>50</td><td>45</td><td>65</td><td>50</td><td>70</td><td>75</td><td>65</td></tr>
<tr><td colspan="3">Residential (or public spaces or rights-of-way)</td><td>65</td><td>50</td><td>70</td><td>75</td><td>65</td></tr>
<tr><td colspan="3">Commercial or public service or community service facility</td><td>65</td><td>50</td><td>70</td><td>75</td><td>65</td></tr>
<tr><td colspan="3">Industrial or public service industrial facility</td><td>65</td><td>50</td><td>70</td><td>75</td><td>65</td></tr>
</table>

Regardless of the decibel limits, the provisions of this Ordinance shall not apply to noise from construction activity provided all motorized equipment used in such activity is equipped, where applicable, with functioning mufflers, except as provided in Ordinance Section 16-6.

L.2.3.3 Village of Island Park

The onshore substation, portions of the onshore export cable route (the north side of the Reynolds Channel HDD) and portions of the interconnection cable route will be located within the Village of Island Park. Work in the Village of Island Park also includes the Reynolds Channel bulkhead upgrade and potential marina removal at the onshore substation, as well as the crossing of Barnums Channel via cable bridge. The following noise restrictions are found within Chapter 349 of The Village of Island Park Codes:

- No person, with the intent to cause public inconvenience, annoyance, or alarm, or recklessly creating a risk thereof, shall cause, suffer, allow, or permit to be made, unreasonable noise.
- The erection, including excavation, demolition, alteration, or repair, of any building other than between 7:00 a.m. and 9:00 p.m., except in case of a public safety emergency.
- The sounding of any horn or signaling device of an automobile, motorcycle, or other vehicle for any unnecessary or unreasonable period of time.
- No person or persons, firm, association, corporation, or contractor shall do, perform, cause, suffer or permit the operation of any mower or power lawn mower, machine or power tools or any other power equipment to commence operation earlier than 8:00 a.m. or later than 9:00 p.m. on Monday through Saturday or earlier than 9:00 a.m. and later than 9:00 p.m. on Sunday. All other noise generated from musical instruments or events will be allowed until 11:00 p.m.
- No person or persons, firm, association, corporation, or contractor shall do, perform, cause, suffer or permit the operation of any mower or power lawn mower, machine or power tools or any other power equipment to commence operation earlier than 8:00 a.m. or later than 9:00 p.m. on Monday through Saturday or earlier than 9:00 a.m. and later than 9:00 p.m. on Sunday. All other noise generated from musical instruments or events will be allowed until 11:00 p.m.

L.3 Existing Ambient Conditions

To characterize existing ambient conditions at the proposed onshore NY Project Area, baseline sound measurements were conducted with an operator present for a minimum of thirty minutes during daytime and nighttime periods in accordance with ANSI 12.9: 2013/ Part 3 "Quantities and Procedures for Description and Measurement of Environmental Sound–Part 3: Short-Term Measurements with an Observer Present" (ANSI 2013) and ANSI S12.100, "Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas" (ANSI 2014). The period for nighttime measurements was between 12:00 AM and 4:00 AM when ambient conditions are typically quietest (i.e., more conservative).

Baseline ambient measurement locations were pre-selected to be representative of the surrounding community and other potential noise sensitive areas (NSAs) near the proposed onshore substation, the Hampton Road substation, and where landfall of the export cables will occur. The measurements were conducted for a minimum of 30 minutes at 5 feet (ft, 1.5 meters [m]) above grade and a minimum of 25 ft (7.5 m) from any dwelling or structure, generally at publicly accessible sidewalk locations.

The ambient sound monitoring locations are shown in **Figure L-2**, as well as nearby residential receptors.

The sound level analyzers used for the field program met the requirements of ANSI Specification S1.4-1983 and ANSI S1.43-1997 for precision Type 1 sound level analyzers (ANSI 2006). The sound level analyzers were programmed to document broadband and octave band sound level data. Windscreens recommended by the manufacturer were used. In-situ field calibrations were performed on the equipment at the start and end of each survey period.

The acoustic environment at most locations was largely influenced by vehicular traffic. Localized traffic was steady during the daytime hours, although fewer cars traversed local roads at night. Noise from trains and planes was observed during both daytime and nighttime. Natural sounds from birds, trees and other wildlife were also minor sound sources in the area, as were waves in coastal areas.

Weather conditions were clear, roadways were dry, and winds were minimal; these conditions are considered suitable for acoustic measurements. **Table L-5** summarizes the ambient sound measurement results. Sound-level monitoring shows existing nighttime L_{90} levels are in the range of 36 to 52 dBA. A quiet suburban area would typically have nighttime levels in the range of 36 to 45 L_{90} dBA (ANSI 2013). Measured ambient sound levels exhibited typical diurnal patterns, with higher ambient sound levels during the daytime, ranging from 43 to 60 L_{90} dBA.

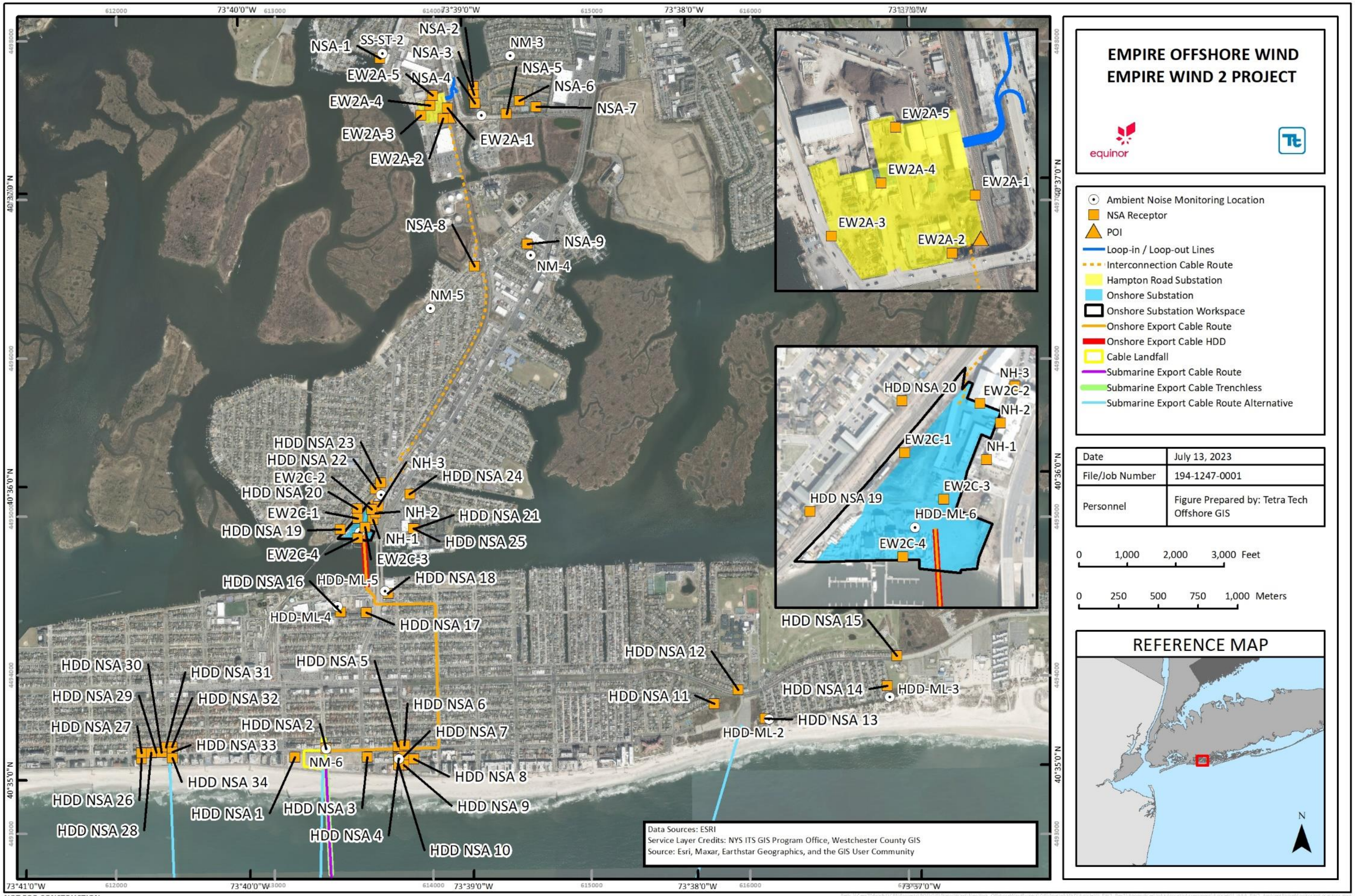

Figure L-2 Ambient Sound Monitoring Locations and Receptor Locations

Table L-5 Baseline Noise Measurement Results

Monitoring Location	Location	Time Period	Sound Level Metrics (dBA)			
			L_{10}	L_{50}	L_{90}	L_{eq}
NM-3	136 Harris Drive	Day	57	49	48	55
		Night	52	46	44	49
NM-4	1 Georgia Avenue	Day	59	55	51	56
		Night	54	49	47	51
NM-5	154 Waterford Road	Day	51	47	45	48
		Night	50	48	47	50
NM-6	125 East Broadway	Day	59	53	51	59
		Night	50	47	46	49
HDD-ML-1	65 Lincoln Boulevard	Day	58	50	47	58
		Night	44	43	42	47
HDD-ML-2	1 Ocean Boulevard	Day	54	45	44	52
		Night	44	43	42	44
HDD-ML-3	78 Prescott Street	Day	51	45	43	50
		Night	52	44	41	49
HDD-ML-4	109 East Pine Street	Day	56	49	47	56
		Night	48	45	44	51
HDD-ML-5	270 East State Street	Day	65	61	55	63
		Night	60	53	52	56
HDD-ML-6	15 Railroad Place	Day	59	55	51	56
		Night	54	46	40	52
HDD-ML-7	1 Long Beach Road	Day	56	52	49	53
		Night	53	47	41	49
SS-ST-1	4001 Daly Boulevard	Day	75	70	60	72
		Night	69	50	45	64
SS-ST-2	561 Bothner Street	Day	60	52	50	57
		Night	47	38	36	50

L.4 Acoustic Modeling Methodology

The acoustical modeling for the NY Project was conducted with the Cadna-A® sound model from DataKustik GmbH (Version 2023 MR1). The outdoor sound propagation model is based on the International Organization for Standardization (ISO) 9613, Part 1: "Calculation of the absorption of sound by the atmosphere," (1993) and Part 2: "General method of calculation," (1996). Model predictions are accurate to within 1 dB and/or 1 dBA of calculations based on the ISO 9613 standard, as appropriate.

The ISO 9613 standard was instituted in Cadna-A® to calculate propagation and attenuation of sound energy with distance, surface and building reflection, and shielding effects by equipment, buildings, and ground topography. Offsite topography was determined using U.S. Geological Survey digital elevation data with a 98-ft (30-m) interval between height points for the NY Project Area. The sound model propagation calculation parameters are summarized in **Table L-6**.

Table L-6 Acoustic Model Setup Parameters

Model Input	Parameter Value
Standards	ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors a/
Terrain Description	Per site grading plan and U.S. Geological Survey topography of surrounding areas
Ground Absorption	0.0 for water surface, onsite area, reflective ground 0.5 for offsite areas, moderately absorptive ground
Receiver Characteristics	5 ft (1.52 m) above ground level
Meteorological Factors	Omnidirectional downwind propagation / mild to moderate atmospheric temperature inversion
Temperature	50°F (10°C)
Relative Humidity	70 percent

Note:
a/ Propagation calculations under the ISO 9613 standard incorporate the effects of downwind propagation (from facility to receptor) with wind speeds of 3 to 16 ft/s (2.0 to 10.9 mi/hour) (1 to 5 m/s; 3.6 to 18 km/hour) measured at a height of 10 to 36 ft (3 to 11 m) above ground level.

