Empire Offshore Wind LLC

Empire Wind 1 Project

Article VII Application

Appendix J
In-Air Acoustic Assessment

June 2021

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ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
BOEM	Bureau of Ocean Energy Management
ConEdison	Consolidated Edison Company of New York, Inc.
dB	decibel
dBA	A-weighted decibel
dBL	linear decibel
Empire, or the Applicant	Empire Offshore Wind LLC
EW 1	Empire Wind 1
ft	foot
GIS	gas-insulated switchgear
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
m	meter
mi	mile
NEMA	National Electrical Manufacturers Association
nm	nautical mile
NSA	noise sensitive area
NYC Code	Title 24, Chapter 2 of the New York City Administrative Code (New York City Noise Control Code)
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 Gowanus 345-kV Substation
PPV	peak particle velocity

Project Area	onshore Project facility and submarine cable corridor in New York State waters
PSL	New York Public Service Law
SBMT	South Brooklyn Marine Terminal
SVC	static VAR compensator
the Project	EW 1 Project transmission facilities in New York

J.1 Introduction

Empire Offshore Wind LLC (Empire, or the Applicant) proposes to construct and operate the Empire Wind 1 (EW 1) Project (**Figure J-1**) 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). This assessment is being submitted to the New York State Public Service Commission (NYSPSC or Commission) for the portions of the EW 1 Project transmission system located within the State of New York (collectively the Project) pursuant to Article VII of the New York Public Service Law (PSL).

The Project will interconnect to the New York State Transmission System operated by the New York Independent System Operator, Inc. (NYISO) at the Gowanus 345-kilovolt (kV) Substation (the point of interconnection, or POI). The Gowanus 345-kV Substation is owned by the Consolidated Edison Company of New York, Inc. (ConEdison). The Project's onshore facilities, including the onshore cable route, onshore substation, and the POI, are located entirely within Brooklyn, Kings County, New York.

The Article VII components of the EW 1 Project include:

- Two three-core 230-kV high-voltage alternating-current (HVAC) submarine export cables located within an approximately 15.1-nautical mile (nm, 27.9-kilometer [km])-long, submarine export cable corridor from the boundary of New York State waters 3 nm (5.6 km) offshore to the cable landfall in Brooklyn, New York;
- A 0.2-mile (mi, 0.3-km)-long onshore cable route and substation including:
    - Two three-core 230-kV HVAC EW 1 onshore export cables buried underground from the cable landfall either directly to the cable terminations or to a vault within the onshore substation;
    - An onshore substation located at the South Brooklyn Marine Terminal (SBMT), which will increase the voltage to 345 kV for the onshore interconnection cables; and
    - Two 345-kV cable circuits, each with three single-core HVAC onshore interconnection cables, buried underground from the onshore substation to the POI.

This In-Air Acoustic Assessment has been completed to document how the Project has been adequately 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 Project as well as describing the standards by which the Project will be assessed. Existing conditions were documented through ambient sound surveys, and 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 Project. Mitigation measures are presented to show the feasibility of the Project to meet the specific noise requirements. Final design may incorporate different mitigation measures to achieve the same objective as demonstrated in this analysis.

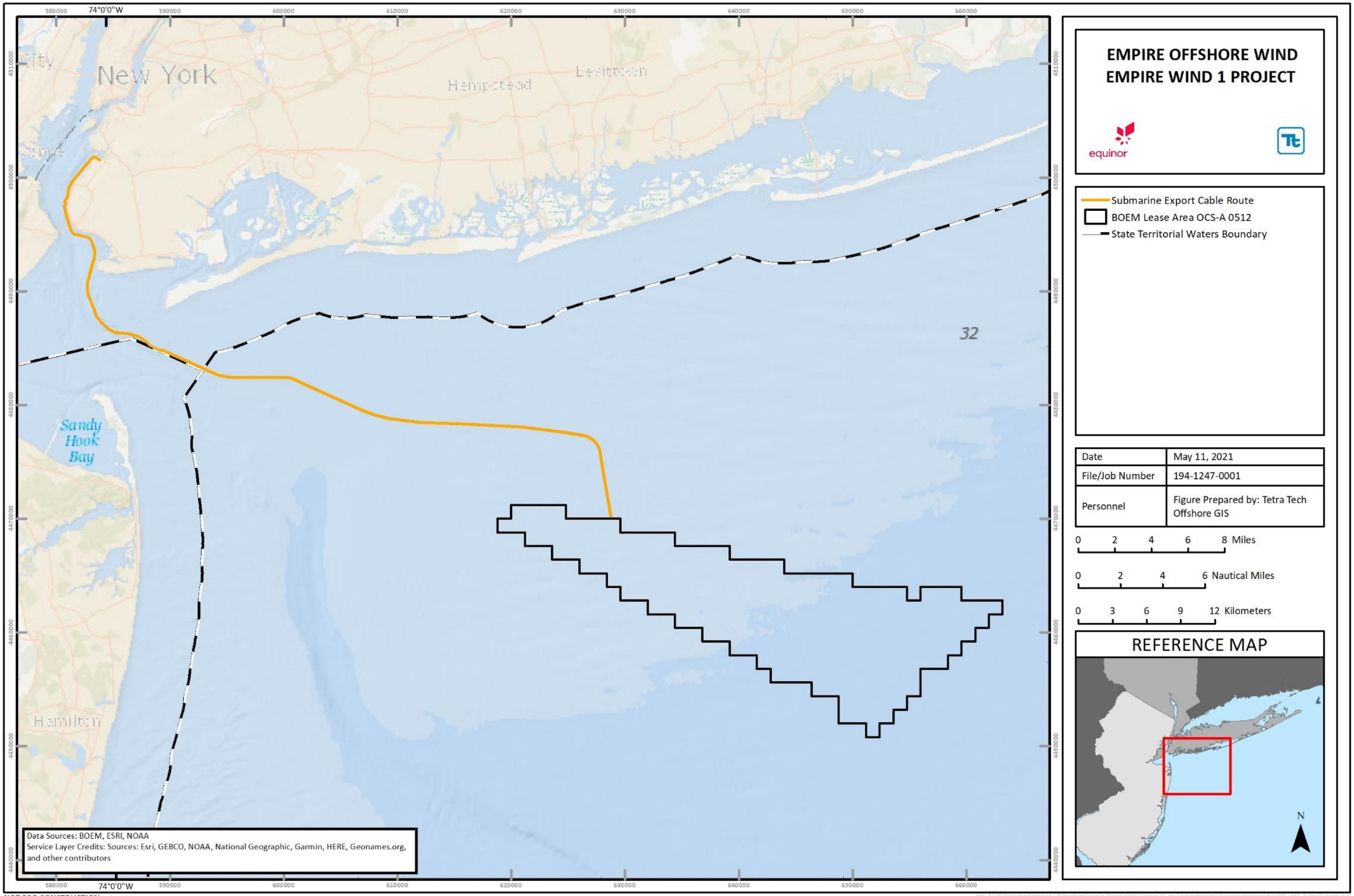

Figure J-1 Overview of the EW 1 Project

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;
- Specialized construction activities including:
  - Vibratory pile driving;
  - Impact pile driving of bulkhead and onshore 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 Project is further evaluated and refined. Additional sound modeling will be completed, as needed, once final Project components are selected.

J.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 J-1**.

Table J-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])	70	Moderate
Passenger car at 65 mi per hour (25 ft [8 m])	65	
Large store air-conditioning unit (20 ft [6 m])	60	
Light auto traffic (100 ft [30 m])	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room Bird calls	40	Faint
Typical wilderness area	35	
Quiet library, soft whisper (15 ft [5 m])	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
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.

J.2 Regulatory Criteria

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

J.2.1 Federal Noise Requirements

There are no federal community noise regulations applicable to the Project; however, the federal government has long recognized the potential hazards caused by noise to the health and safety of humans. 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. 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.

J.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.

J.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 1 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 Project's Article VII application.

J.2.3 Local Noise Requirements New York City

The onshore substation, submarine export cable landfall and onshore cable route will be located in the borough of Brooklyn in New York City, Kings County, New York. This section describes the local noise requirements for the proposed onshore substation. The local noise requirements will be followed unless otherwise authorized by the appropriate regulatory authority.

J.2.3.1 Construction

Title 24, Chapter 2 of the New York City Administrative Code (the New York City Noise Control Code, or "NYC Code") regulates sound by the existing land use of receiving property, not its zoning designation. According to the New York City Noise Control Code, construction is limited to Monday through Friday from 7:00 am to 6:00 pm, unless otherwise authorized. A noise mitigation plan must be completed for any construction activity before construction begins. A noise mitigation plan must be in place before any authorization to work outside of the construction window is granted. The following provisions are given for construction devices, including both continuous (i.e., non-impulsive) and impulsive sound sources.

