Appendix P Supplemental Air Quality and Climate Change Analysis

Environmental Analysis of the South Brooklyn Marine Terminal Port Infrastructure Improvement Project

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South Brooklyn Marine Terminal Port Infrastructure Improvement Project

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1. Introduction

The purpose of the Proposed Project is to upgrade the South Brooklyn Marine Terminal (SBMT) to enable it to serve as a staging facility and operations & maintenance (O&M) base for the offshore wind (OSW) industry. The Proposed Project is needed to support the development of OSW power generation capacity to fulfil the State's mandate of 9,000 megawatts (MW) of OSW energy capacity by 2035, the United States' goal of 30 gigawatts (GW) of OSW capacity by 2030, and the City's *Offshore Wind NYC* plan. In the near term, the Proposed Project would be used to support the construction and staging of the Empire Wind Projects, which will bring offshore wind power capacity to the region, and the Proposed Project is expected to support other developers and OSW projects in the future. The Proposed Project also will support the O&M of the Empire Wind Projects.

The construction of the Proposed Project is anticipated to commence in November 2023 and is estimated to take approximately 32 months with completion expected at the end of June 2026. In 2026 through 2027, the Proposed Project will be used for staging operations to support the offshore construction of the Empire Wind Projects. It is assumed for purposes of this analysis that the use of the Proposed Project for other offshore wind projects will continue thereafter for the remainder of the port facility's anticipated useful life, estimated to be approximately 30 years. Beginning in 2028, SBMT also will support the O&M of the Empire Wind Projects during the Empire Wind Projects' lifetimes.

The following supplemental air quality analysis was performed according to New York State's Supplemental Scoping Comments for South Brooklyn Marine Terminal for the Environmental Impact Statement for Empire Offshore Wind, LLC's Proposed Wind Energy Facilities Offshore New York (February 16, 2022) and entails:

- Estimate foreseeable air pollutant emissions including criteria pollutants, hazardous air pollutants (HAPs), and greenhouse gases (GHG) during all phases of the Proposed Project, direct and indirect, including project-related upstream emissions, that can be reasonably estimated.
- Perform Clean Air Act General Conformity Rule analysis for the Federal approval action from United States Army Corps of Engineers (USACE).
- Assess the Proposed Project's consistency with the State Climate Leadership and Community Protection Act (CLCPA).
- Evaluate how future physical climate risks were considered for the Proposed Project.

2. Air Pollutant Emissions Estimate

Pollutant sources that could affect air quality include mobile and stationary sources associated with construction and operation activities. Mobile sources are related to vehicular traffic or other moving sources, such as trucks and vessels. Stationary sources are fixed in a location and can include exhaust stacks used for the heating, hot water, ventilation, and air conditioning (HVAC) systems of a building. The emissions from both mobile and stationary sources related to the Proposed Project are considered in this supplemental analysis.

2.1 Pollutants of Concern

2.1.1 Criteria Pollutants

The National Ambient Air Quality Standards (NAAQS) are the basis to measure the effects of mobile and stationary pollutant sources in ambient air to protect public health and welfare from the adverse impacts associated with ambient air pollutants, as required under the Clean Air Act (CAA). The US Environmental Protection Agency (USEPA) has established NAAQS for six contaminants, referred to as criteria pollutants, and they are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (including with diameters up to 10 µm [PM_{10}] and up to 2.5 µm [$PM_{2.5}$]), lead (Pb), and sulfur dioxide (SO_2). The criteria pollutants of primary concern related to the Proposed Project are vehicle and/or construction equipment-related CO, PM_{10} and $PM_{2.5}$, and O_3 precursors (nitrogen oxides (NO_x) and volatile organic compounds (VOCs)).

The CAA requires geographic areas to be designated according to their ability to attain the NAAQS, and these areas are categorized for each criteria pollutant as:

- *Attainment Area* – Areas where no exceedance of NAAQS for a specific criteria pollutant occurred.
- *Nonattainment Area* – Areas where exceedance of NAAQS for a specific criteria pollutant occurred.
- *Maintenance Area* – Areas that have previously been designated as a nonattainment area but are still in need of efforts to maintain the improved conditions in the future. Most of the CAA rules for nonattainment areas are still applicable to a maintenance area.

If an area is designated as nonattainment for a criteria pollutant under the NAAQS, state governments must develop a specific State Implementation Plan (SIP) and implement control plans to reduce the emission level of that pollutant.