Cadna-A® allows for three basic types of sound sources to be introduced into the model: point, line, and area sources. Each sound-radiating element was modeled based on its sound emission pattern. Small dimension sources, such as transformer fans, which radiate sound hemispherically, were modeled as point sources. Larger dimensional sources, such as the onshore transformer walls were modeled as area sources. Transformers, firewalls, and onsite buildings and barriers were modeled as solid structures because diffracted paths around and over structures tend to reduce sound levels in certain directions.

Ground absorption rates are described by a numerical coefficient. For pavement and water bodies, the absorption coefficient is defined as G=0 to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in vegetation, including suburban lawns, are acoustically absorptive and aid in sound attenuation, i.e., G=1.0.

L.5 Acoustic Modeling Scenarios

The representative acoustic modeling scenarios were derived from descriptions of the expected construction activities and operational conditions through consultations between the NY Project design and engineering teams. The subsections that follow provide more detailed information about the parameters used to model the sound sources associated with each scenario.

L.5.1 Construction Acoustic Assessment

Two types of pile driving may be required during NY Project construction, impact and vibratory pile driving. Impact pile driving may be used to install the onshore substation and Hampton Road substation foundations, and vibratory pile driving may be required to construct the temporary cofferdams to support export cable landfall, as well as bulkhead cofferdams along the shoreline of the onshore substation, where applicable. In addition, a cable bridge will be constructed, which requires the installation of piles using pile driving. Specialized HDD or Direct Pipe construction will also be required during export cable landfall. Onshore export and interconnection cable, loop-in / loop-out line, and substation installation construction generally consists of site clearing and grading, excavation, foundation work, building erection, and finishing work.

L.5.1.1 Construction of Onshore NY Project Components

The construction of the onshore substation, Hampton Road substation, onshore export and interconnection cables, and loop-in / loop-out lines will result in a temporary increase in sound levels near the activity. The construction process will require the use of equipment that could be periodically audible from off-site locations at certain times. Construction generally consists of site clearing and grading, excavation, foundation work, building erection, and finishing work which is anticipated to have a total duration of up three years for EW 2. Construction of the onshore export and interconnection cables and loop-in / loop-out lines involves site preparation, duct bank installation, restoration, cable installation, cable jointing, and final testing.

The noise levels resulting from construction activities vary greatly depending on factors such as the type of equipment, the specific equipment model, the operations being performed, and the overall condition of the equipment. The EPA has published data on the L_{eq} sound levels for typical construction phases (EPA 1971). This calculation conservatively assumes all equipment operating concurrently onsite for the specified construction phase and no sound attenuation for ground absorption or onsite shielding by the existing buildings or structures.

The results of these calculations are presented in **Table L-7** and show that estimated construction sound levels in A-weighted decibels will vary depending on construction phase and distance, with the highest levels expected in proximity to the closest neighborhoods during the site excavation phase. An urban area would typically have daytime levels in the range of 55 to 66 L_{eq} dBA (ANSI 2013). The modeled levels in **Table L-7** are similar to existing daytime sound levels experienced at these same locations. Thus, construction sound would not be expected to create a noise nuisance condition as it will be similar in character to existing daytime sound levels. Onshore substation, Hampton Road substation, onshore export and interconnection cable, and loop-in / loop-out line construction will generally be limited to daytime periods. Reasonable efforts will be made to minimize the impact of noise resulting from construction activities. As such, the following noise mitigation measures will be implemented unless otherwise authorized by the appropriate regulatory authority:

- Construction will be limited to daytime period unless deemed acceptable from the appropriate regulatory authority;
- Construction equipment will be well maintained and vehicles using internal combustion engines equipped with mufflers will be routinely checked to ensure they are in good working order;
- Quieter-type adjustable backup alarms will be used for vehicles as feasible;
- Noisy equipment onsite will be located as far as possible from NSAs;
- If noise issues are identified, when possible Empire will install moveable temporary noise barriers as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 dBA; and
- A noise complaint hotline will be made available to help actively address all noise related issues.

Table L-7 General Construction Noise Levels (dBA)

Construction Phase	50 ft from Source (L_{eq})	250 ft from Source (L_{eq})	500 ft from Source (L_{eq})	1,000 ft from Source (L_{eq})
Clearing	84	70	65	58
Excavation	91	77	72	65
Foundations	78	64	59	52
Erection	85	71	66	59
Finishing	89	75	70	63

In addition to the above listed construction equipment, pile driving may be needed to install the foundation for the substations. Impact pile driving is expected to support installation of onsite equipment and structures, the installation of cable bridge piles, and the installation of nearshore goal posts for the cable landfall HDD. The nearshore goal posts were modeled at two representative locations. The western location represents the installation of goal posts associated with proposed cable landfall Alternative A and E, while the eastern location represents installation associated with cable landfall Alternative C. Vibratory pile driving is expected along the bulkheads adjacent to the onshore substation.

Due to the character of the impulsive sound they produce, impact pile drivers are not typically analyzed in combination with non-impulsive construction sound sources such as heavy-duty vehicles. Noise is generated from pile driving equipment from both the ram striking the pile as well as the operating steam, air, or diesel exhaust as it is exhausted from the cylinder (this is not present with hydraulic impact hammers).

Final design of the impact hammer and/or piles planned for installation is currently under development. Assuming the installation of steel piles with a diameter between 24 and 36 inches (61 to 91 cm), an average sound pressure level would correspond to 108 dBA at 50 feet (15 m), which is used as a modeling input for the construction acoustic analysis (Blackwell et al. 2004; Ghebreghzabiher 2017; Illingworth and Rodkin 2012; Laughlin 2007, 2010; U.S. Navy 2015; Soderberg 2016; Soderberg and Laughlin 2016a, 2016b). For the purposes of the construction noise assessment, it is assumed that pile driving may be required to support the foundations of Control Buildings, SVC Building, and GIS Buildings as well as the main transformers, as applicable, at the onshore substation and the Hampton Road substation.

Vibratory pile driving installation is estimated to produce sound levels of 78 dBA in air at a distance of approximately 400 ft (122 m) with a corresponding L_W of 127 dBA (USDOT 2012). The resulting sound levels from pile driving activities are shown in **Table L-8** and sound contour isopleths in **Figure L-3** and **Figure L-4** depict the sound contour isopleths.

Table L-8 Pile Driving Noise Levels (dBA)

Pile Driving	Location	Distance (ft)	Modeling Results
Hampton Road Substation Foundations (Impact)	NSA-1	1,650	69
	NSA-2	750	75
	NSA-3	650	73
	NSA-4	600	72
	NSA-5	1,300	67
	NSA-6	1,550	67
	NSA-7	1,900	65
	NSA-8	3,300	61
	NSA-9	3,300	61
Onshore Substation Foundations (Impact)	HDD-NSA 19	510	83
	HDD-NSA 20	155	93
	HDD-NSA 21	1,150	77
	HDD-NSA 22	170	81
	HDD-NSA 23	790	79
	HDD-NSA 24	1,115	78
	HDD-NSA 25	1,115	77
	NH-1 a/	250	86
	NH-2 a/	300	90
	NH-3 a/	400	87
	NSA-1	3,114	60

Pile Driving	Location	Distance (ft)	Modeling Results
Cable Bridge Pile Location 1 (Impact) (Proposed Route)	NSA-2	2,024	65
	NSA-3	1,870	65
	NSA-4	1,686	66
	NSA-5	1,700	71
	NSA-6	2,067	69
	NSA-7	2,185	64
	NSA-8	1,821	66
	NSA-9	1,706	66
Cable Bridge Pile Location 2 (Impact) (Proposed Route)	NSA-1	2,959	61
	NSA-2	1,867	65
	NSA-3	1,673	66
	NSA-4	1,641	66
	NSA-5	1,558	72
	NSA-6	1,939	65
	NSA-7	2,080	64
	NSA-8	1,969	65
	NSA-9	1,887	65
Cable Bridge Pile Location 3 (Impact) (Long Beach Road Alternatives)	NSA-1	4,610	55
	NSA-2	2,769	66
	NSA-3	2,625	62
	NSA-4	2,477	63
	NSA-5	1,870	70
	NSA-6	1,919	70
	NSA-7	1,690	71
	NSA-8	1,467	67
	NSA-9	2,510	73
Cable Bridge Pile Location 4 (Impact) (Long Beach Road Alternatives)	NSA-1	4,593	55
	NSA-2	2,707	61
	NSA-3	2,585	67
	NSA-4	2,444	63
	NSA-5	1,805	66
	NSA-6	1,870	66
	NSA-7	1,595	67
	NSA-8	1,618	62
	NSA-9	2,658	67
Cable Landfall Goal Post Western Representative Location (Impact)	Shore	1,654	76
Cable Landfall Goal Post Eastern Representative Location (Impact)	Shore	1,805	74
Onshore Substation Bulkhead (Vibratory)	HDD-NSA 19	175	81
	HDD-NSA 20	680	69
	HDD-NSA 21	1,525	53

Pile Driving	Location	Distance (ft)	Modeling Results
	HDD-NSA 22	1,245	63
	HDD-NSA 23	1,410	62
	HDD-NSA 24	1,690	54
	HDD-NSA 25	1,510	53
	NH-1 a/	775	60
	NH-2 a/	900	62
	NH-3 a/	1,000	62

Note:
a/ NH = Nursing Home

Pile driving will be temporary and short-term, and pile driving activities are planned to occur during daytime hours. If necessary, subject to regulatory requirements and stakeholder engagement, Empire will install moveable temporary noise barriers as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 dBA (NYC Mayor's Office of Environmental Coordination 2021).

L.5.1.2 Vibratory Pile Driving at Nearshore Cofferdam for HDD Exit

Vibratory pile drivers install piling into the ground by applying a rapidly alternating force to the pile. This is generally accomplished by rotating eccentric weights about shafts. Each rotating eccentric weight produces a force acting in a single plane and directed toward the centerline of the shaft. The weights are set off-center of the axis of rotation by the eccentric arm. If only one eccentric is used, in one revolution a force will be exerted in all directions, giving the system a good deal of lateral whip. To avoid this problem, the eccentrics are paired so the lateral forces cancel each other, leaving only axial force for the pile. Vibratory sheet pile installation and removal of the temporary cofferdam is estimated to produce sound levels of 78 dBA in air at a distance of approximately 400 ft (122 m) with a corresponding L_W of 127 dBA (USDOT 2012). The schedule for vibratory pile driving is expected to be one to two days in duration, but specific details are not available at this time. The resulting received sound levels are presented in **Table L-9** and sound contour isopleths in **Figure L-3,** , **Figure L-4**, and **Figure L-5**depict representative sound contour isopleths for the proposed cable landfall (A) in Long Beach, Alternative C3, and Alternative E respectively.

Table L-9 Sound Levels (dBA) during Vibratory Pile Driving at Nearshore Cofferdam

Site	Distance (ft)	Sound Level at Shore During Vibratory Piling (dBA)
Proposed Cable Landfall (Alternative A)	1,825	60
Cable Landfall Alternative C3	1,450	64
Cable Landfall Alternative E	2,050	61

The vibratory pile driving at the proposed cable landfall (Alternative A) cofferdam will result in a modeled sound pressure level of 60 dBA, while the cofferdams associated with Alternative C3 and Alternative E will result in modeled sound pressure levels of 64 dBA and 61 dBA at the shore respectively. Considering this construction activity will last for a relatively short duration of time and will be limited to daytime periods, this construction activity is not expected to constitute a violation of local ordinances nor result in a potential imminent hazard to public health or the environment.

L.5.1.3 HDD and Direct Pipe Construction

Export cable landfall will be completed using HDD installation techniques within the export cable landfall area. Direct Pipe installation techniques were also assessed as a reasonable alternative for cable landfall Alternative C3. Use of HDD was analyzed at the export cable landfall and found to potentially generate relatively high sound levels. HDD is also proposed for crossing Reynolds Channel along the onshore export cable route.