NYC Code § 24-228 Construction devices

> *(a) No person shall operate or use or cause to be operated or used a construction device or combination of devices in such a way as to create an unreasonable noise. For the purposes of this section unreasonable noise shall include but shall not be limited to sound that exceeds the following prohibited noise levels*:

> (1) *Sound, other than impulsive sound, attributable to the source or sources, that exceeds 85 dB(A) as measured 50 or more feet from the source or sources at a point outside the property line where the source or sources are located or as measured 50 or more feet from the source or sources on a public right-of-way.*
>
> (2) *Impulsive sound, attributable to the source, that is 15 dB(A) or more above the ambient sound level as measured at any point within a receiving property or as measured at a distance of 15 feet or more from the source on a public right-of-way. Impulsive sound levels shall be measured in the A-weighting network with the sound level meter set to fast response. The ambient sound level shall be taken in the A-weighting network with the sound level meter set to slow response.*

As noted above, construction activities may take place during the hours of 7:00 a.m. to 6:00 p.m. on weekdays. If a waiver for after-hours work is granted, the Project would be subject to the substantive provisions of § 24-223.

NYC Code § 24-223 After hours work authorization

> *(d) During the time that an after-hours authorization is in effect, notwithstanding full compliance with the noise mitigation plan the department shall issue an advisory or a violation where aggregate sound levels from the site exceed the following limits:*
>
> *(1)8dB(A), and on or after January 1, 2020, 7 dB(A) above the ambient sound level as measured in any residential receiving property dwelling unit with windows and doors that may affect the measurement closed, or*
> *(2)The noise levels specified in section 24-228(a) of this code on a construction site that is not within 200 feet of a residential receptor, or*
> *(3)Except as provided in paragraph (4) of this subdivision, 80dB(A), and on or after January 1, 2020, 75 dB(A) as measured 50 or more feet from the source or sources at a point outside the property line where the source or sources are located or as measured 50 or more feet from the source or sources on a public right-of-way when that source is within 200 feet of a residential receptor, or*
> *(4)85dB(A) as measured 50 or more feet from the source or sources at a point outside the property line where the source or sources are located, or as measured 50 or more feet from the source or sources on a public-right-of-way when the source is street construction.*

In addition, within the Rules of the City of New York, Chapter 28 "Citywide Construction Noise Mitigation" provides prescriptive noise mitigation strategies for various construction activities including options for source controls and noise pathway controls. As Project construction plans progress and are refined, Empire will evaluate the need for construction noise mitigation and appropriate controls, as needed, to minimize offsite impacts. In addition to noise, the NYC Code specifies vibration limits for both continuous and impulsive sound sources, which are applicable at the adjacent lot lines. **Table J-2** provides the maximum permitted vibration limits for continuous sound sources for the three manufacturing districts (M1, M2, and M3).

Table J-2 Maximum Permitted Steady State Vibration Displacement (inches)

	District		
Frequency (cycles per second)	M1	M2	M3
10 and below	.0008	.0020	.0039
10 - 20	.0005	.0010	.0022
20 - 30	.0003	.0006	.0011
30 - 40	.0002	.0004	.0007
40 - 50	.0001	.0003	.0005
50 - 60	.0001	.0002	.0004
60 and over	.0001	.0001	.0004

Table J-3 provides the maximum permitted vibration limits for impulsive sound sources.

Table J-3 Maximum Permitted Impact Vibration Displacement (inches)

	District		
Frequency (cycles per second)	M1	M2	M3
10 and below	.0016	.0040	.0078
10 - 20	.0010	.0020	.0044
20 - 30	.0006	.0012	.0022
30 - 40	.0004	.0008	.0014
40 - 50	.0002	.0006	.0010
50 - 60	.0002	.0004	.0008
60 and over	.0002	.0002	.0008

J.2.3.2 Operation

Under the New York City Administrative Code there are two separate regulations that apply to the Project operation: (1) absolute octave band limits at residential and commercial property, and (2) incremental limits for all off-site locations. The octave band limits in Administrative Code Section 24-232 are summarized in **Table J-4** and apply to residential/commercial property as measured inside a room with the windows open. The octave band limits are prescribed in linear or unweighted decibels. They are equivalent to broadband limits of 45 dBA for residential use and 49 dBA for commercial use.

Table J-4 New York City Noise Code Section 24-232 Octave Band Limits (dB)

Octave Band (Hz)	Limits for Residential Property Receiver	Limits for Commercial Property Receiver
31.5	70	74
63	61	64
125	53	56
250	46	50
500	40	45
1,000	36	41
2,000	34	39
4,000	33	38
8,000	32	37

The incremental limits in Administrative Code Section 24-218 prohibit an increase in the "ambient sound level" of 7 dBA or more during the nighttime hours of 10:00 p.m. to 7:00 a.m. at any receiving property. Ambient sound is defined in Section 24-203 of Administrative Code as the total sound level "at a location that exists" excluding "extraneous sounds," which are defined as "intense, intermittent" sounds. Although the Noise Code assigns no sound metric to the term "ambient sound," the standard convention in acoustical assessment is to represent this condition as the average (L_{eq}) sound level.

In addition to the City of New York Noise Code Regulations, the City also has a zoning regulation, established by the New York City Department of City Planning. Sections 42-213 and 42-214 of the City's Zoning Resolution set regulatory limits on octave band sound levels from operation of a facility "at any point on or beyond any lot line." The decibel limits for whole octave bands from 31 Hz to 16,000 Hz differ depending on manufacturing districts. The manufacturing district relevant to the project will be M3-1, as shown in **Table J-5**, given in linear or unweighted decibels.

Table J-5 New York City Zoning Resolution Sections 42-213 & 214 Octave Band Limits (dB)

Octave Band (Hz)	Limits for M3-1 District
31.5	80
63	80
125	75
250	70
500	64
1,000	58
2,000	53
4,000	49
8,000	46

J.3 Existing Ambient Conditions

To characterize existing ambient conditions at the proposed onshore 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 substations and where landfall of the export cables will occur. A combination of short-term (~30 minutes) and long-term (~3 days) measurements were collected. The measurements were conducted 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 within the onshore Study Area are shown in **Figure J-2** as well as nearby receptors such as the closest residential receptors, which are TT 14, TT 15, TT 16, TT 17, and the Industry City apartments. Other receptors included in the analysis represent onshore substation boundary[1] locations (EQ-1, EQ-2, EQ-3, EQ-5, and EQ-6). Short-term measurements were collected during daytime and nighttime hours at monitoring locations NM-1,NM-2 and NM-3, and a long-term (3 days) ambient sound measurement was collected onsite at the SBMT site, which is identified as LT-1 on Figure 4.11-2. 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 J-6** summarizes the ambient sound measurement results that were collected at SBMT at short-term monitoring locations NM-1 and NM-2. Sound-level monitoring shows existing nighttime L_{90} levels are in the range of 33 to 65 dBA. A quiet suburban area would typically have nighttime levels in the range of 35 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 45 to 66 L_{90} dBA. **Figure J-3** also displays a time history plot of the long-term measurement data collected at LT-1 monitoring location showing both L_{eq} and L_{90} sound metrics logged over the 3-day period. The time history data supports the tabulated results in **Table J-6** in that ambient sound levels (both L_{90} and L_{eq} metrics) essentially remain above 50 dBA.

[1] The Applicant considers the whole SBMT parcel (Brooklyn, Block 662, Lot 1) to be the Zoning Lot under the New York Zoning Resolution (see **Exhibit 7**). However, for the purposes of assessing sound levels at the lot line, the onshore substation boundary was used conservatively rather than the SBMT property boundary.