2.1.2 Hazardous Air Pollutants (HAPs)

In addition to the criteria pollutants, the CAA also lists 187 air toxins, known as HAPs. The CAA authorizes the USEPA to characterize and control emissions of these pollutants. However, unlike the criteria pollutants, the majority of HAPs do not have ambient air quality standards. Of the 187 HAPs with potential to be emitted from both stationary and mobile sources, 93 have been identified as Mobile Source Air Toxics (MSATs) and the following nine MSATs are priority MSATs:

- Acetaldehyde
- Acrolein
- Benzene
- 1,3-butadiene
- Diesel particulate matter plus diesel exhaust organic gases (diesel PM)
- Ethylbenzene
- Formaldehyde
- Naphthalene
- Polycyclic organic matter

2.1.3 Greenhouse Gas Emissions

GHG emissions trap heat in the atmosphere and contribute to global warming. Under Section 202(a) of the CAA, the USEPA has recognized the potential risks to public health and welfare and signed an endangerment finding regarding GHG emissions. The USEPA's finding states that six key current and projected concentrations of well-mixed GHG emissions in the atmosphere threaten the public health and welfare of current and future generations. These GHG pollutants include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Each GHG is assigned a global warming potential (GWP). The global warming potential is the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of one. The equivalent CO_2 (CO_2e) rate is calculated by multiplying the emissions of each GHG by its GWP and adding the results together to produce a single, combined emissions rate representing all GHGs.

2.2 Emissions Sources

2.2.1 Off-site (Indirect) Sources

On-road traffic includes construction and operations worker commuting trips and truck deliveries. According to the off-site on-road traffic analysis results in Section 3.14 (Transportation) and Section 3.20 (Construction) of the SBMT Environmental Analysis, the estimated daily vehicle trips under the Future with Project condition under the construction and operational phases of the Proposed Project were used in association with the below assumptions:

- Each commuter vehicle trip would have a round trip over an average of 20 miles with an even split between expressways and local roadways.
- Each truck trip would have a round trip mostly traveling along the expressways from various potential destinations in New York City, Long Island, New Jersey, upper New York State, Connecticut, and Pennsylvania within a 100-mile radius around SBMT.

Air emissions would be generated by the operation of vessels in transit to and from the Proposed Project during the construction of the Proposed Project as well as during the Proposed Project's operations. The vessels associated with transit for OSW construction have been accounted for in the Empire Wind Projects' COP (May 2022), so they are not considered in this analysis.

2.2.2 On-site (Direct) Sources

During construction, the following emissions sources were considered in the analysis:

- Trucks and non-road equipment engine exhaust (including marine vessels); and
- Surface fugitive dust resulting from the movement of trucks on-site.

During operations, the following emissions sources were considered in the analysis:

- Berthing vessels and tug and barge set engine exhaust during the offloading and loading operations of WTG components. The berthing hoteling operating mode covers vessels that are moored, berthed, or docked at SBMT. When hoteling, a vessel either uses its auxiliary engines and boilers, or it uses shore power, if available. For this emission estimate purpose, it was assumed that no shore power is available. Vessel propulsion engines are not used in this mode. Auxiliary engine usage in this operating mode was considered in the analysis.
- Non-road equipment and on-site truck engine exhaust during material handling and transport.

2.3 Emissions Estimate

The air pollutants estimated consist of criteria pollutants, HAPs, and GHGs. Emissions were estimated for both the construction and operational phases of the Proposed Project. For the construction phase, emissions were estimated from end of 2023 to June 2026. For the Proposed Project's operations, emissions were estimated for two phases of operations: Operational Phase 1, during 2026 and 2027 when the proposed Project will be used for the staging and construction of the Empire Wind Projects; and Operational Phase 2, during 2028 and beyond when the Proposed Project will be used for O&M of the Empire Wind Projects as well as for staging and construction of other OSW projects.

2.3.1 Methodology

2.3.1.1 Engine Emissions

There are three categories of engine sources for which emissions were estimated:

- Commercial marine vessels (CMVs), including tugs;
- Nonroad equipment; and
- On-road trucks and commuter vehicles.