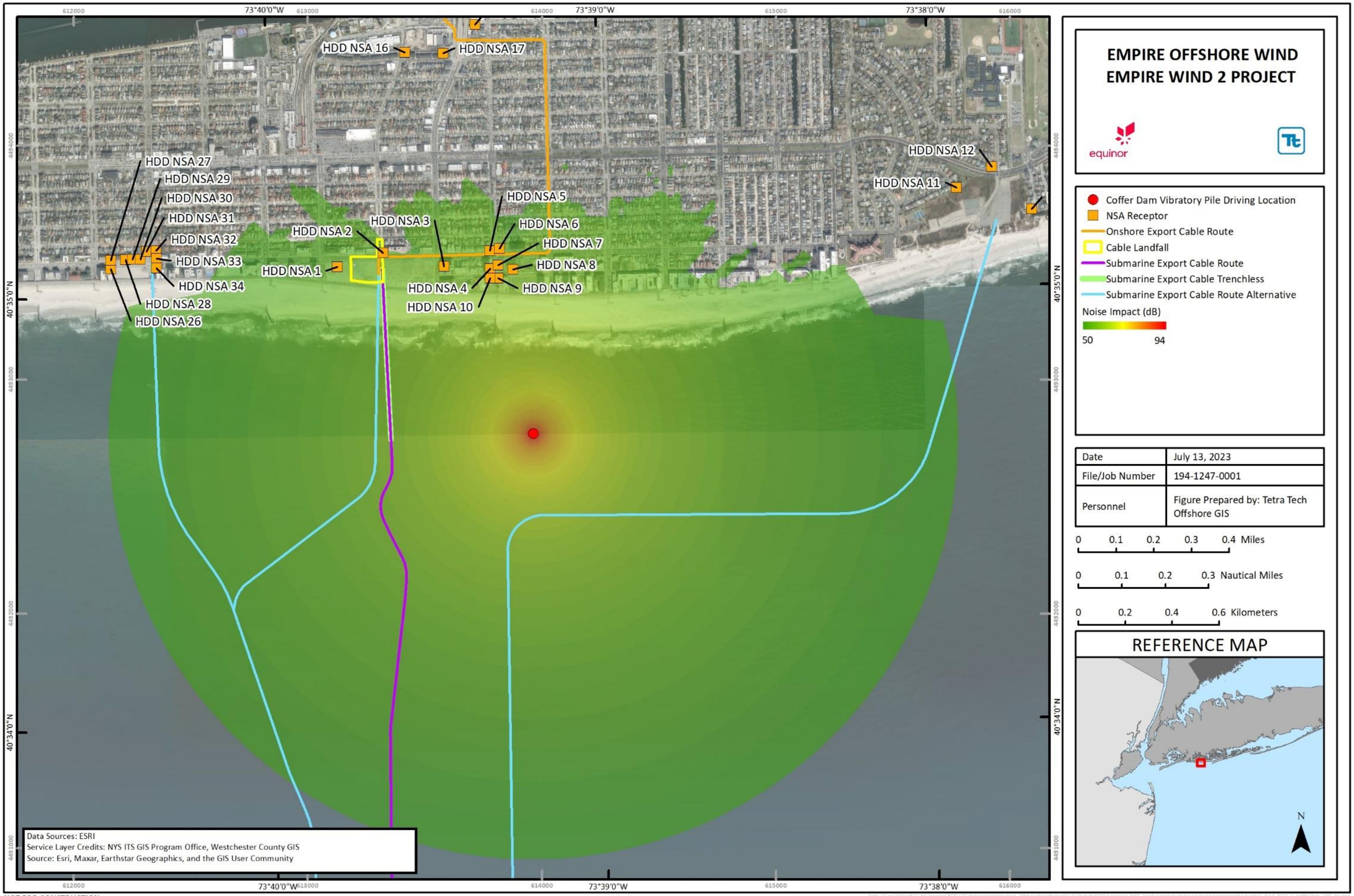

Figure L-3 Representative Proposed Cable Landfall Alternative A Vibratory Pile Driving Sound Contour Isopleth

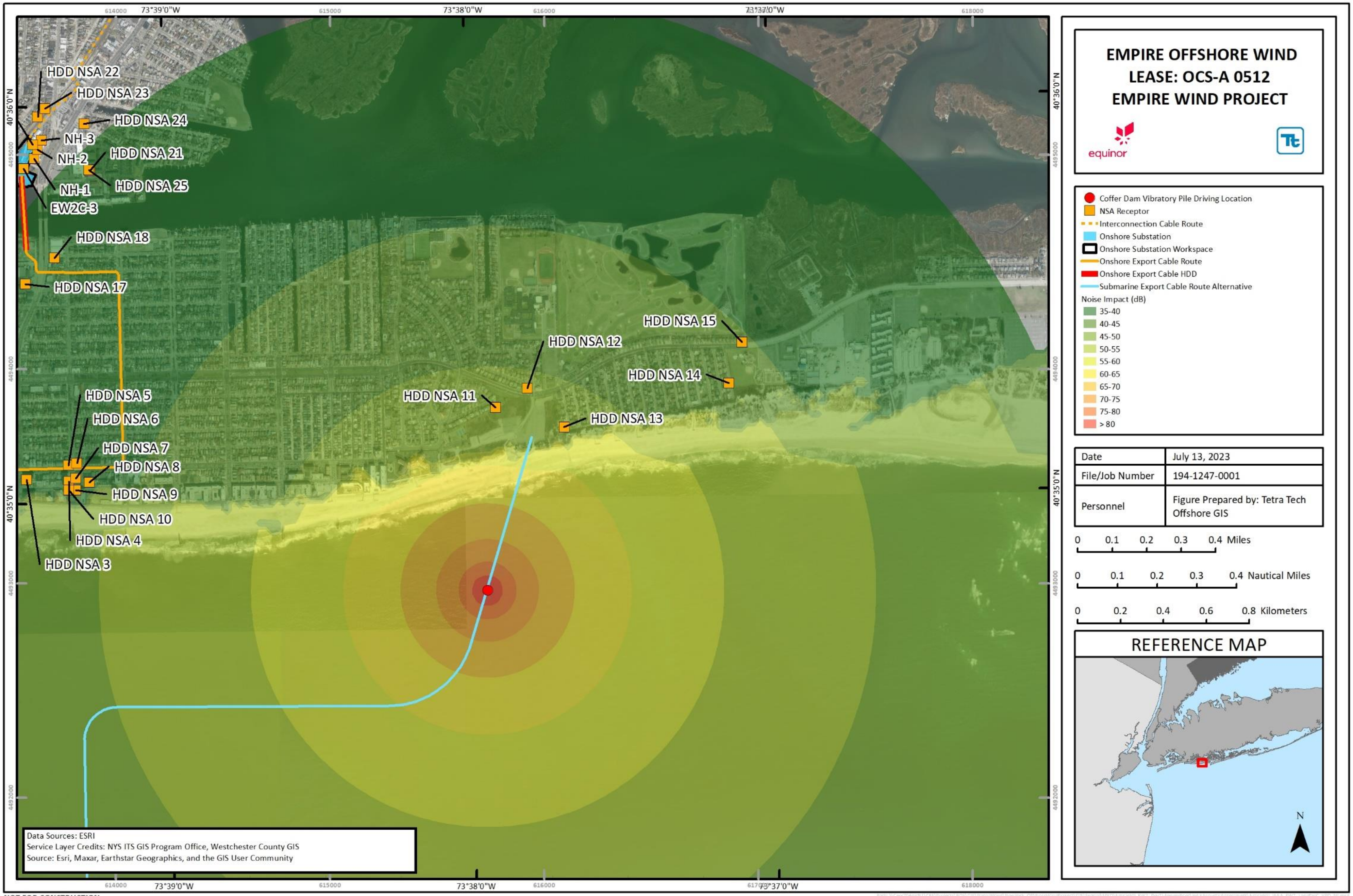

Figure L-4 Representative Cable Landfall (Alternative C3) Vibratory Pile Driving Sound Contour Isopleth

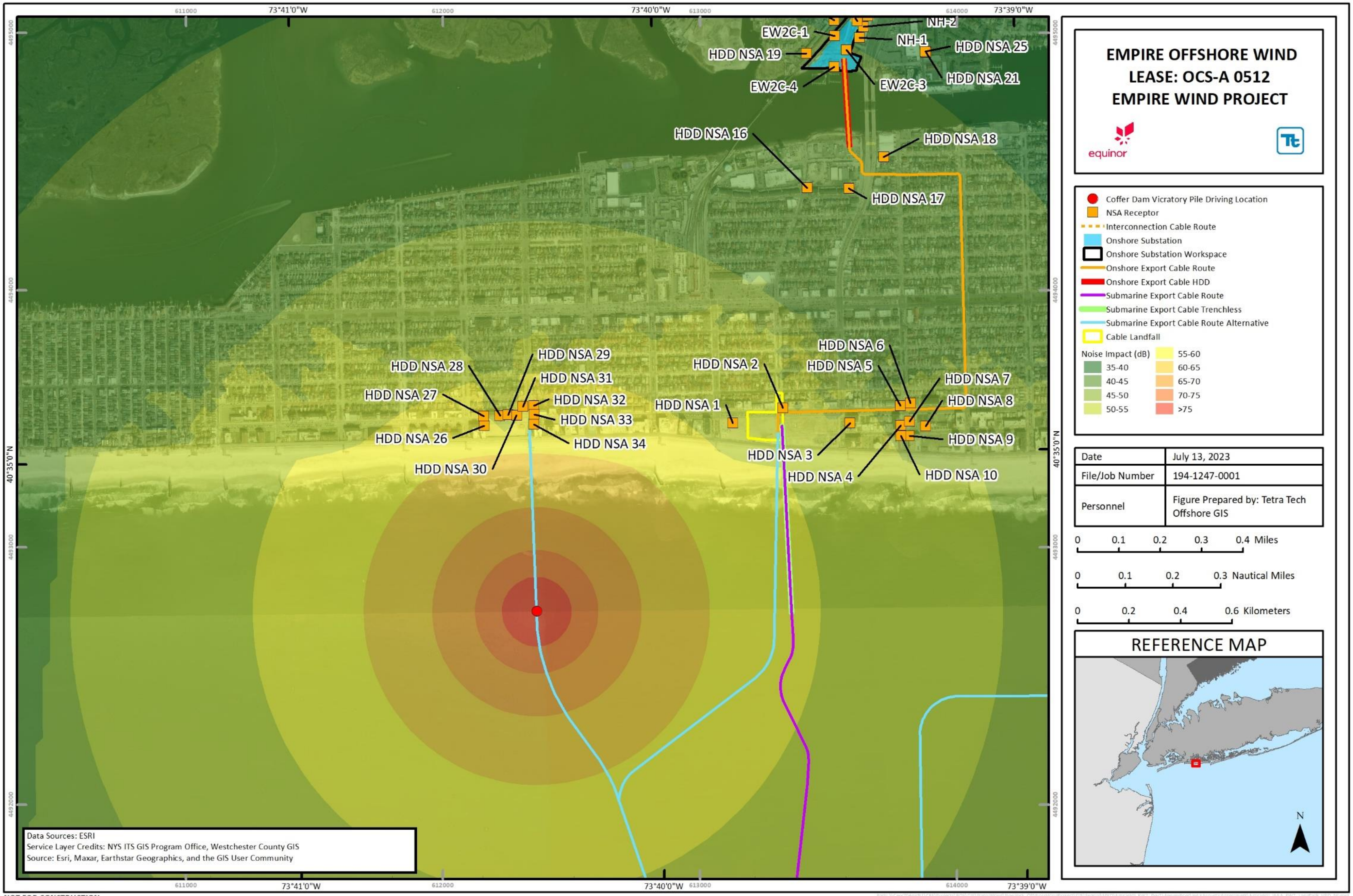

Figure L-5 Representative Cable Landfall Alternative E Vibratory Pile Driving Sound Contour Isopleth

HDD and Direct Pipe construction equipment consists of drill rigs and auxiliary support equipment including electric mud pumps, portable generators, mud mixing and cleaning equipment, forklifts, loaders, cranes, trucks, and portable light plants. **Table L-10** presents the HDD and Direct Pipe components included in the analysis (Jones and Evans 2000) and **Table L-11** provides candidate noise control mitigation strategies. Once the HDD/Direct Pipe and pull-back are complete, noise from the export cable landfall site will be limited to typical construction activities associated with equipment such as tracked graders, backhoes, and pickup trucks. HDD and Direct Pipe construction activities will occur during the daytime period unless a situation arises that would require operation to continue into the night or the appropriate regulatory authority deems it acceptable. In the case of night operations, only the HDD/Direct Pipe rig and power unit will be used unless deemed acceptable from the appropriate regulatory authority.