Figure J-2 Ambient Sound Monitoring Locations and Receptor Locations

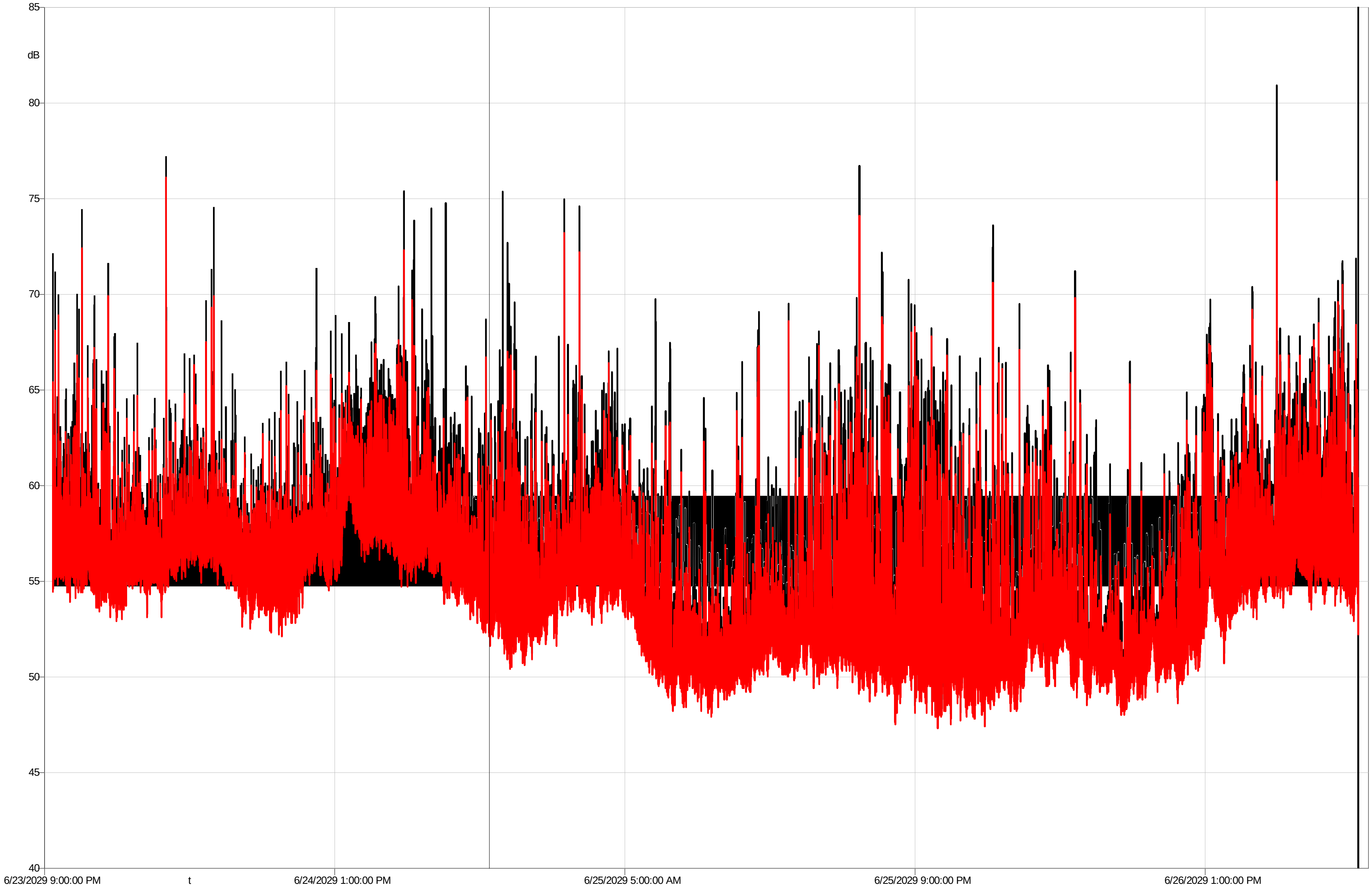

Figure J-3 LT-1 – Ambient Sound Level Time History Plot

Table J-6 Short-term Ambient Sound Measurement Results for SBMT

Site	Monitoring Location	Location	Time Period	Sound Level Metrics (dBA)			
				L_{10}	L_{50}	L_{90}	L_{eq}
EW 1 Onshore Substation and Landfall	NM-1	630 2nd Avenue	Day	72	67	66	69
			Night	58	55	53	63
EW 1 Onshore Substation and Landfall	NM-2	100 39th Street	Day	67	56	46	65
			Night	69	66	65	67

J.4 Acoustic Modeling Methodology

The acoustical modeling for the Project was conducted with the Cadna-A® sound model from DataKustik GmbH (Version 2019 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 Project Area. The sound model propagation calculation parameters are summarized in **Table J-7**.

Table J-7 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.

J.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 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.

J.5.1 Construction Acoustic Assessment

Two types of pile driving may be required during Project construction, impact and vibratory pile driving. Impact pile or vibratory pile driving may be required to install the piles and sheet piles to support landfall of the submarine export cables. Onshore substation and onshore cable installation construction generally consists of site clearing and grading, excavation, piling, foundation work, building erection, and finishing work.

J.5.1.1 Construction of Onshore Project Components

The construction of the onshore substation and the onshore cables 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. The onshore substation construction generally consists of four phases. Phase 1 will consist of equipment mobilization, site clearing and demolition work to prepare the site for the following phase (2) where the earth work is performed and ground is compacted. Phase 3 consists of building foundation and structure construction and finally phase 4 involves electrical equipment installation, testing and installation. Installation of the onshore cables involves site preparation, duct bank installation, restoration, cable installation, cable jointing/termination, and final testing to ensure proper cable transmission has been established.

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 Federal Highway Administration has published data on the average sound levels (L_{eq}) for typical construction equipment. **Table J-8** presents the anticipated construction equipment type, number of construction equipment, maximum sound emission level at 50 feet, and maximum vibration level at 25 feet.

Table J-8 Substation Construction Summary

Construction Phase	Equipment Type	Quantity	Maximum Sound Level at 50 feet (L_{max})	Maximum Vibration Level at 25 feet (inches per second)
Phase 1: Mobilization, Site Clearing and Demolition Work	Tractor	1	84	0.076
	Excavator	2	85	0.089
	Loader	1	80	0.035
	Backhoe	1	80	0.035
	Dozer	1	85	0.089
	Drill Rig	1	84	0.076
	Concrete/Industrial Saw	1	90	0.21
	Tractor	1	84	0.076
	Excavator	2	85	0.089

Construction Phase	Equipment Type	Quantity	Maximum Sound Level at 50 feet (L_{max})	Maximum Vibration Level at 25 feet (inches per second)
Phase 2: Compaction and Earth Work	Loader	1	80	0.035
	Backhoe	1	80	0.035
	Dozer	1	85	0.089
	Compactor	1	80	0.035
	Roller	1	85	0.21
	Dump Truck	1	84	0.076
Phase 3: Building Foundation and Structure Construction	Tractor	1	84	0.076
	Excavator	2	85	0.089
	Loader	1	80	0.035
	Backhoe	1	80	0.035
	Roller	1	85	0.21
	Paver	1	85	0.089
	Cement Mixer	4	85	0.089
	Mobile Crane	1	85	0.089
	Forklift	2	82	0.076
	Generator	2	82	0.076
	Welder	2	73	0.003
Phase 4: Electrical Equipment Installation, Testing and Commissioning	Tractor	1	84	0.076
	Loader	1	80	0.035
	Backhoe	1	80	0.035
	Mobile Crane	1	85	0.089
	Forklift	2	82	0.076
	Generator	2	82	0.076
	Welder	2	73	0.003
	Air Compressor	2	80	0.035

Noise produced by construction activities was evaluated employing CadnaA. **Table J-9** presents the results received sound levels generated by construction phase. Results show that construction noise levels of 85 dBA and greater remain in close proximity to the substation property. **Figure J-4**, **Figure J-5**, **Figure J-6**, and **Figure J-7** also show the sound contour plots for each construction phase. Sound contour plots display broadband (dBA) sound levels presented as color-coded isopleths and are graphical representations of the cumulative noise associated with full operation of the construction equipment associated with each phase and show how noise would be distributed over the surrounding area and at receptors including residential receptors (TT 14, TT 15, TT 16, TT 17, and the Industry City apartments) and property line locations (EQ-1, EQ-2, EQ-3, EQ-5).

Table J-9 Onshore Substation: Construction Noise Levels at the Closest Noise Sensitive Areas

Construction Phase	Received Sound Level (dBA)													
	TT 14	TT 15	TT 16	TT 17	EQ-1 a/	EQ-2 a/	EQ-3 a/	EQ-4	EQ-5 a/	EQ-6 a/	EQ-7	EQ-8	EQ-9	Industry City
Phase 1: Mobilization, Site Clearing and Demolition Work	76	71	75	67	86	88	86	79	80	81	78	73	70	75
Phase 2: Compaction and Earth Work	74	68	72	63	84	86	84	77	77	79	75	70	66	72
Phase 3: Building Foundation and Structure Construction	77	71	75	66	87	89	87	80	80	82	78	73	69	75
Phase 4: Electrical Equipment Installation, Testing and Commissioning	74	68	72	63	84	86	84	77	77	79	75	70	66	72