These engine emissions were quantified for the following three elements of the Proposed Project:

- Proposed Project Construction: Detailed construction activity schedule between 2023 and 2026 (see Section 3.20 (Construction) of the SBMT Environmental Analysis);
- Proposed Project's Operational Phase 1: Operational plan in terms of specific equipment model type, size, and usage and truck and commuter vehicle trips to be generated during 2026 and 2027 when the Proposed Project is being used for the Empire Wind Projects' staging and construction (see Section 3.14 (Transportation) and Section 3.15 (Air Quality) of supplemental environmental analysis to the FEAF and the operational data used for onshore facilities under the Empire Wind Projects' COP Appendix K, (May 2022); and
- Proposed Project's Operational Phase 2: From 2028 and beyond during the O&M phase of the Empire Wind Projects (see the operational data used for onshore facilities under the EW 1 and EW 2 Projects COP (May 2022), as well as the Proposed Project's use for construction and staging for other OSW projects.

During the Proposed Project construction, emissions would be generated from equipment, including excavators, loaders, cranes, commercial marine vessels, generators, impact drivers, and dump and concrete trucks, needed for the following construction operations:

- Site clearing, demolition, and excavation;
- Site fill, grading, and foundation construction;
- Material transportation;
- Material such as soil transferring among various sites within the Project Area;
- Building and structure construction; and
- Dredging and bulkhead reinforcement and replacement.

The estimates for sizes, types, operating hours, and number of units of construction engines to be used during each construction phase were based on SBMT preliminary engineering design and historical data for other similar projects. The detailed equipment bidding inputs were then distributed based on the construction schedule for the Proposed Project.

During Proposed Project's Operational Phase 1, sizes and operational hours of specific equipment, including cranes, forklifts, manlifts, and self-propelled modular transporters, were based on the onshore facility equipment inputs identified from the Empire Wind Projects' staging and construction (see Section 3.14 (Transportation) and Section 3.15 (Air Quality) of supplemental environmental analysis to the FEAF and the Empire Wind Project's COP Appendix K, (Empire, May 2022).

During Proposed Project's Operational Phase 2 under EW Projects O&M, one crane and one forklift and their annual operating hours were identified to be used at SBMT per the Empire Wind Project's COP Appendix K, (May 2022). Since the HVAC system within the O&M base would likely run on electricity, no stationary emission sources would occur in this operational phase.

Emission factors for each concerned pollutant including criteria pollutants, HAPs, and GHGs from on-site equipment engines were developed using the USEPA's "Motor Vehicle Emission Simulator" emission model (Version MOVES2014b) associated with the Kings County, New York (where the Proposed Project is located) model input parameters provided by the New York State Department of Environmental Conservation (NYSDEC) for each pollutant. The same model was also used to estimate on-site and off-site truck and commuter vehicle engine emission rates for each pollutant, including HAPs and GHGs. Marine vessel emissions were based on commercial marine vessels, including tug emission factors provided in USEPA's "Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions (April 2022),"[1] To be conservative, since project-specific engine tiers for the marine vessels were not available at the time of the analysis, the emission factors assumed the use of Tier 2 engines.

The below USEPA-recommended formula was used to calculate hourly emissions from equipment engine sources including cranes, front end loaders, forklift, SPMT, and other machines:

$$M_i = N \times HP \times LF \times EF_i$$

where:

M_i = mass of emissions of i^{th} pollutants during inventory period;
N = source population (units);
HP = average rated horsepower;
LF = typical load factor; and
EF_i = average emissions of i^{th} pollutant per unit of use (e.g., grams per horsepower-hour) predicted by MOVES 2014b.

The annual emissions were calculated by multiplying the annual operational hours for each equipment on an annual basis with the estimated hourly emissions.

2.3.1.2 Fugitive Dust

During construction, fugitive dust emissions from construction truck travel on-site were calculated based on USEPA procedures provided in AP-42, Compilation of Air Pollutant Emissions Factors, Section 13.2.1. In order to minimize potential adverse air quality impacts from construction activities, measures would be implemented as practicable to reduce pollutant emissions in accordance with applicable regulations. These regulations ensure compliance with the New York City Air Pollution Control Code regulating construction-related dust emissions. Pursuant to New York City Local Law 77, all construction diesel-powered equipment rated at 50 horsepower or more, and used on behalf of a City agency, would use ultra-low sulfur diesel (ULSD) fuel and Best Available Technology (BAT) to reduce emissions to the extent practicable, such as requiring all combustion equipment to be equipped with Tier 4 engines to minimize potential effects of construction on air quality. Dust suppression measures also would be implemented, such as:

- trucks and tugs hauling loose material would have loads securely covered prior to leaving the Project Area to minimize airborne dust; and
- water spray would be used for demolition, excavation and transfer of soil and debris to avoid the suspension of dust into the air.