Table L-10 HDD and Direct Pipe Equipment Sound Pressure Source Levels, dBA at 3 ft

Installation Technique	Equipment Component	Sound Level without Acoustical Treatment	Sound Level with Acoustical Treatment
HDD	HDD Drill Rig and Power Unit	102	88
	Drilling Mud Mixer/Recycling Unit	90	85
	Mud Pumping Unit	102	85
	Generator Set, 100 kilowatts	100	80
	Generator Set, 200 kilowatts	102	80
	Vertical Sump Pump	75	75
	Total Sound Level	108	92
Direct Pipe	Separation Plant	90	80
	Power Plant	85	80
	Mud Pumps	90	80
	Pipe Thruster	85	80
	Pneumatic Hammer	140	115
	Side Boom	83	83
	Excavator	85	85
	Crane	85	85

Table L-11 HDD/Direct Pipe Candidate Noise Control Strategies

HDD Equipment Component	Candidate Noise Control Strategies
Trucks	Restrictions of hours of operations and routes (away from receivers).
Light Plants (electric generators)	Acoustical enclosures or barriers for generators.
Mud Pumping Units	Acoustical enclosures for mud pumps and engines equipped with exhaust silencers.
Loaders/Forklifts	Engines equipped with exhaust silencers. Modification of backup alarms to low volume types. Locating loading bins away from receivers.
Power Unit and HDD Rig	A complete acoustical enclosure for the power unit equipped with a critical grade exhaust silencer. Partial enclosure or barrier for the HDD rig.
Light Plants (Electric Generators)	Acoustical enclosures or barriers for electric generators and exhaust silencers.
Cranes and Boom Trucks	Exhausts equipped with silencers. Engine compartment acoustically treated. Usage restrictions.

Table L-12 summarizes the modeled sound levels at the closest NSAs, indicated as HDD-NSA#, assuming the HDD and Direct Pipe sources operate continually for daytime and nighttime construction scenarios. **Figure**

L-6 through **Figure L-11** display the sound level contours from these scenarios. These predictive results demonstrate that with application of the proposed noise mitigation strategies, resulting sound levels will not constitute a violation of the Town of Hempstead's or the City of Long Beach's stationary source noise limits, nor result in a potential imminent hazard to public health or the environment.

Table L-12 Sound Levels (dBA) during HDD and Direct Pipe Construction

Site	Location	Distance (ft)	Sound Level at NSAs due to Drill Rig Only (Nighttime Operations)	Sound Level at NSAs due to all HDD/Direct Pipe Sources (Daytime Operations)
Proposed Cable Landfall (HDD) – Alternative A	HDD-NSA 1	620	55	59
	HDD-NSA 2	190	66	70
	HDD-NSA 3	850	52	56
Cable Landfall Alternative C3 (HDD)	HDD-NSA 11	748	54	57
	HDD-NSA 12	689	54	58
	HDD-NSA 13	377	60	63
Cable Landfall Alternative C3 (Direct Pipe)	HDD-NSA 11	705	58	83
	HDD-NSA 12	655	58	83
	HDD-NSA 13	425	62	87
Cable Landfall Alternative E (HDD)	HDD-NSA 26	500	57	61
	HDD-NSA 27	490	57	61
	HDD-NSA 28	290	61	65
	HDD-NSA 29	180	65	68
	HDD-NSA 30	80	71	75
	HDD-NSA 31	130	68	72
	HDD-NSA 32	150	67	71
	HDD-NSA 33	60	73	76
	HDD-NSA 34	70	72	76
Reynolds Channel Crossing (South Shore) (HDD)	HDD-NSA 17	568	56	59
	HDD-NSA 18	417	53	57
Reynolds Channel Crossing (North Shore) (HDD)	HDD-NSA 19	584	56	60
	HDD-NSA 20	548	51	54
	HDD-NSA 21	902	49	53
	HDD-NSA 22	925	51	55
	HDD-NSA 23	1,050	50	54
	HDD-NSA 24	1,150	49	53
	HDD-NSA 25	900	50	53
	NH-1 a/	275	61	65
	NH-2 a/	425	58	62
	NH-3 a/	600	55	59