Note:
a/ Substation boundary location

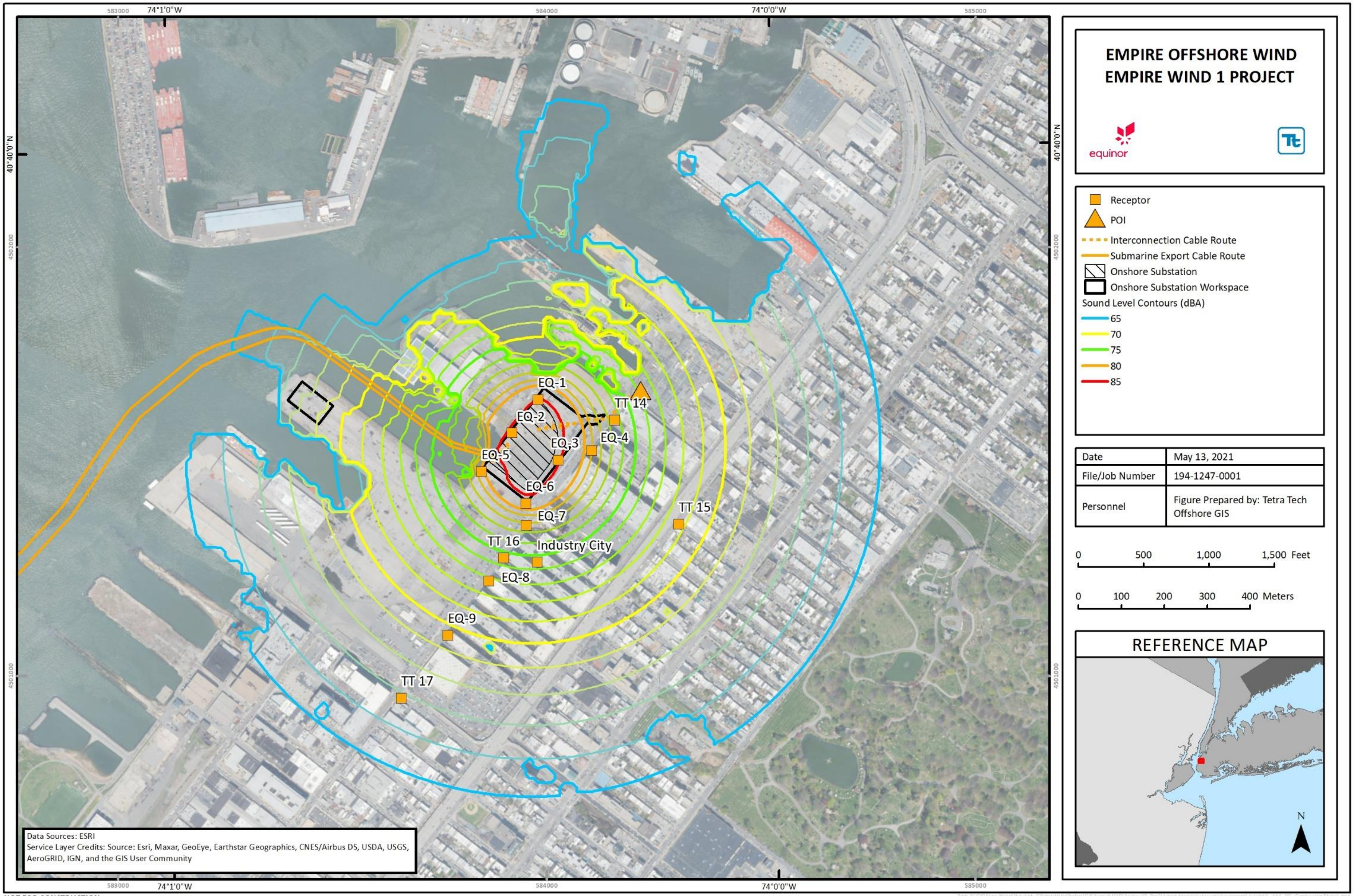

Figure J-4 Received Sound Levels, Construction Phase 1 (Mobilization, Site Clearing and Demolition Work)

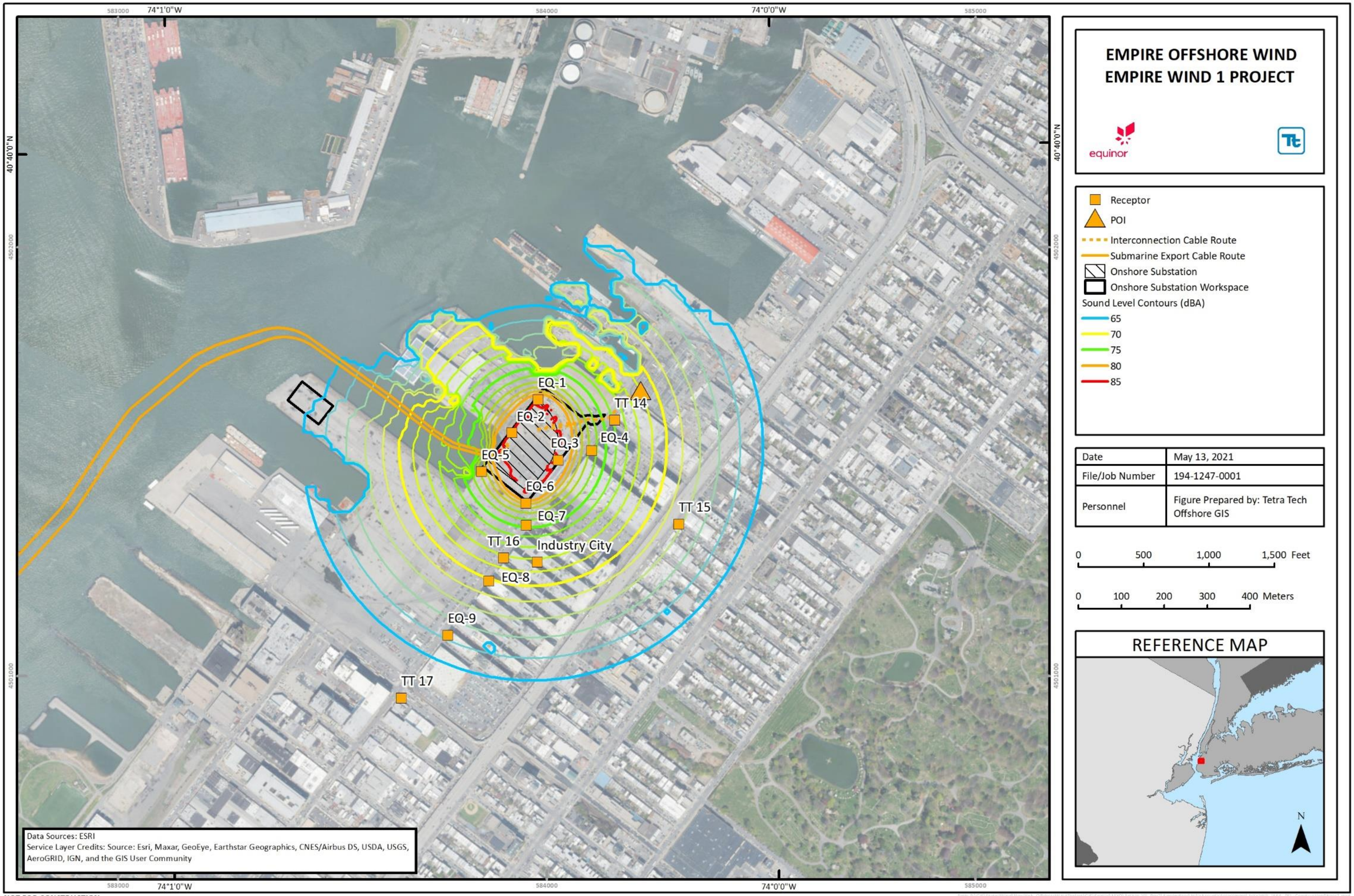

Figure J-5 Received Sound Levels, Construction Phase 2 (Compaction and Earth Work)