The planned control of fugitive emissions during construction would result in reduction of PM emissions by 50 percent or greater.

2.3.2 Estimated Emissions for All Proposed Project Phases

The estimated annualized pollutant emissions associated with engines and fugitive dust for each of three elements of the Proposed Project and the emission estimate methodologies described above are presented in **Table 2-1**.

[1] USEPA, 2022. Port Emissions Inventory Guidance: Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions. EPA-420-B-22-011. April 2022.

Table 2-1 Total Projected Annual Emissions*

Year/Activity	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
2024/Proposed Project Construction	***0.7***	***9.1***	***4.1***	***0.6***	***0.5***	***0.1***	***0.1***	***6712.1***
-On-Site Emissions	0.5	7.6	2.5	0.4	0.4	0.04	0.05	5256.5
-Off-Site Emissions from Vehicles	0.2	1.5	1.6	0.2	0.1	0.01	0.03	1455.6
2025/Proposed Project Construction	***0.5***	***7.1***	***3.1***	***0.4***	***0.4***	***0.0***	***0.1***	***4184.0***
-On-Site Emissions	0.4	6.1	1.9	0.3	0.3	0.02	0.04	3167.7
-Off-Site Emissions from Vehicles	0.1	1.0	1.2	0.1	0.1	0.01	0.02	1016.3
2026/Proposed Project Construction & Operational Phase 1	***1.3***	***14.9***	***6.5***	***0.8***	***0.6***	***0.0***	***0.2***	***5868.7***

Construction

Year/Activity	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
-On-Site Emissions	0.01	0.09	0.03	0.01	0.01	0.0	0.0	38.65
-Off-Site Emissions from Vehicles	0.01	0.13	0.19	0.02	0.01	0.0	0.0	129.4

Phase 1 Operation

Year/Activity	VOC	NOx	CO	PM_{10}	$PM_{2.5}$	SO_2	HAPs	CO_2e
-On-Site Emissions	0.8	6.4	1.9	0.3	0.3	0.0	0.2	2990.9
-On-Site Emissions from Vessels	0.4	6.9	1.8	0.2	0.2	0.0	0.0	715.2
-Off-Site Emissions from Vehicles	0.1	1.4	2.6	0.2	0.1	0.0	0.0	1994.5
2027/Proposed Project's Operational Phase 1	***1.3***	***14.7***	***6.3***	***0.8***	***0.6***	***0.0***	***0.2***	***5700.6***
-On-Site Emissions	0.8	6.4	1.9	0.3	0.3	0.0	0.2	2990.9
-On-Site Emissions from Vessels	0.4	6.9	1.8	0.2	0.2	0.0	0.0	715.2
-Off-Site Emissions from Vehicles	0.1	1.4	2.6	0.2	0.1	0.0	0.0	1994.5
2028 and on/Proposed Project's Operational Phase 2	***1.4***	***15.5***	***6.9***	***0.9***	***0.6***	***0.0***	***0.2***	***6380.7***
-On-Site Emissions	0.9	6.8	2.0	0.3	0.3	0.0	0.2	3174.7
- On-Site Emissions from Vessels	0.4	6.9	1.8	0.2	0.2	0.0	0.0	715.2
-Off-Site Emissions from Vehicles	0.1	1.8	3.1	0.3	0.1	0.0	0.0	2490.8
GCR De Minimis Level	***50***	***50***	***100***	***N/A***	***100***	***N/A***	***N/A***	***N/A***

Notes
* Pollutants are reported in tons

3. General Conformity Applicability Analysis

The USEPA published final rules on General Conformity (40 CFR Parts 51 and 93) in the Federal Register on November 30, 1993, and subsequently revised the rules on March 24, 2010. The rules apply to federal actions in nonattainment or maintenance areas for any of the applicable criteria pollutants. The rules specify *de minimis* emission levels by pollutant to determine the applicability of conformity requirements on a project level.