Note:
a/ NH = Nursing Home

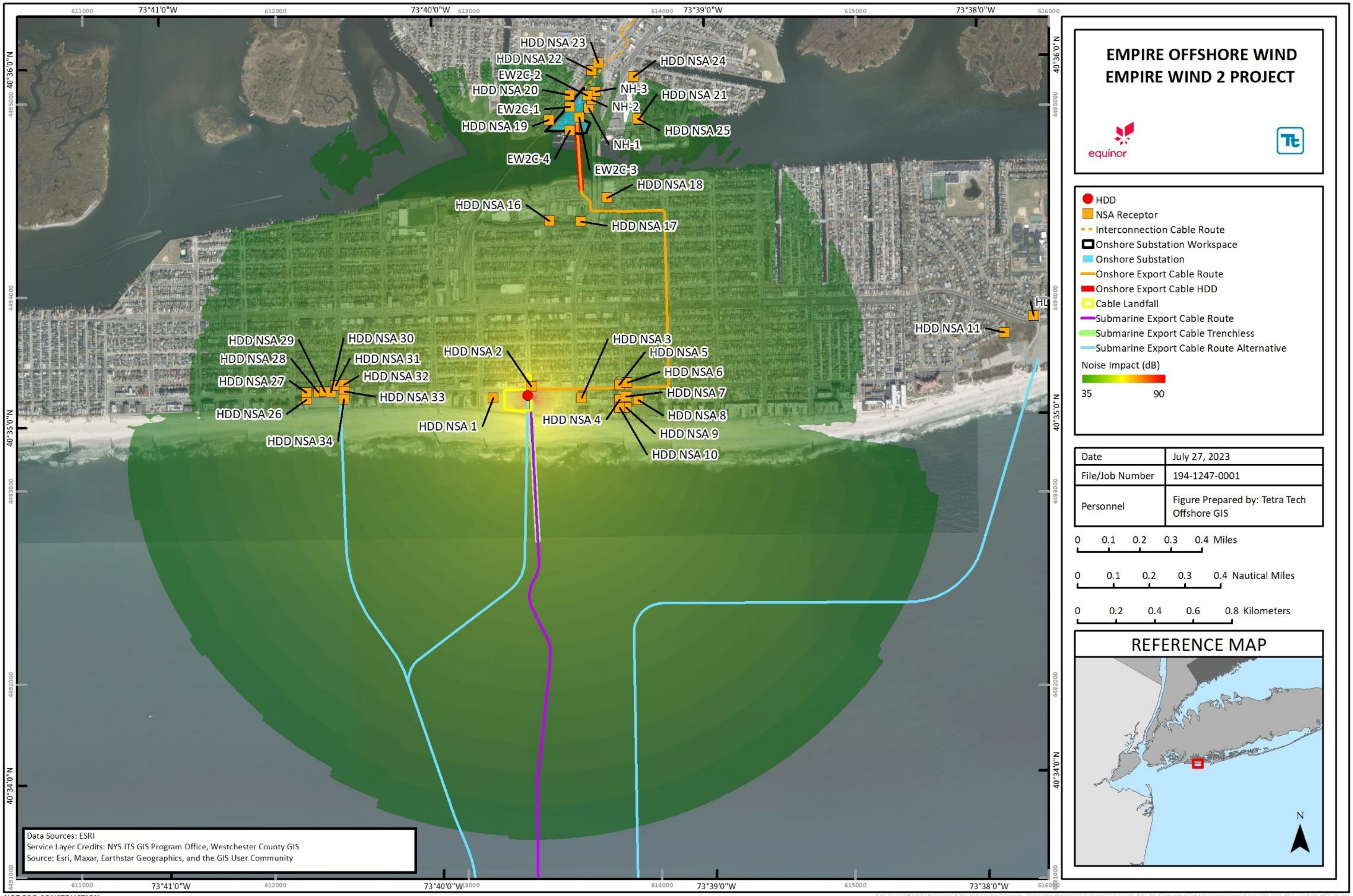

Figure L-6 Proposed Cable Landfall (Alternative A) HDD Contour Isopleth

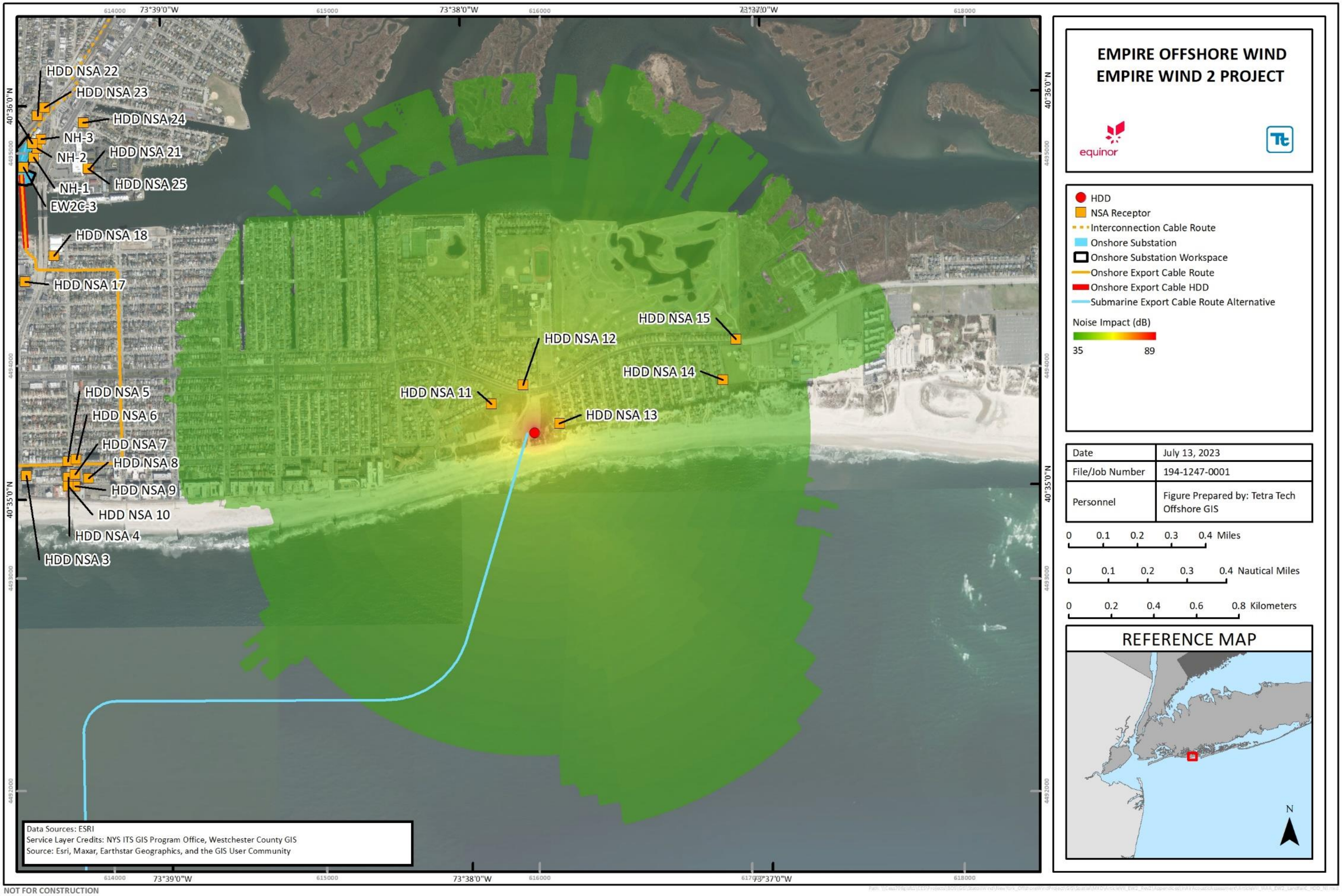

Figure L-7 Cable Landfall Alternative C3 HDD Contour Isopleth

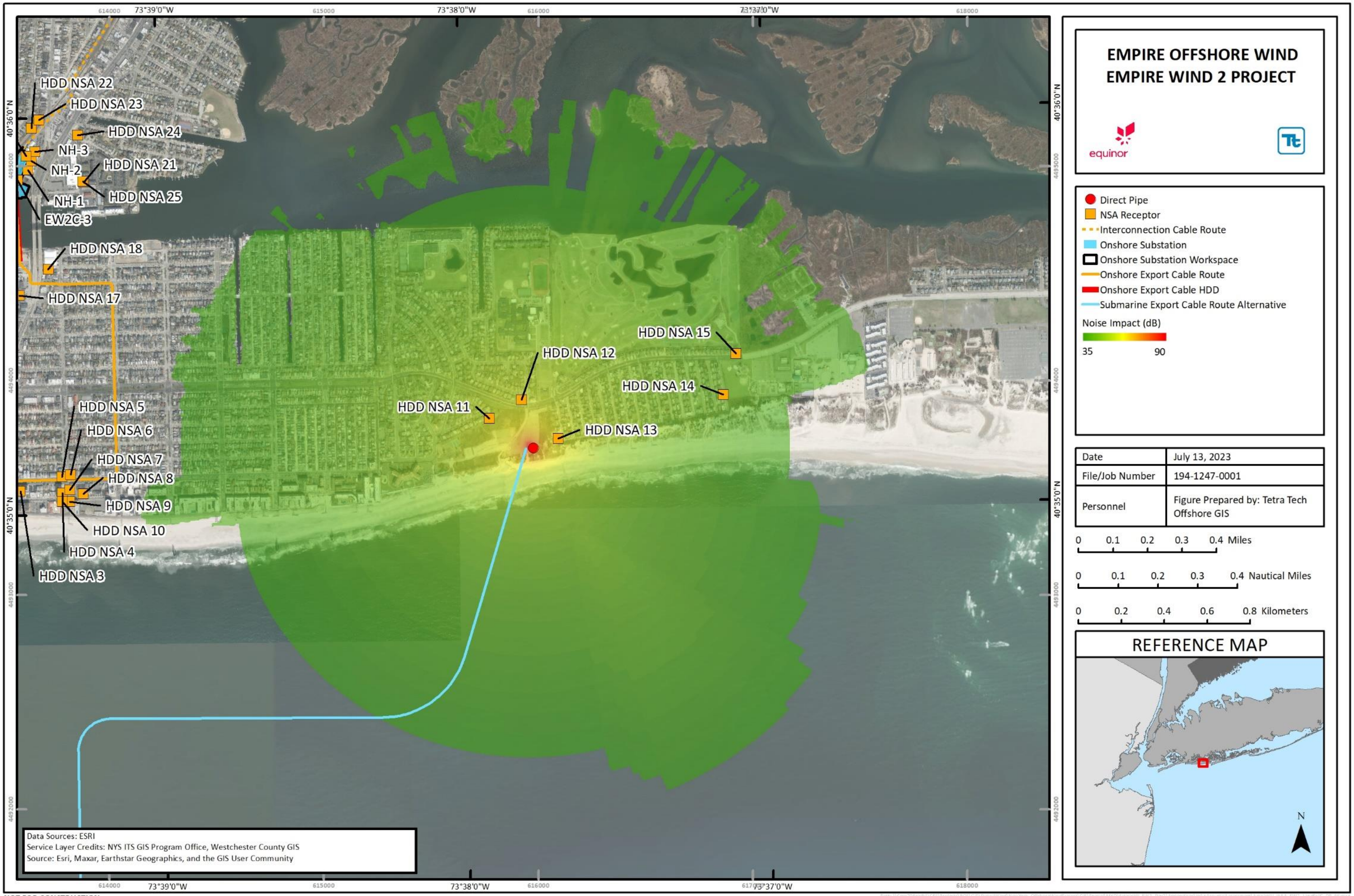

Figure L-8 Cable Landfall Alternative C3 Direct Pipe Contour Isopleth

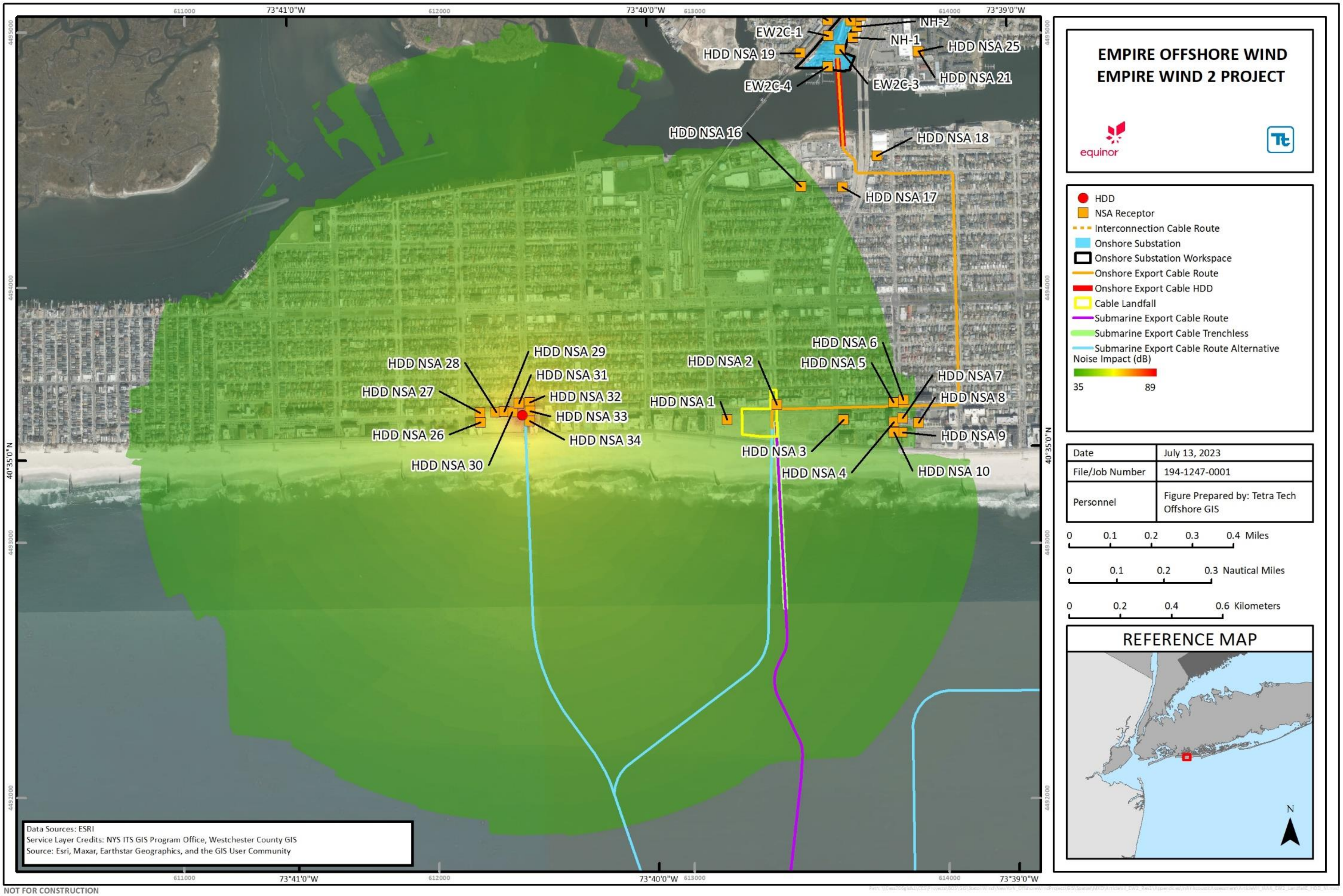

Figure L-9 Cable Landfall Alternative E HDD Contour Isopleth

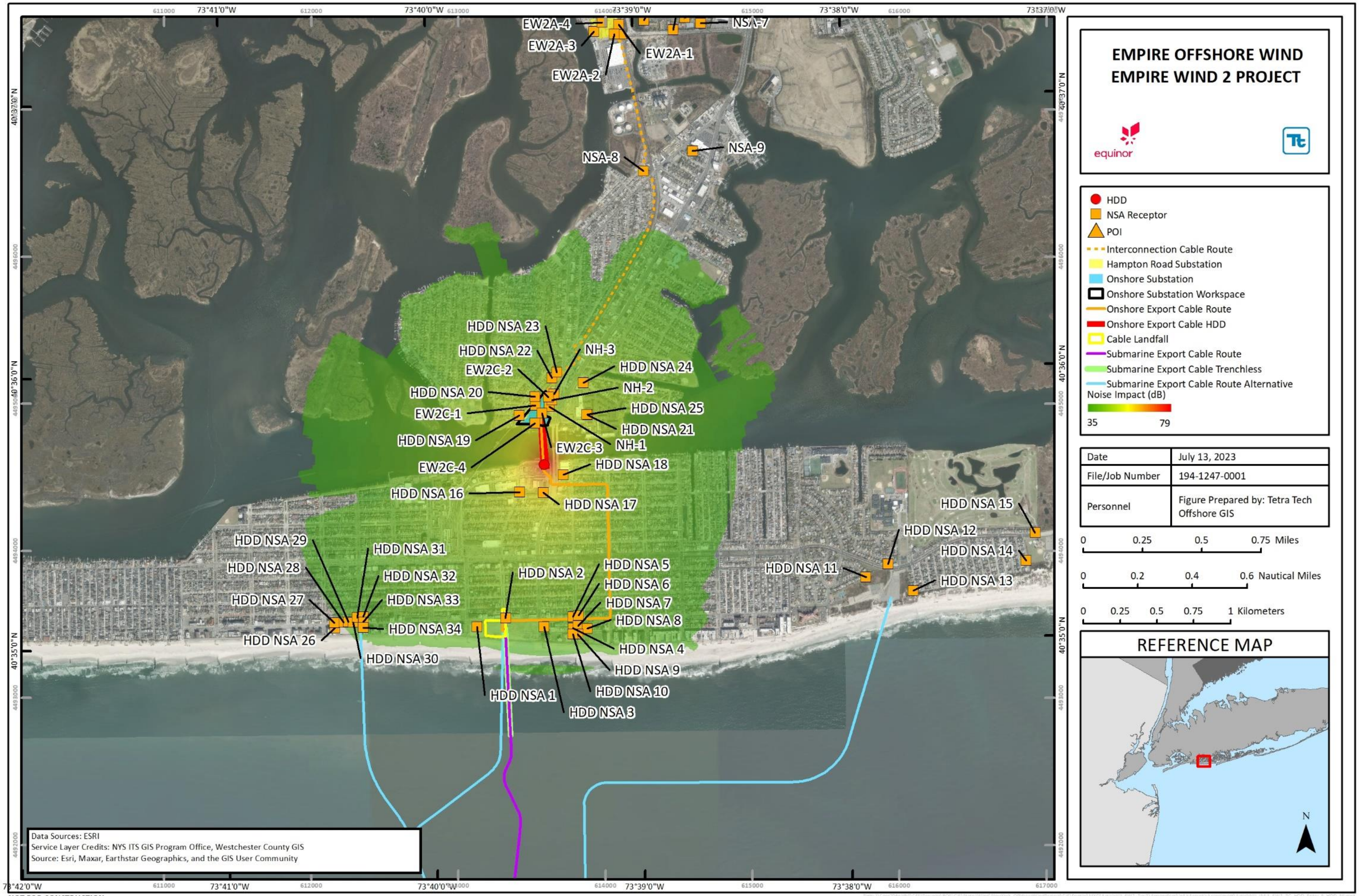

Figure L-10 Reynolds Channel Crossing (South Shore) – HDD Contour Isopleth

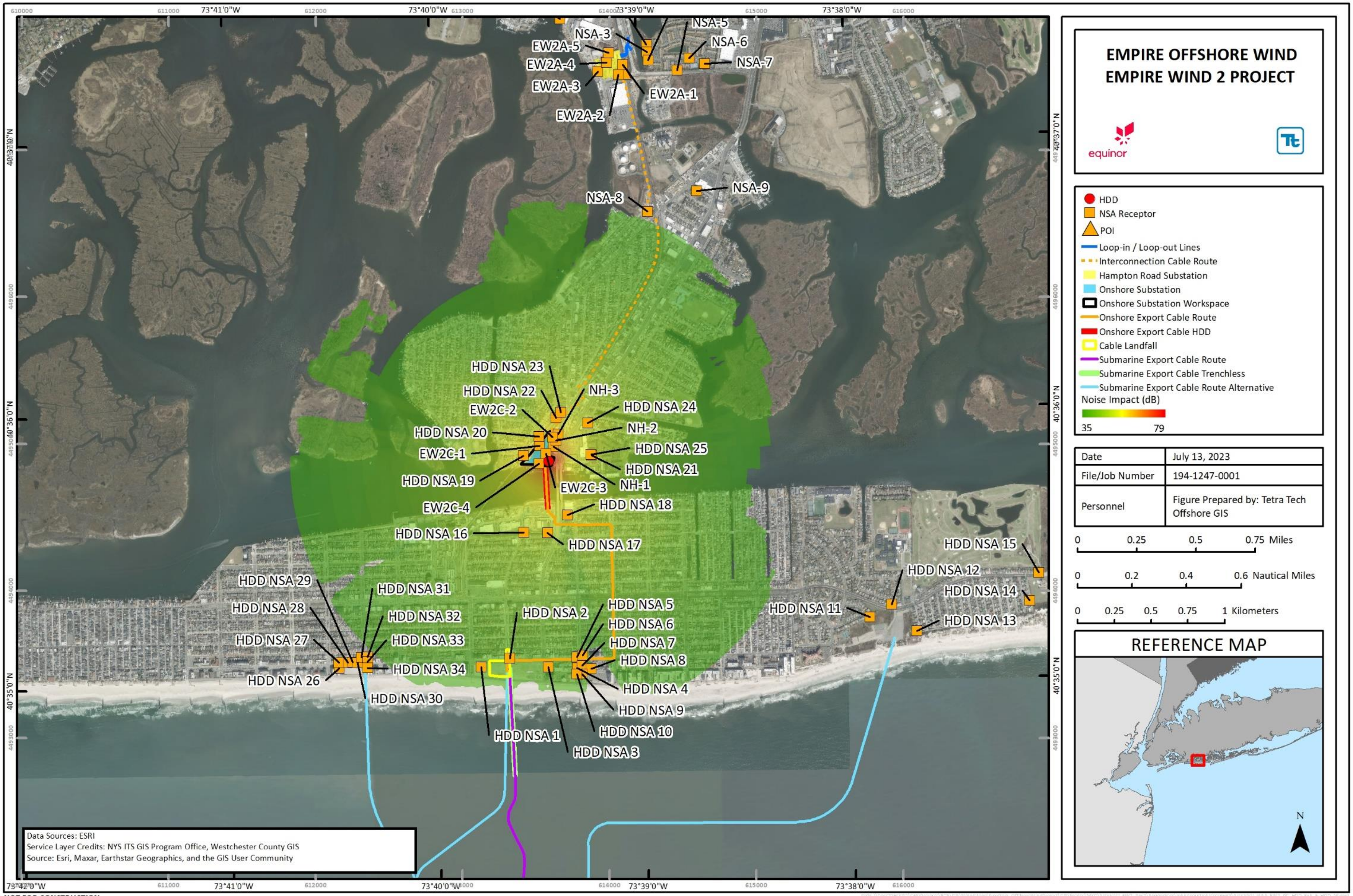

Figure L-11 Reynolds Channel Crossing (North Shore) – HDD Contour Isopleth

Once the HDD/Direct Pipe and pull-back are complete, noise from the export cable landfall area will be limited to typical construction activities associated with equipment such as tracked graders, backhoes, and pickup trucks. As noted above, HDD/Direct Pipe construction activities will occur during the daytime period unless a situation arises that would require operation to continue into the night or appropriate regulatory authority deems it acceptable. In the case of night operations, only the HDD drill rig and power unit will be used unless deemed acceptable from the appropriate regulatory authority. If necessary, subject to regulatory requirements and stakeholder engagement, Empire will install moveable temporary noise barriers as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 dBA (NYC Mayor's Office of Environmental Coordination 2021).

L.5.1.4 Support Vessels

A specialized vessel will install the submarine export cables from a turntable on the lay vessel. The number of vessels used for the installation of the cables will depend on a number of factors, such as seabed depth, depth of cable protection, distance to shore, installation methodology, and the type of cable protection method to be used. Nearshore, installation of the submarine export cables activities move along the cable progressively and be located relatively far from shoreline NSAs; therefore, no shoreline NSAs will be exposed to significant noise levels for an extended period of time. Due to the relatively short duration and distance from shore, it is not anticipated that construction activities associated with the installation of the submarine export cables will cause any significant noise impact in the communities along the shoreline.