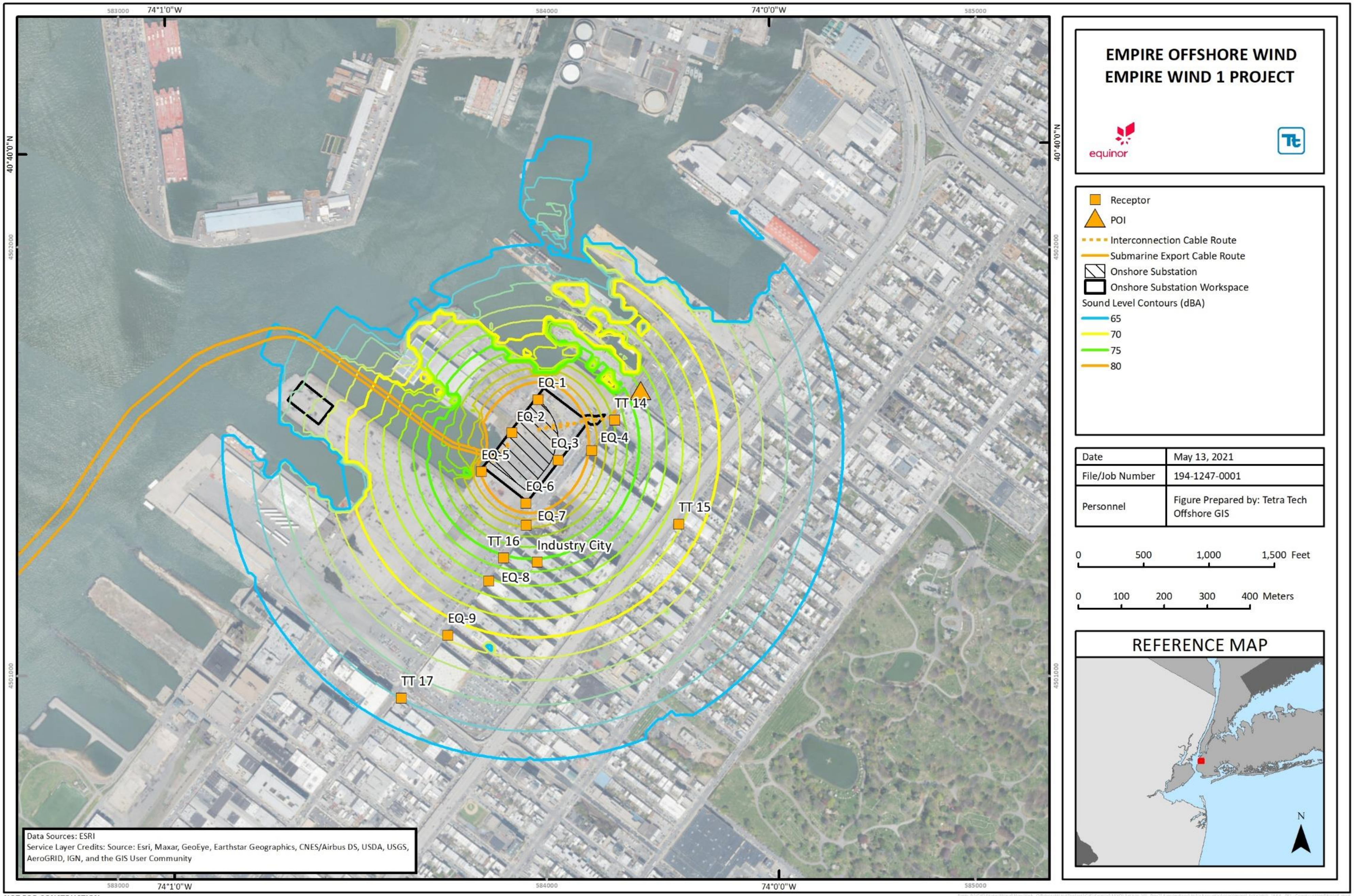

Figure J-6 Received Sound Levels, Construction Phase 3 (Building Foundation and Structure Construction)

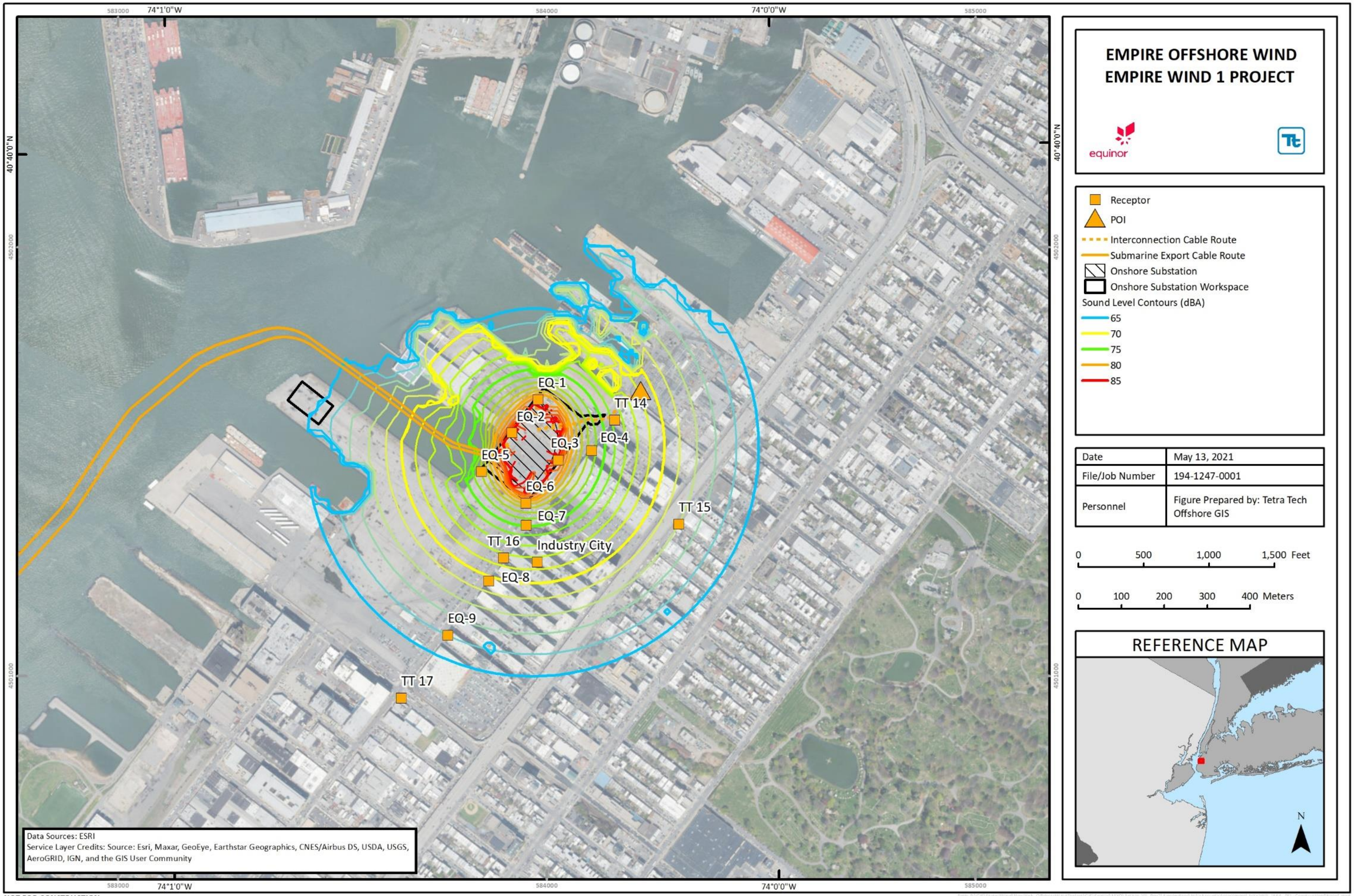

Figure J-7 Received Sound Levels, Construction Phase 4 (Electrical Equipment Installation, Testing and Commissioning)

In addition to the equipment listed in **Table J-8,** pile driving will also be required to install the pipe piles or H-piles, install the equipment and building foundations, and install the cofferdam at the bulkhead. For the purposes of the acoustic modeling analysis, and to capture potential worst case noise impacts, it was assumed that pile driving would be accomplished using an impact hammer. In the event that a vibratory hammer is used, resulting noise levels would be less than those associated with impact hammering. 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. The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. 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). In order to determine reasonable airborne sound pressure levels. **Table J-10** summarizes some pile driving activities that have taken place for other similar developments in recent years.

Table J-10 Example Impact Pile Driving Activities - Airborne Sound Pressure Levels

Project and Location	Pile Size and Type	Pile Type	Water Depth (ft)	Hammer Type	L_{eq} (dBA) at 50 ft (15 m)	L_{max} (dBA) at 50 ft (15 m)
EHW-2 First Year, Bangor, WA	24 inch		N/A			109
EHW-2 First Year, Bangor, WA	36 inch		N/A			108
Test Pile Program (TPP), Bangor, WA	36 inch		N/A			107
TPP, Bangor, WA	48 inch		N/A			105
Transit Protection Program Pier and Support Facilities Naval Base Kitsap, Bangor, WA	24 inch	Steel				110
Transit Protection Program Pier and Support Facilities Naval Base Kitsap, Bangor, WA	36 inch	Steel				112
Coupeville Ferry Terminal, Coupeville, WA	30 inch	Steel	30	APE	97	95
Coleman Ferry Terminal, Seattle, WA	36 inch	Steel	18	-	97	116
Mukilteo Ferry Terminal, Mukilteo, WA	36 inch	Steel	-	-	-	113
SR 520 Portage Bay, King County, WA	24 inch	Steel	23	-	78	106
Vashon Ferry Terminal, Seattle, WA	24 inch	Steel	12	-	96	108
Vashon Ferry Terminal, Seattle, WA	30 inch	Steel	22	-	94	110
Coleman Ferry Terminal, Seattle, WA	36 (hollow)	Concrete	18	-	95	115
Mukilteo Ferry Terminal, Mukilteo, WA	18 (octagonal)	Concrete	15	-	89	108
Mukilteo Ferry Terminal, Mukilteo, WA	36 (hollow)	Concrete	25	DelMag D62	-	111

The impact hammer and piles that will be used for installation are unknown at this time. Assuming the installation of steel piles with a diameter between 24 and 36 inches, an average sound pressure level would correspond to 108 dBA at 50 feet (15 m), which is proposed as a modeling input for the SBMT construction acoustic analysis. Empire has not finalized the locations where pile driving is anticipated during substation construction, although it is understood that pile driving will be required at the bulkhead. In addition, for the purposes of the construction noise assessment, Tetra Tech assumed that pile driving would be required to support the foundations of the Control Building, static VAR compensator (SVC) Building or static synchronous compensator, and Gas-Insulated Switchgear (GIS) Building, as well as the main transformer. Please refer to **Figure J-8**, which presents the onshore substation site and representative candidate pile driving locations, which are symbolized using red triangles.