A conformity applicability analysis is the first step of a conformity evaluation and assesses if a federal action must be supported by a conformity determination. The General Conformity Rule (GCR) would apply to the Proposed Project due to the following:

- The Proposed Project has federal funding;
- Some elements of the Proposed Project, such as in-water dredging, marine improvement, etc., would require a permit from the USACE.
- The Proposed Project would take place in an area currently designated as a nonattainment area for O_3 and a maintenance area for CO and $PM_{2.5}$. The pollutants of concern per the GCR are CO, $PM_{2.5}$, and the O_3 precursors, NOx, and VOCs.

The GCR requires that potential emissions generated by the activity associated with a federal action be determined on an annual basis and compared to the annual *de minimis* levels for those pollutants (or their precursors) for which the area is designated as nonattainment or maintenance. If estimated annual emissions are below the respective *de minimis* thresholds, potential air quality impacts are deemed to be less than significant and a formal GCR determination is not required. Because Kings County (where SBMT is located) is within the New York City metropolitan area that has been classified as a serious nonattainment area for the 2008 8-hour O_3, a moderate nonattainment area for the 2015 8-hour O_3 NAAQS, and a maintenance area for CO and $PM_{2.5}$ NAAQS, the *de minimis* levels are 50 tons for VOCs or NOx, and 100 tons each for CO and $PM_{2.5}$.

Emissions for those pollutants applicable to the GCR analysis were calculated using the methodology described above for both on-site and off-site sources, direct and indirect under both construction and operational phases. Total calendar year annual emissions as summarized were then compared to the applicable *de minimis* thresholds to determine whether a formal GCR determination is required. A breakdown of predicted estimated tons per year for nonattainment and maintenance criteria pollutants is summarized in **Table 2-1**. The predicted annual emissions associated with the Proposed Project are below the applicable *de minimis* levels. Therefore, no formal conformity determination is required under the GCR requirements for the Proposed Project.

4. Greenhouse Gas Emissions and CLCPA Consistency

4.1 Greenhouse Gas Emission Limits and Targets

The CLCPA (Chapter 106 of the Laws of 2019) and Article 75 of the Environmental Conservation Law (ECL) require NYSDEC to promulgate regulations to establish a State-wide GHG emissions limit for 2030 that is 60 percent of 1990 GHG emissions, and for 2050 that is 15 percent of 1990 GHG emissions. The CLCPA requires that CO_2e emissions be calculated based on a 20-year GWP for GHGs that are not CO_2. GHGs in addition to CO_2 associated with the operation of the Proposed Project combustion equipment include CH_4 and N_2O.

An assessment of the Proposed Project's projected GHG emissions is provided in Section 2.3.2 (Estimated Emissions for All Proposed Project Phases) as CO_2e calculated using the 20-year global warming potentials adopted in 6 New York Codes, Rules, and Regulations (NYCRR) § 496.5 (GWP20). Section 2.3.2 (Estimated Emissions for All Proposed Project Phases) provides an assessment of Proposed Project-related GHG emissions, including direct mobile source emissions, and indirect mobile source emissions associated with the construction and operational phases. The Proposed Project's indirect upstream GHG emissions from on-site electricity use, and indirect upstream emissions attributable to the extraction, transmission and use of fossils fuels imported into the State are presented below in Section 4.2.1 (Upstream Indirect Operational Emissions).

4.2 Projected Greenhouse Gas Emissions

As noted above, in the Proposed Project's Operational Phase 1 from 2026 through 2027, the Proposed Project would be used for staging operations to support the offshore construction of the Empire Wind Projects. During the Proposed Project's Operational Phase 2 beginning in 2028, the facility would support the O&M of the Empire Wind Projects and also would be used for other OSW projects' construction and staging.

GHG emissions in terms of CO_2e have been quantified for the Proposed Project are summarized as follows:

- Direct and indirect GHG emissions during construction of the Proposed Project (see **Table 2-1**).
- Direct and indirect GHG emissions from mobile sources, respectively, during the Proposed Project's Operational Phases 1 and 2 (see **Table 2-1**).
- Indirect upstream GHG emissions from on-site electricity use during the Proposed Project's Operational Phases 1 and 2 (see **Table 2-1**).
- Indirect upstream GHG emissions attributable to the Proposed Project resulting from the extraction, transmission and use of fossils fuels during Operational Phases 1 and 2 (see **Table 4-3**).