L.5.2 Operational Acoustic Assessment

The noise-generating operational component of the NY Project consists of the onshore substation and Hampton Road substation. No operational sound is expected from the submarine export cables, onshore export cables, interconnection cables or loop-in / loop-out lines. **Figure L-12**and **Figure L-13** provide the conceptual onshore NY Project features at the onshore substation and Hampton Road substation sites.

The onshore substation site is located within the Village of Island Park, the Town of Hempstead, Nassau County, New York. The onshore substation will be located on Long Beach Boulevard. The onshore substation site is bounded primarily by commercial land uses on all sides with an existing railroad also located to the west.

The Hampton Road substation site will be located in Oceanside, in the Town of Hempstead, Nassau County, New York. The Hampton Road substation will be located north of the corner of Daly Boulevard and Hampton Road. The Hampton Road substation site is bounded by industrial land use to the north and south, a water body to the west, and a railroad to the east.

Electrical onshore substations have switching, protection and control equipment, as well as one or more transformers which can generate the sound generally described as a low humming. There are three main sound sources associated with a transformer: core sound, load sound, and sound generated by the operation of the cooling equipment. The core is the principal sound source, dominating in the intermediate frequency range between 100 and 600 Hz. The relative magnitudes of the sound at these different frequency levels are dependent on the design of the transformer (i.e., core material, core geometry); however, the sound generated is largely independent of the transformer load. The load sound is primarily caused by the load current in the transformer's conducting coils (or windings), and the main frequency of this sound is twice the supply frequency; 100 Hz for 50 Hz transformers and 120 Hz for 60 Hz transformers. The cooling equipment (fans and pumps) typically dominates the sound when operating in secondary cooling modes.