The resulting sound levels from pile driving at the seven locations indicated in **Figure J-8** are provided in **Table J-11**.

Pile driving activities will occur during daytime hours, but the results show that there may be exceedances of the of section 24-228 of the NYC Code, which allows for an increase of 15 dBA above the ambient sound level. The Applicant is requesting that the Commission not apply this local law, because it is unreasonably restrictive in view of existing technology to the extent that construction and operation activities may result in transient and temporary occurrences of these conditions (see **Exhibit 7: Local Ordinances**). 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/cushions, and/or nose shrouds installed in proximity to pile driving.

In accordance with the NYC Code, vibration generated during construction was also reviewed. Vibration levels for activities associated with Project construction were based average of source levels in peak particle velocity (PPV) published with the Federal Transit Administration (FTA 2006) Noise and Vibration Manual, which documents several types of construction equipment measured under a wide variety of construction activities. Using the documented vibration levels as inputs into a basic propagation model, construction vibration levels were calculated at the closest NSAs (**Table J-12**).

Table J-11 Onshore Substation: Pile Driving Noise Levels at the Closest Receptors

Construction Phase	Received Sound Level (dBA)													
	NSA-14	NSA-15	NSA-16	NSA-17	EQ-1 a/	EQ-2 a/	EQ-3 a/	EQ-4	EQ-5 a/	EQ-6 a/	EQ-7	EQ-8	EQ-9	Industry City
Daytime Ambient Sound Level, L_{90} (dBA)	**66**	**66**	**66**	**46**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**66**	**66**
Pile Driving Location 1	92	84	86	78	100	96	96	94	90	90	88	84	81	86
Pile Driving Location 2	91	85	88	79	93	95	106	95	92	94	91	86	82	88
Pile Driving Location 3	89	85	89	80	92	96	99	92	94	96	93	87	83	89
Pile Driving Location 4	89	84	87	79	95	104	96	92	94	93	90	86	82	87
Pile Driving Location 5	90	84	87	79	97	102	96	92	92	92	89	85	82	87
Pile Driving Location 6	88	78	87	79	94	107	93	85	96	92	90	86	82	87
Pile Driving Location 7	86	82	90	81	90	94	91	88	120	93	92	88	84	88

Note:
a/ Substation boundary location

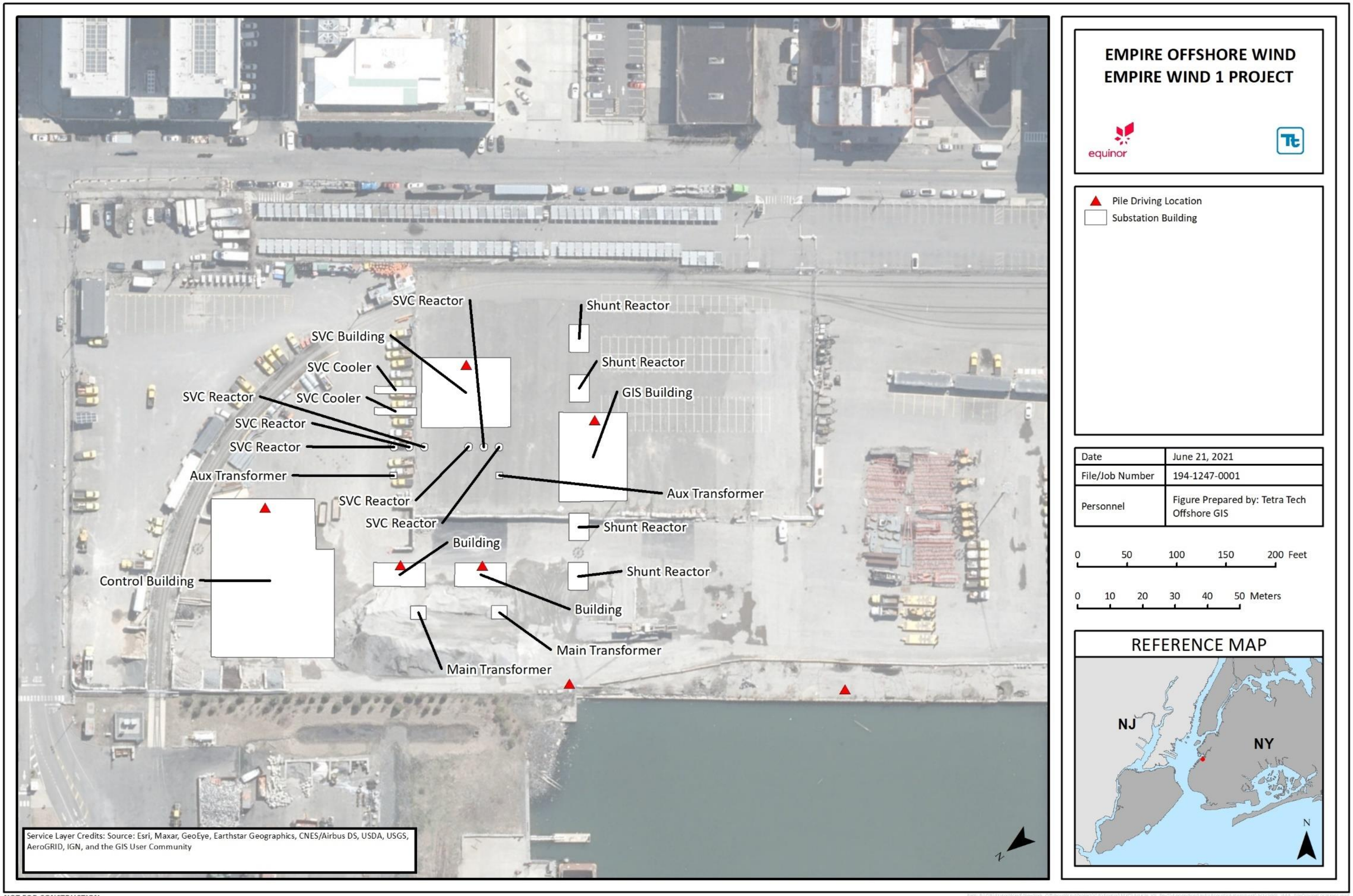

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Figure J-8 EW 1 Substation Pile Driving Locations

Table J-12 Onshore Substation: Vibration Levels at the Closest Receptors

Construction Phase	Equipment Type	Quantity	PPV at 25 feet (in/sec)	NSA 14 at 300 feet (in/sec)	NSA 15 at 1,050 feet	NSA 16 at 450 feet (in/sec)	NSA 17 at 1,780 feet (in/sec)	EQ-1 at 25 feet (in/sec)	EQ-2 at 25 feet (in/sec)	EQ-3 at 25 feet (in/sec)	EQ-4 at 150 feet (in/sec)	EQ-5 at 25 feet (in/sec)	EQ-6 at 25 feet (in/sec)	EQ-7 at 150 feet (in/sec)	EQ-8 at 650 feet (in/sec)	EQ-9 at 1,150 feet (in/sec)	Industry City at 150 feet (in/sec)
Phase 1: Mobilization, Site Clearing and Demolition Work	Tractor	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Excavator	2	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Loader	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Backhoe	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Dozer	1	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Drill Rig	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Concrete/Industrial Saw	1	0.21	0.0051	0.0008	0.0027	0.0003	0.2100	0.2100	0.2100	0.0143	0.2100	0.2100	0.0143	0.0016	0.0007	0.0143
Phase 2: Compaction and Earth Work	Tractor	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Excavator	2	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Loader	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Backhoe	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Dozer	1	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Compactor	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Roller	1	0.21	0.0051	0.0008	0.0027	0.0003	0.2100	0.2100	0.2100	0.0143	0.2100	0.2100	0.0143	0.0016	0.0007	0.0143
	Dump Truck	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
Phase 3: Building Foundation and Structure Construction	Tractor	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Excavator	2	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Loader	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Backhoe	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Roller	1	0.21	0.0051	0.0008	0.0027	0.0003	0.2100	0.2100	0.2100	0.0143	0.2100	0.2100	0.0143	0.0016	0.0007	0.0143
	Paver	1	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Cement Mixer	4	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Mobile Crane	1	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Forklift	2	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Generator	2	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Welder	2	0.003	0.0001	0.0000	0.0000	0.0000	0.0030	0.0030	0.0030	0.0002	0.0030	0.0030	0.0002	0.0000	0.0000	0.0002
Phase 4: Electrical Equipment Installation, Testing and Commissioning	Tractor	1	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Loader	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Backhoe	1	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024
	Mobile Crane	1	0.089	0.0021	0.0003	0.0012	0.0001	0.0890	0.0890	0.0890	0.0061	0.0890	0.0890	0.0061	0.0007	0.0003	0.0061
	Forklift	2	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Generator	2	0.076	0.0018	0.0003	0.0010	0.0001	0.0760	0.0760	0.0760	0.0052	0.0760	0.0760	0.0052	0.0006	0.0002	0.0052
	Welder	2	0.003	0.0001	0.0000	0.0000	0.0000	0.0030	0.0030	0.0030	0.0002	0.0030	0.0030	0.0002	0.0000	0.0000	0.0002
	Air Compressor	2	0.035	0.0008	0.0001	0.0005	0.0001	0.0350	0.0350	0.0350	0.0024	0.0350	0.0350	0.0024	0.0003	0.0001	0.0024