4.2.1 Upstream Indirect Operational Emissions

Guidance and emission factors provided by NYSDEC on the State-wide Greenhouse Gas Emissions Report website[2] were used to estimate the upstream emissions attributable to the Proposed Project from on-site equipment diesel fuel use. For electricity use, information was used from USEPA's eGRID2020[3] compilation of electric sector data for the NYC/Westchester subregion. Use of the current eGRID data source is a conservative estimate of GHG from indirect electric use; as the Empire Wind Projects, other renewable energy sources, and regulatory initiatives which affect the electric power sector take effect, the GHG emissions associated with the electric sector are expected to decrease over time. **Table 4-1** summarizes the GHG emission factors used for upstream emissions associated with the production and transport of the fuels used by the Proposed Project combustion sources. **Table 4-2** summarizes the emission factors to estimate the GHG emissions for power use associated with SBMT.

[2] https://www.dec.ny.gov/energy/99223.html, Appendix A, Table A1.
[3] https://www.epa.gov/egrid/download-data eGRID2020 Data File (xlsx)SRL20 tab,

Table 4-1 Fossil Fuel Upstream Emission Factors (lb/MMBtu)

Fuel	CO_2	CH_4	N_2O	CO_2e
Diesel	15,164	121	0.23	25,375

Table 4-2 Electric Power Use Upstream Emission Factors (lb/MWh)

Power	CO_2	CH_4	N_2O	CO_2e
Electric Power Use	634.612	0.022	0.0003	637.252

Table 4-3 provides estimates of the upstream indirect GHG emissions associated with operation of the Proposed Project for both Operational Phases. The construction support and staging values are total tons over Operational Phase 1 (i.e., Empire Wind Projects' construction and staging period from 2026 to 2027). The Operational Phase 2 values represent annual tons per year of GHG emissions from 2028 onward. Estimated diesel fuel usage was developed from on-site equipment for each phase of Proposed Project operation. Additionally, electric use for building heating, cooling, and site-wide lighting were estimated for each phase of Proposed Project construction and operation. These usages were combined with the emission factors from **Table 4-1** and **Table 4-2** to estimate the GHG emissions from the Proposed Project's operational phases.

Table 4-3 Upstream Indirect GHG Emissions Associated with Operation of the Proposed Project

Scenario (1)	Component	Usage	CO_2	CH_4	N_2O	CO_2e
Operational Phase 1: EW Projects' Construction Support/Staging (2026-2027) (1)	On-Site Equipment Diesel Fuel Use	382,927 gal	876.9	7.0	0.015	889.1
	Electric Power Use	14,220 MWh	4,512.2	1.6	0.021	4,649.2
	Total		**5,389.1**	**8.6**	**0.036**	**5,538.4**
Operational Phase 2: EW Projects' O&M and other OSW Projects' Construction Support/Staging (2028 and on) (2)	On-Site Equipment Diesel Fuel Use	203,927 gal/yr	466.1	3.7	0.008	472.6
	Electric Power Use	7,422 MWh/yr	2,354.9	0.8	0.011	2,426.5
	Total		**2,821.1**	**4.5**	**0.019**	**2,899.1**

Notes:
1) Combined total tons for the entire construction support and staging period
2) Annual tons per year for the duration of the Operational Phase 2 period

4.2.2 2030 and 2050 Projections

To assist with reducing GHG emissions in future years as per the CLCPA guidelines, emissions in the years 2030 and 2050 are included in this supplemental study. As discussed above, **Table 2-1** and **Table 4-3** present the direct and indirect GHG emissions attributable to the Proposed Project's Operational Phase 2 for 2028 and beyond (i.e., associated with the O&M phase of the Empire Wind Projects and other OSW projects' staging and construction). The total CO_2e emissions for the Proposed Project are summarized in

Table 4-4. The direct and indirect mobile emissions from **Table 2-1** have been modified to use the GWP20 values for methane and nitrous oxide as required by the CLCPA. These adjustments result in slightly higher calculated CO_2e for both direct (3,175.9 versus 3,174.7) and indirect mobile (2,496.8 versus 2,490.8).

Table 4-4 Proposed Project Operational GHGs (as CO_2e) Emissions (tons)

Component	2030	2050
Direct On-site Equipment	3,174.7	3,174.7
Direct On-site Vessels	715.2	715.2
Indirect Mobile	2,490.8	2,490.8
Indirect Upstream (Diesel & Electric Use)	2,899.1	2,899.1
Total	**9,279.8**	**9,279.8**

4.3 Consistency with Climate Leadership and Community Protection Act

The Proposed Project would help to achieve CLCPA goals of:

- 60 percent of 1990 CO_2e emissions by 2030 state-wide (§75-0107 1. A.);
- 15 percent of 1990 CO_2e emissions by 2050 state-wide (§75-0107 1. B.);
- Reducing emissions from the electric sector by displacing fossil-fuel fired electricity with renewable electricity (§75-0103 13. B.); and
- 9 GW of OSW capacity by 2035 (§75-0103 13. E.).