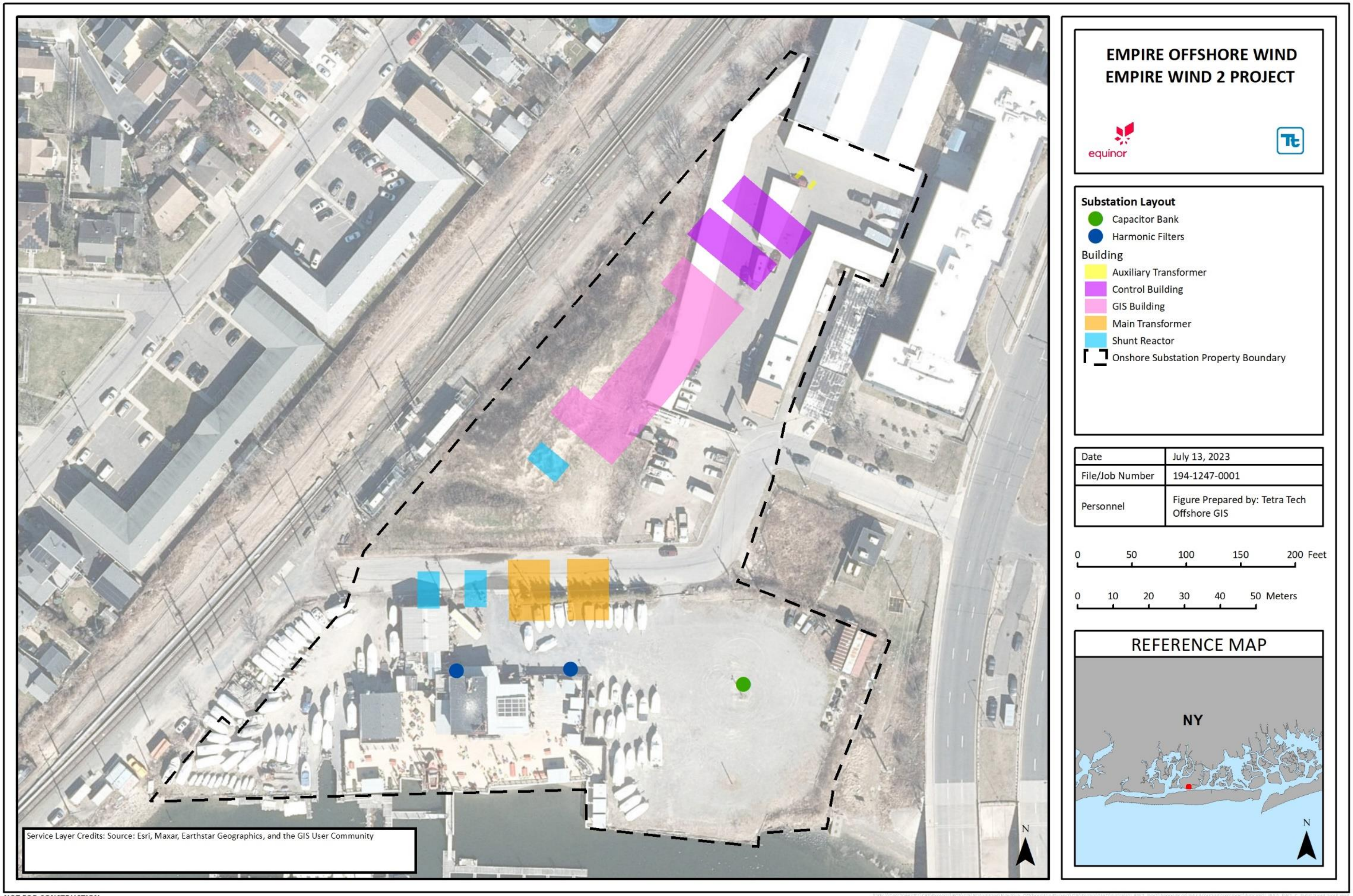

Figure L-12 Conceptual Onshore Substation Features

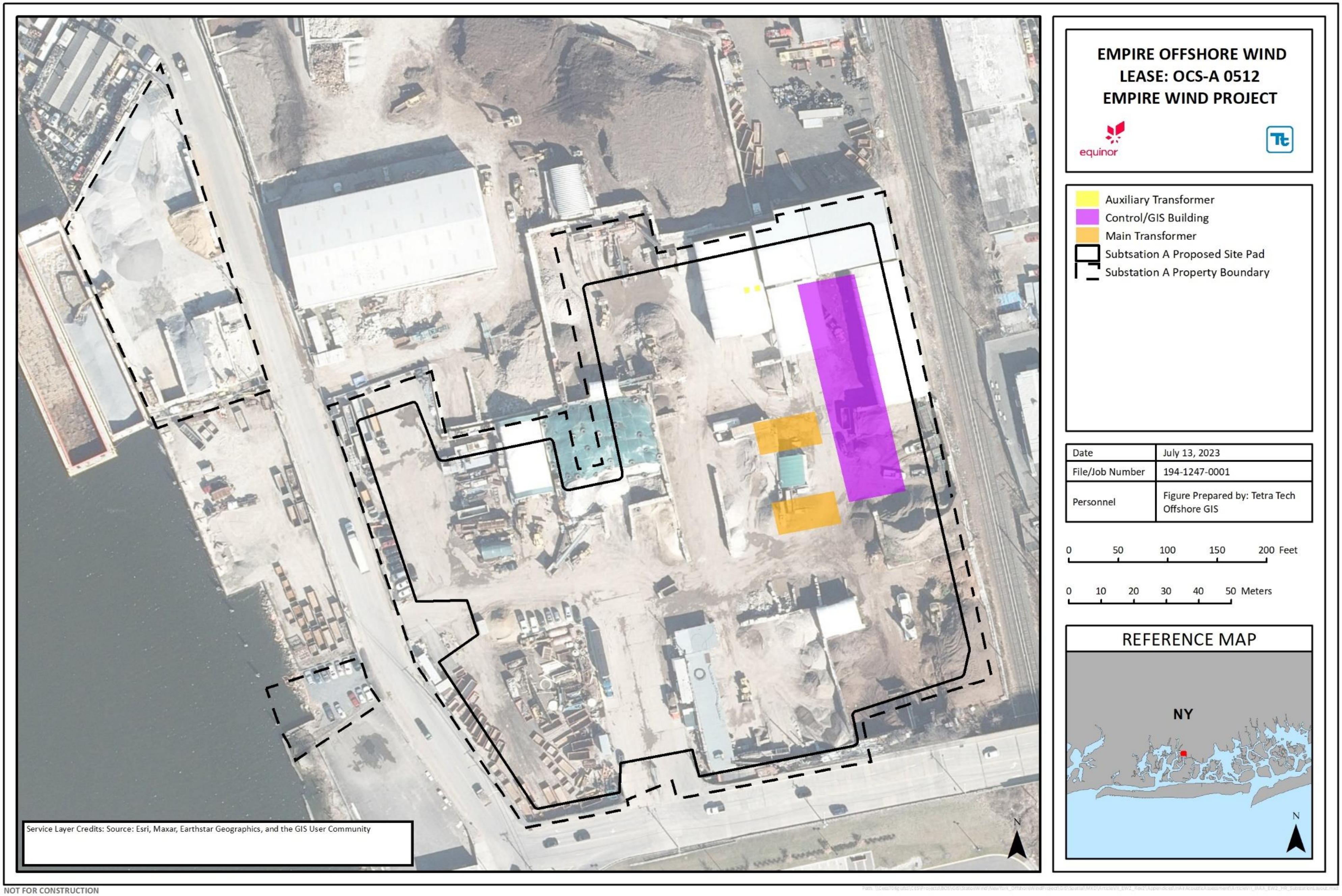

Figure L-13 Conceptual Hampton Road Substation Features

Transformers are designed and catalogued by kilovolt ampere or megavolt ampere ratings. Just as horsepower ratings designate the power capacity of an electric motor, a transformer's rating indicates its maximum power output capacity. The transformer industry uses the National Electrical Manufacturers Association's (NEMA) published NEMA Standards TR1-1993 (R2000) (NEMA 1993). These standards establish noise ratings to designate maximum sound emitted from transformers, voltage regulators, and shunt reactors based on the equipment's method of cooling, its dielectric fluid (air-cooled versus oil-cooled), and the electric power rating. The NEMA methodology for measuring sound involves A-weighted sound measurements using microphones positioned from a tautly drawn string that encircles the device at a height that is one-half the overall height of the device. The equipment sound output is the average of all measurements taken around the perimeter, incorporating contributions from both cooling fans and transformer casing. Shunt reactors contain components similar to power transformers, but sound generated is primarily from vibrational forces resulting from magnetic "pull" effects at iron-air interfaces. Also, unlike transformers, operation of shunt reactors is typically intermittent, operating when voltage stabilization is needed during load variation. Both transformers and shunt reactors were included in the acoustic modeling analysis, as identified in the site plans. Circuit-breaker operations, particularly air-blast breaker operations, may also cause audible sound. This sound is characterized as an impulsive sound event of very short duration and is expected to occur no more than a few times throughout the year. Because of its short duration and infrequent occurrence, circuit breaker sound was not considered in this sound modeling analysis.

While the onshore substation and Hampton Road substation engineering designs are only at a conceptual level, it is reasonable to expect that any transformer installed as part of the NY Project will conform to all relevant NEMA standards; however, it is possible that the final warranty sound specifications could vary slightly. Representative octave band center frequencies were derived from standardized engineering technical guidelines based on measurements from similar equipment types. Empire provided a detailed design for the onshore substation and Hampton Road substation, which included the site layouts and number and sound power levels for the equipment (**Table L-13**). The onshore substation and Hampton Road substation were modeled for maximum design scenario conditions, which included no sound screening walls and no roof for the filter building.

Table L-13 Sound Ratings of Onshore Substation Components

Project	Substation Component	Number	Sound Power Level
Onshore Substation	Main Power Transformers	2	98 dBA
	Shunt Reactors	3	95 dBA
	AC Filter Shunt Reactors	2	95 dBA
	AC Filter Capacitors	1	95 dBA
	Auxiliary Transformers	2	68 dBA
	Exhaust Fans	8	64 dBA
	Air Handling Units	8	74 dBA
Hampton Road Substation	Main Transformers (Outdoor)	2	98 dBA
	Aux Transformers (Outdoor)	2	68 dBA
	Exhaust Fans (Outdoor)	8	64 dBA
	Air Handling Units (Outdoor)	8	74 dBA

Received sound levels were evaluated at the closest NSAs to the onshore substation and the Hampton Road substation and shown in **Table L-14** with resultant sound contour plots displaying operational sound levels in **Figure L-14**and **Figure L-15**Compliance was assessed relative to both state and local noise requirements.

Sound produced by the Hampton Road substation operations conforms with the NYSDEC 6 dBA incremental increase guideline at all NSAs, while the onshore substation exceeds the guideline at four NSAs (HDD-NSA 19, HDD-NSA 20, NH-1, and NH-2).

In addition, the NYSDPS "General Recommendations for Applications for Substations, Stations, and Converter Stations under Article VII" recommends a 35 dBA acoustic design goal outside any residence, assuming a 5 dBA penalty for prominent tones, and a 45 dBA acoustic design goal at the property boundary. Modeled results indicate that operation of the onshore substation and the Hampton Road substation will not comply with the 45 dBA property boundary acoustic design goal. In addition, operation of the onshore substation will exceed the 35 dBA acoustic design goal for residences at all nearby identified NSAs. The NYSDPS recommended acoustic design goals are conservative guidelines different from the applicable regulatory standards for the Town of Hempstead.

Most of the applicable noise regulations consist of octave band frequency sound limits and not broadband sound limits. Compliance with those octave band sound limits is addressed for the onshore substation and the Hampton Road substation in **Table L-15** and **Table L-16**. The onshore substation and the Hampton Road substation will adhere to the Town of Hempstead octave band frequency sound limits at all nearby NSAs but not at their respective property boundary locations. The design and layout of the onshore substation and Hampton Road substation are currently undergoing refinement, which may reduce the received noise levels. Further review of the substation site layouts, equipment and noise mitigation measures will be conducted to minimize received noise levels as practicable.

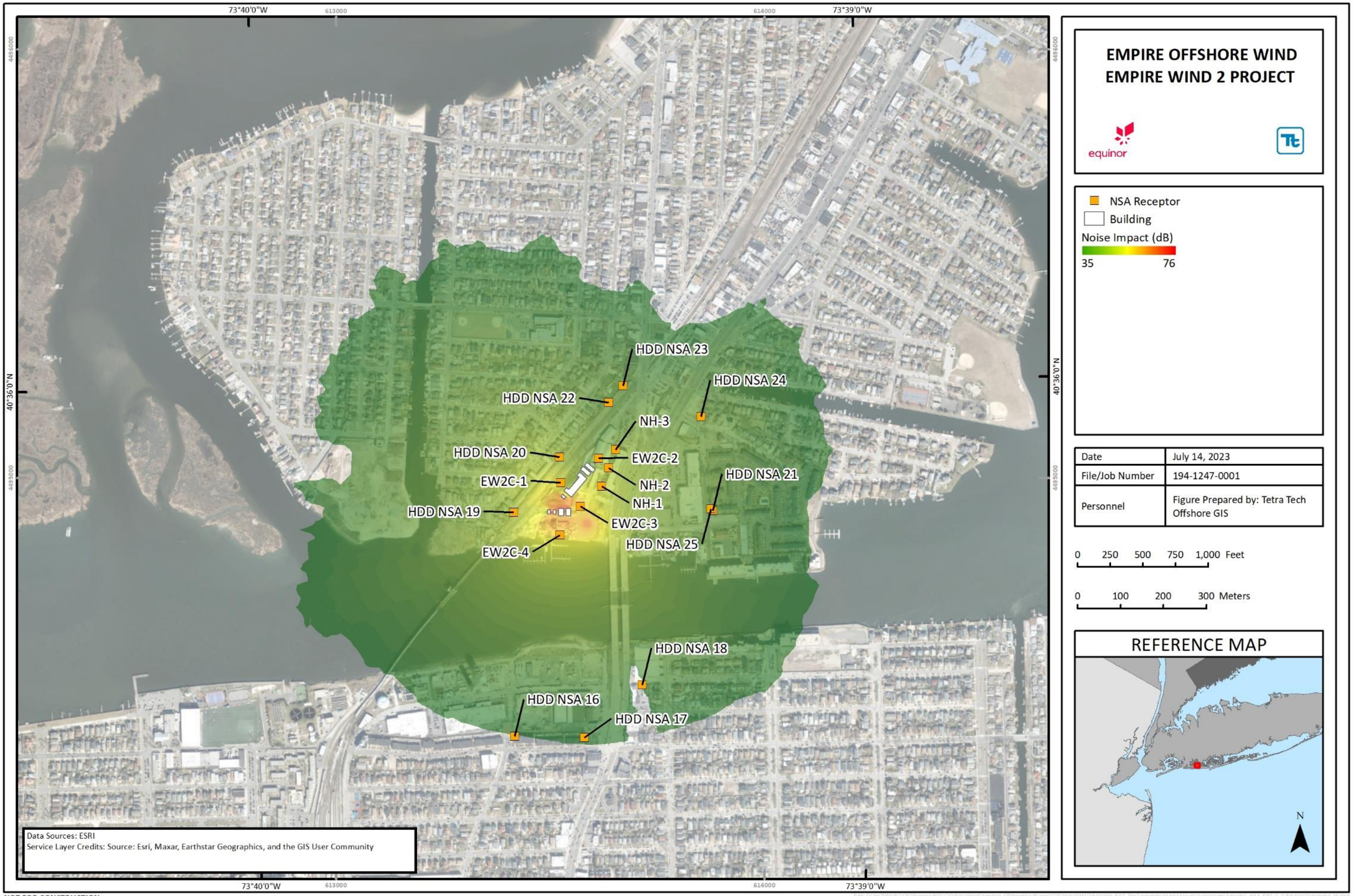

Figure L-14 Onshore Substation Operational Sound Levels (dBA)