Pile driving activities will likely generate vibration levels ranging from 0.0025 inches/second to 0.1033 inches/second at the closest NSAs. Since equipment vibratory specifications by frequency are not available, it is not possible to provide a direct comparison between the anticipated construction vibration levels and the NYC Code. However, since construction vibration levels at the nearest NSAs show an overall PPV that is higher than the NYC Code frequency limits, it is reasonable to assume that the Project will generate vibration levels in excess of the limits for a temporary and short-term window during construction activities.

Other construction activities that will generate noise include jet (or mechanical) plowing and dredging. Jet (or mechanical) plowing will likely be needed to assist in burying the submarine export cable to the desired depth below the seabed. The jet plow embedment process produces minimal airborne sound beyond that generated by typical vessel traffic, and therefore would result in minimal increases to ambient sound levels at NSAs.

Dredging will be required for cable installation along the submarine export cable corridor approaching the landfall at EW 1. Depths below the existing bathymetry are expected to be required because of the need for deeper cable burial within Bay Ridge Channel, and cable installation vessel draft requirements. Sound production due to dredging is largely influenced by sediment properties. To excavate hard, cohesive and consolidated soils, the dredger must apply greater force to dislodge the material (Robinson et al. 2011). Sounds from dredges can be variable, depending on the phase of operation, and the type of dredge used, but typically occur at low frequencies (<500 Hz) (Reine et al. 2014). The noise will vary as the activities move nearer or farther from the NSAs, but even at the closest approach using the noisiest (cutterhead) dredge option, sound levels would be expected to attenuate to approximately 50 dBA at the closest NSAs.

The Applicant proposes to implement the following measures to avoid, minimize, and mitigate impacts:

- 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 backup alarms will be used for vehicles as feasible;
- Noisy construction equipment will be located as far as possible from NSAs; and
- A noise complaint hotline will be made available to help actively address all noise-related issues.

J.5.1.2 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 laterally 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.

J.5.2 Operational Acoustic Assessment

The noise-generating operational component of the Project consists of the onshore substation. No operational sound is expected from the submarine export and onshore interconnection cables. The EW 1 site was assessed for operational noise; **Figure J-9** describes the indicative onshore Project features at the onshore substation site. The EW 1 onshore substation site is located in Brooklyn, New York. The onshore substation site will be located on 2nd Avenue and bounded to the north by Gowanus Bay and industrial use, to the east and south by industrial and residential use, and to the west by Gowanus Bay. 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.

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 engineering design is only at a conceptual level, it is reasonable to expect that any transformer installed as part of the 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. Sound modeling of onshore substation components are provided for the maximum design scenario for operations (**Table J-13**).

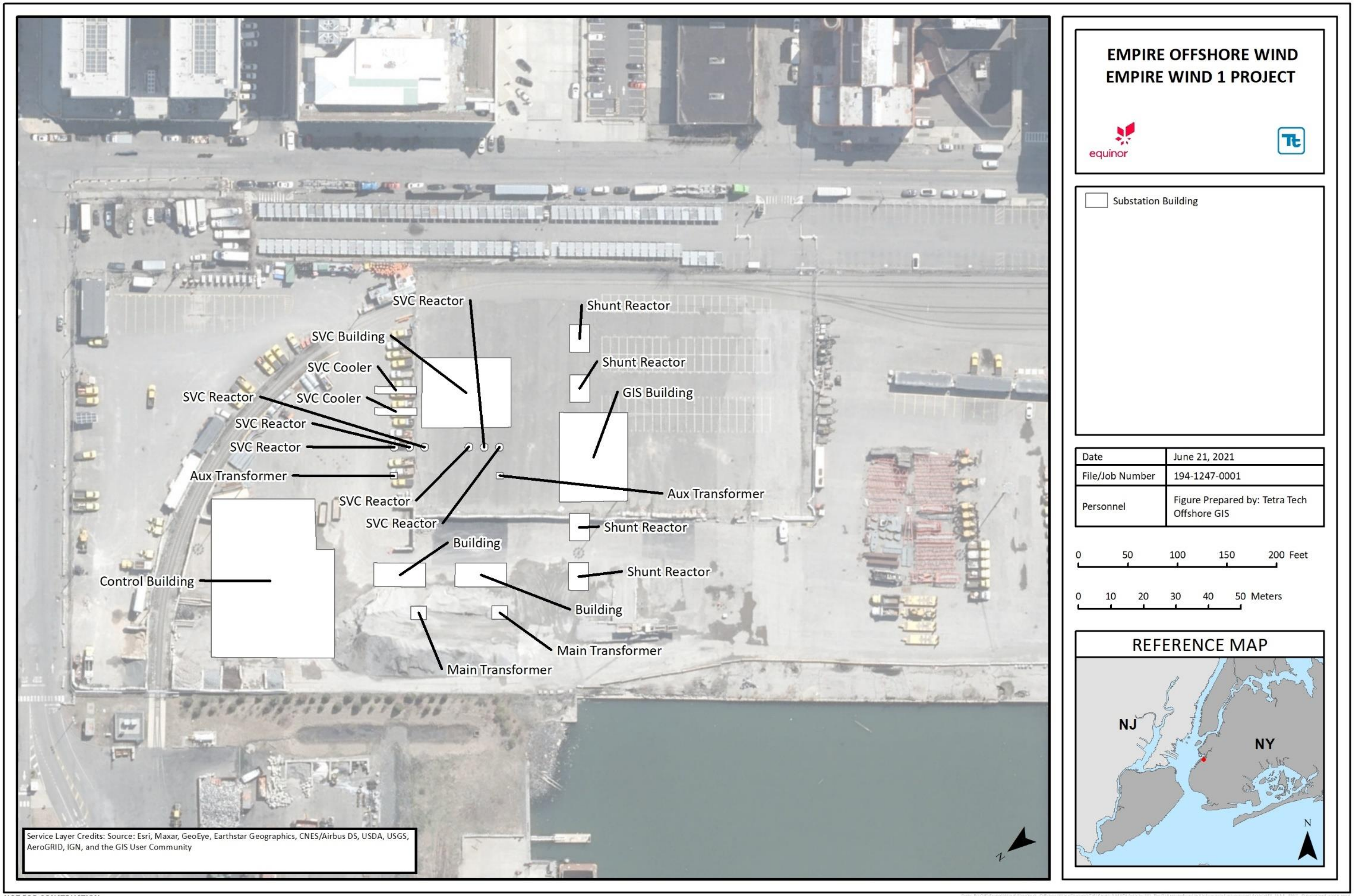

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Figure J-9 EW 1 Onshore Substation

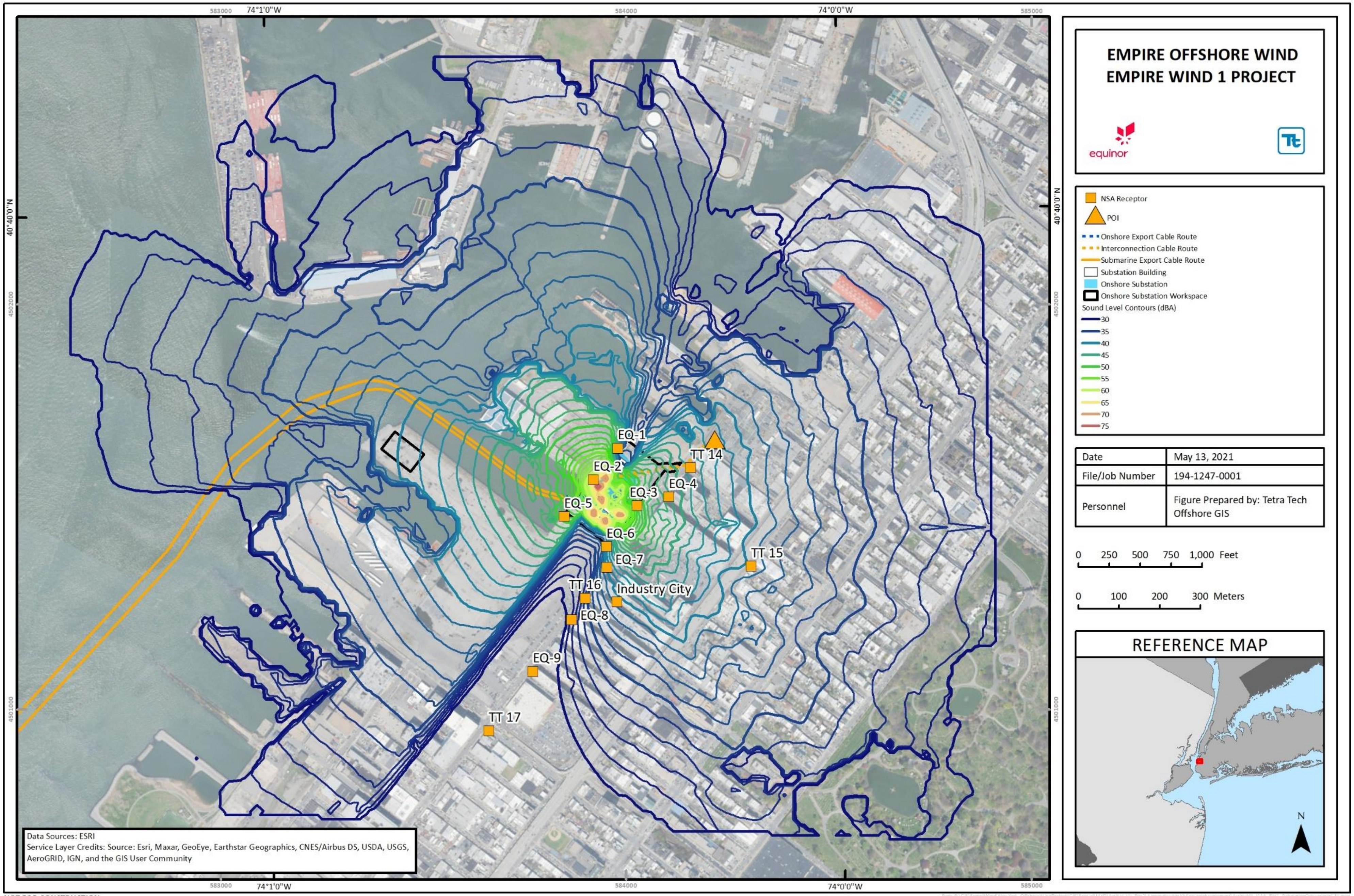
Table J-13 Sound Ratings of EW 1 Substation Components

Substation Component	Number	Sound Power Level
450 MVA Main Transformers (Outdoor)	2	98 dBA
150 MVAr Shunt Reactors (Outdoor)	2	95 dBA
80 MVAr filter Shunt Reactors (Outdoor)	2	95 dBA
80 MVAr Filter Capacitors (Indoor)	2	56 dBA
SVC Converter (Indoor) a/	1	66 dBA
SVC Reactors (Outdoor) a/	6	85 dBA
SVC Coolers (Outdoor) a/	2	75 dBA
Aux Transformers (Outdoor)	2	68 dBA
Exhaust Fans (Outdoor)	6	64 dBA
Air Handling Units (Outdoor)	6	74 dBA

Note:
a/ SVC equipment is expected to have comparable sound emissions to static synchronous compensator; therefore, modeling results are expected to be similar for both types of equipment.

Received sound levels were evaluated at the closest NSAs (TT 14, TT 15, TT 16, and TT 17) to each site with resultant sound contour plots displaying operational sound levels in **Figure J-10.** Compliance was assessed relative to both state and local noise requirements. Sound produced by substation operations conforms with the NYSDEC 6 dBA incremental increase guideline. 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 Project property boundary. Modeled results indicate that the Project does not fully comply with the NYSDPS recommended acoustic design goals at TT 14 and TT 15 as well as the property boundary; however, ambient sound levels are consistently and sufficiently higher than those design goals given the urban setting of the SBMT site. Therefore, an incremental increase criterion, similar to those given by the NYSDEC and New York City Noise Control Code, may be more appropriate measures for assessing potential noise impacts at NSAs given the elevated ambient acoustic environment within the Project Study Area.

As shown in **Table J-14**, and **Table J-15**, compliance is demonstrated with the applicable noise policy for the all sites. The New York City Noise Control Code, which applies to the onshore substation site, includes an incremental increase limit of 7 dBA at a receiving property relative to ambient nighttime sound levels. **Table J-14** demonstrates that the EW 1 site will successfully demonstrate compliance with the 7-dBA incremental increase limit. **Table J-15** shows that the onshore substation will be in compliance with New York City octave band noise limits for the M3 district and at residential receivers. Locations EQ-1, EQ-2, EQ-3, EQ-5, and EQ-6 are receptors at the onshore substation boundary and are shown to be in compliance with the M3 district limits.



NOT FOR CONSTRUCTION

Figure J-10 Onshore Substation Operational Sound Levels

Table J-14 Predicted Night-time L_{90} Sound Levels (dBA) at the Closest Noise Sensitive Areas

Location	Distance (ft)	Nighttime Ambient Sound Level, L_{90}	Ambient Location from Table J-6	Modeling Results	Modeling Results Plus Existing Ambient	Increase Above Existing Ambient
TT 14	278	53	NM-1	44	53	0
TT 15	1,035	53	NM-1	40	53	0
TT 16	435	53	NM-1	34	53	0
TT 17	1,775	65	NM-2	25	65	0
EQ-1 a/	0	53	NM-1	41	53	0
EQ-2 a/	0	53	NM-1	64	64	11
EQ-3 a/	0	53	NM-1	52	56	3
EQ-4	137	53	NM-1	46	54	1
EQ-5 a/	0	53	NM-1	51	55	2
EQ-6 a/	0	53	NM-1	40	53	0
EQ-7	162	53	NM-1	40	53	0
EQ-8	628	53	NM-1	31	53	0
EQ-9	1,160	53	NM-1	27	53	0
Industry City	448	53	NM-1	39	53	0

Note:
a/ Substation boundary location

Table J-15 Tonal L_{90} Sound Levels (dB) at the Closest Noise Sensitive Areas

Maximum Permitted Sound Pressure Level (in dB)			Octave Band Sound Pressure Level (dB)													
Octave Band (Hz)	District M3	Limits for Residential Property Receiver	TT 14	TT 15	TT 16	TT 17	EQ-1 a/	EQ-2 a/	EQ-3 a/	EQ-4	EQ-5 a/	EQ-6 a/	EQ-7	EQ-8	EQ-9	Industry City
63	80	70	49	45	41	35	51	67	56	51	54	47	46	40	37	44
125	75	61	50	46	41	35	50	69	58	52	56	46	46	39	36	45
250	70	53	45	41	35	27	43	64	52	47	51	40	41	32	28	40
500	64	46	44	40	34	24	40	64	52	46	50	39	40	31	26	39
1,000	58	40	37	33	27	15	31	58	46	39	44	33	34	24	18	33
2,000	53	36	30	25	20	5	24	53	40	34	38	27	28	17	9	26
4,000	49	34	21	12	10	0	15	47	34	26	31	19	19	5	0	16
8,000	46	33	0	0	0	0	2	38	23	8	14	5	1	0	0	0
		Average (dBA)	44	40	34	25	41	64	52	46	51	40	40	31	27	39

Note:
a/ Substation boundary location

J.6 Conclusions

In-air acoustic modeling was conducted for the Project to assess the potential noise impacts associated with construction and operational activities, including vessel activities associated with submarine export cable installation and the construction and operation of the onshore 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.

Substation construction and operation were modeled using CadnaA and site-specific inputs Noise levels from the four phases of substation construction were tabulated at the closest NSAs and presented visually in the form of sound contour plots. 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 resultant sound contour plots are independent of the existing acoustic environment (i.e., the plots and tabulated results represent Project-generated sound levels only). Pile driving is required onsite at the bulkhead, as well as to support the foundations of the Control Building, SVC Building, GIS Building, and the main transformer. Noise and vibration levels expected from pile driving at those locations was also reviewed.

Sound from substation operation was modeled and assessed relative to the 7 dBA incremental increase criterion prescribed by the New York City Administrative Code and the octave band sound limits prescribed by both the City's Zoning Resolution and the Code. Results of that analysis were also tabulated and presented as sound contours and successfully demonstrated the ability of the Project to comply with the applicable New York City regulations. Noise guidelines and recommendations provided at the state-level were also considered in the assessment of potential noise impacts associated with substation operation at nearby NSAs.

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