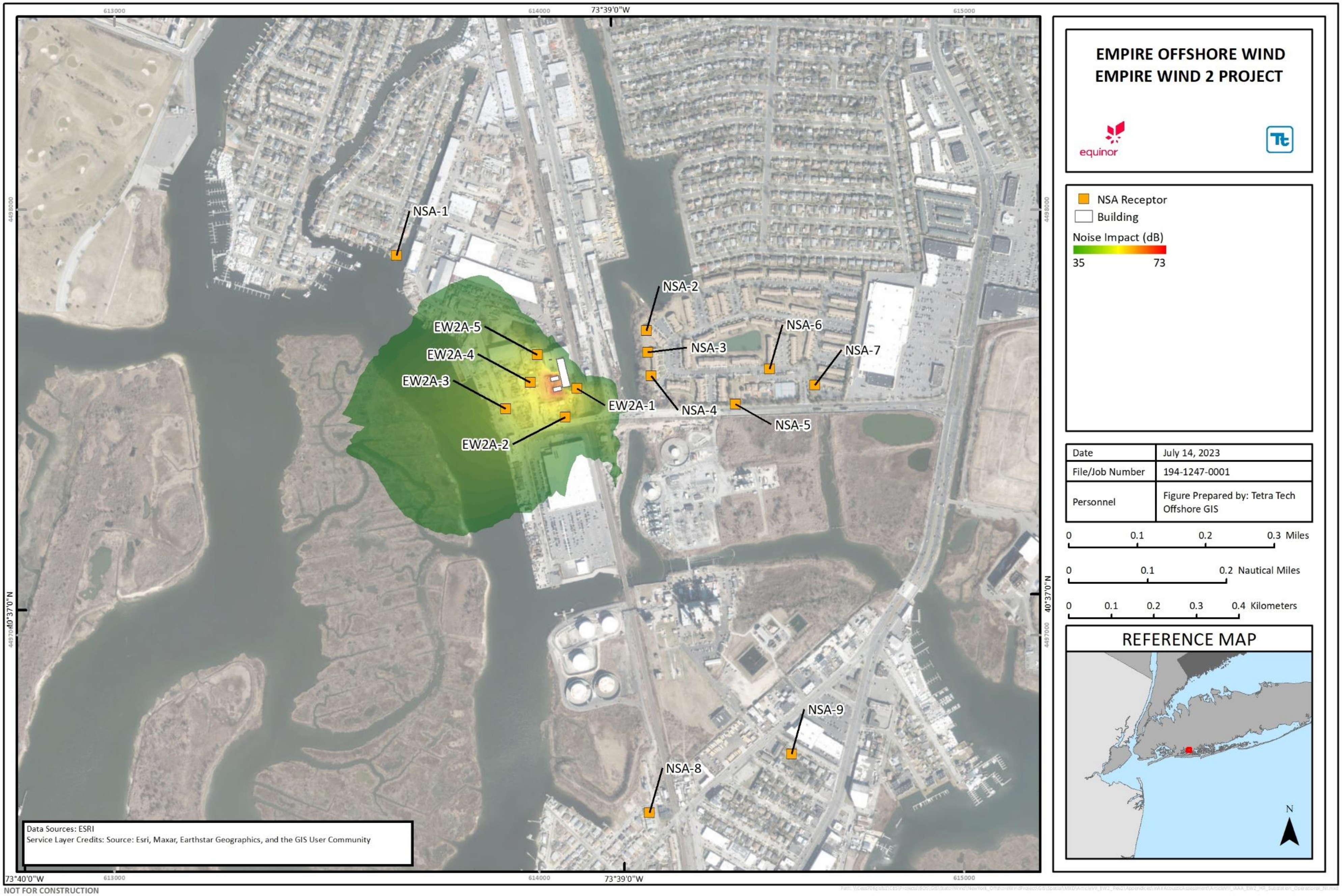

Figure L-15 Hampton Road Substation Operational Sound Levels (dBA)

Table L-14 Predicted Nighttime L_{90} Sound Levels (dBA) at the Closest Noise Sensitive Areas

Site	Location	Distance (ft)	Nighttime Ambient Sound Level, L_{90}	Ambient Location from Table L-5	Modeling Results	Modeling Results Plus Existing Ambient	Increase Above Existing Ambient
Hampton Road Substation	NSA-1	372	44	NM-3	32	44	0
	NSA-2	184	44	NM-3	26	44	0
	NSA-3	177	44	NM-3	28	44	0
	NSA-4	172	44	NM-3	30	44	0
	NSA-5	355	44	NM-3	26	44	0
	NSA-6	450	44	NM-3	24	44	0
	NSA-7	549	44	NM-3	23	44	0
	NSA-8	1,914	47	NM-5	22	47	0
	NSA-9	1,887	47	NM-4	21	47	0
	EW2A-1 a/	0	45	SS-ST-1	47	49	4
	EW2A-2 a/	0	45	SS-ST-1	54	54	9
	EW2A-3 a/	0	45	SS-ST-1	51	52	7
	EW2A-4 a/	0	45	SS-ST-1	56	56	11
	EW2A-5 a/	0	45	SS-ST-1	50	51	6
Onshore Substation	HDD-NSA 19	120	40	HDD-ML-6	49	50	10
	HDD-NSA 20	140	41	HDD-ML-7	47	48	7
	HDD-NSA 21	850	41	HDD-ML-7	40	44	3
	HDD-NSA 22	360	41	HDD-ML-7	39	44	3
	HDD-NSA 23	525	41	HDD-ML-7	38	43	2
	HDD-NSA 24	790	41	HDD-ML-7	40	44	3
	HDD-NSA 25	850	40	HDD-ML-6	40	43	3
	NH-1 b/	62	40	HDD-ML-6	51	51	11
	NH-2 b/	16	40	HDD-ML-6	48	49	9
	NH-3 b/	110	40	HDD-ML-6	44	46	6
	EW2C-1 a/	0	40	HDD-ML-6	53	53	13
	EW2C-2 a/	0	40	HDD-ML-6	46	47	7
	EW2C-3 a/	0	40	HDD-ML-6	60	60	20
	EW2C-4 a/	0	40	HDD-ML-6	61	61	21

Note:
a/ Onshore substation boundary location
b/ NH = Nursing Home

Table L-15 Tonal L_{90} Sound Levels (dB) at the Closest Noise Sensitive Areas to the Onshore Substation

Octave Band Center Frequency (Hz)	Octave Band Sound Pressure Level (dB) Limit	Octave Band Sound Pressure Level (dB)													
		HDD-NSA 19	HDD-NSA 20	HDD-NSA 21	HDD-NSA 22	HDD-NSA 23	HDD-NSA 24	HDD-NSA 25	NH-1 a/	NH-2 a/	NH-3 a/	EW2C-1 b/	EW2C-2 b/	EW2C-3 b/	EW2C-4 b/
63	72	55	54	48	48	47	48	48	57	53	51	58	50	63	64
125	67	55	53	46	47	45	46	46	57	54	51	59	51	65	65
250	59	48	45	38	38	37	38	39	49	47	43	53	45	59	60
500	52	48	46	39	38	37	39	39	50	47	43	52	45	59	60
1,000	46	44	41	34	33	32	34	34	45	42	38	46	39	53	54
2,000	40	38	36	28	27	25	27	28	40	36	32	41	34	48	49
4,000	34	30	27	15	15	12	13	15	32	28	23	34	27	41	43
8,000	32	14	9	0	0	0	0	0	16	9	2	21	17	30	32
	Average (dBA)	49	47	40	39	38	40	40	51	48	44	53	46	60	61

Note:
a/ NH = Nursing Home
b/ Onshore substation boundary location

Table L-16 Tonal L_{90} Sound Levels (dB) at the Closest Noise Sensitive Areas to the Hampton Road Substation

Octave Band Center Frequency (Hz)	Octave Band Sound Pressure Level (dB) Limit	Octave Band Sound Pressure Level (dB)													
		NSA-1	NSA-2	NSA-3	NSA-4	NSA-5	NSA-6	NSA-7	NSA-8	NSA-9	EW2A-1 a/	EW2A-2 a/	EW2A-3 a/	EW2A-4 a/	EW2A-5 a/
63	72	40	40	41	42	38	36	35	33	32	54	57	54	59	54
125	67	38	35	37	38	34	32	30	29	27	54	59	56	61	55
250	59	31	25	27	30	26	24	23	22	21	48	54	51	56	50
500	52	31	22	25	28	25	23	22	22	20	47	54	50	55	50
1,000	46	26	16	18	22	19	17	16	16	14	40	48	44	49	43
2,000	40	18	9	11	14	11	8	8	5	3	34	42	38	43	38
4,000	34	2	0	0	2	0	0	0	0	0	27	35	30	37	31
8,000	32	0	0	0	0	0	0	0	0	0	15	23	12	24	18
	Average (dBA)	32	26	28	30	26	24	23	22	21	47	54	51	56	50

Note:
a/ Onshore substation boundary location

L.6 Conclusions

In-air acoustic modeling was conducted for the NY Project to assess the potential noise impacts associated with construction and operational activities, including vessel activities associated with submarine export cable installation, construction of the onshore export cables, interconnection cables and loop-in / loop-out lines, and the construction and operation of the onshore substation and the Hampton Road substation. Sound generated by vessels installation the submarine export cables is expected to be short term and low level due to the separation distance between vessels and shoreline NSAs.

NY Project construction noise was analyzed at varying distances from typical sources associated with clearing, excavation, foundation, erection, and finishing phases for onshore export cables, interconnection cables, loop-in / loop-out lines and substations. Construction levels will primarily be limited to daytime hours. If required, noise mitigation will be used to minimize offsite noise impacts to the extent practicable pending engagement with regulatory agencies and other stakeholders, as applicable.

Pile driving activities were analyzed for the onshore substation and Hampton Road substation, as well as the bulkhead upgrade at the onshore substation. Noise levels associated with impact pile driving of the substation foundations ranges from 61 to 93 dBA at nearby NSAs while noise levels associated with vibratory pile driving at the onshore substation bulkhead ranges from 53 to 81 dBA at nearby NSAs. Pile driving activities will occur during daytime hours. Pile driving will be temporary and short-term and the Applicant will minimize offsite impacts to the extent practicable using potential mitigation options like temporary noise barriers, pile cap/cushion, trenching, and/or nose shrouds installed in proximity to pile driving.

Vibratory pile driving for construction of nearshore cofferdams has been analyzed at the export cable landfall locations. Noise levels from the vibratory pile driving will reach 64 dBA at the worst-case shore location. These levels are deemed to be not significant due to it being a daytime-only event and the short-lasting duration of the activity. In association with the vibratory pile driving, the export cables will require HDD operations at the associated export cable landfall. HDD will also be needed in association with the onshore export and interconnection cables. The HDD nighttime levels could reach 73 dBA at the worst-case location. If any noise issues are identified, moveable temporary noise barriers can be erected with placement as close to the sound sources as possible, which have been shown to effectively reduce sound levels by 5 to 15 dBA.

Substation operational impacts were evaluated at the onshore substation and Hampton Road substation sites. Operational sound levels associated with the onshore substation ranged from 38 to 51 at nearby NSAs, while operational sound levels at the Hampton Road substation ranged from 21 to 32 dBA at nearby NSAs. The onshore substation and the Hampton Road substation will adhere with the Town of Hempstead octave band frequency sound limits at all nearby NSAs but not at their respective property boundary locations.

The design and layout of the onshore substation and Hampton Road substation are currently undergoing refinement, which may reduce the received noise levels. Further review of the substation site layouts, equipment and noise mitigation measures will be conducted to minimize received noise levels as practicable.

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