Although the Proposed Project would have direct and indirect emissions of GHGs, these emissions would be minimized to the extent possible, as discussed below, and would be more than compensated for by supporting the development of the Empire Wind Projects. The power output by the WTGs associated with the Empire Wind Projects would begin to offset the GHG emissions from the Proposed Project and would increase over time as more WTGs are constructed. This beneficial result of the Proposed Project would grow over time as the Proposed Project continues to support the development of additional OSW projects. The Proposed Project will support the development of the Empire Wind Projects' approximately 2.1 GW of OSW capacity, which is 23% of the CLCPA's goal of 9 GW.

4.4 Minimization of Potential Impacts

The Proposed Project would undertake the following steps to minimize potential direct and indirect GHG emissions from the operation of SBMT:

- The Proposed Project would minimize GHG emissions by using electric power for building heating instead of using the existing natural gas lines to the existing SBMT facility. This would minimize direct GHG emissions from burning of fossil fuels and also would be a mitigation of future indirect GHG emissions. The new HVAC system to be installed would use alternative lower Global Warming Potential (GWP) refrigerants to be consistent with the CLCPA as high-GWP refrigerants regulated by USEPA are phasing out. As stated in Section 1 (Introduction), the purpose of the Proposed Project is to enable it to serve as a staging facility and operations & maintenance (O&M) base for the offshore wind (OSW) industry. By supporting the development of OSW projects, the Proposed Project would lead to lower indirect GHG emissions over time.
- The Proposed Project's O&M base would incorporate stringent electric efficiency standards for lighting, heating, and cooling in accordance with Local Law 97, which regulates GHG emissions from buildings larger than 25,000 square feet, and LEED green building standards. This newly designed O&M base would result in a lower GHG footprint as compared to the existing buildings at SBMT.
- Additional reductions would be achieved by supplying vessels with wayside power cables in lieu of hoteling using onboard fossil fuel-fired engines. The use of shore power would enable the ships to remain operational while loading or unloading cargo at the 35th Street and 39th Street "Piers."
- The use of diesel-powered equipment during construction of the Proposed Project would be temporary and would utilize equipment that meets up-to-date USEPA standards for diesel engines, as they are available.
- During the Proposed Project's Operational Phase 1, some equipment (crawler cranes, heavy lift forklifts, hydraulic lifts) needed by the Proposed Project to move the heaviest of the WTG components would not be readily available in non-fossil fuel-fired equipment. The Proposed Project would assess whether technologies become available

which would supply the required safety carrying load capacity. Alternately, biofuels such as a biodiesel blend, may be used to reduce 100 percent fossil diesel GHG emissions.

- During the Proposed Project's Operational Phase 2, the same heavy lift equipment would remain in use from the first operational phase to support construction/staging of other OSW projects. The same assessment of alternative technologies would be carried through to assess whether non-diesel equipment is available to meet the same heavy lift demand.

The Proposed Project will be consistent with the CLCLA goals and objectives by minimizing onsite GHG emissions and by providing the support needed for OSW construction and O&M activities which will directly enable OSW companies to provide wind power needed to meet the CLCPA's goal of installed capacity and assist with achieving the CLCPA goals of reducing state-wide GHG emissions, specifically from the electric power sector.

5. Climate Change

This section evaluates the potential exposure to physical climate risks at the Proposed Project, aligning with the CLCPA, the Community Risk and Resiliency Act (CRRA), and the sea level rise projections as outlined in the NYCRR Title 6, Part 490 (6 NYCRR Part 490).

Climate change has already been affecting the public health, natural resources, and infrastructure within New York City (the City). As changes in the climate become more frequent and/or severe, it is anticipated that a variety of sectors will experience greater physical risks that result in infrastructure and environmental damage, as well as the loss of life. Physical climate risks often disproportionately impact disadvantaged communities, and the potential risks from climate change on the most vulnerable populations need to be considered.

In recent years, the City has experienced adverse impacts from both chronic and acute climate events such as increasing average annual temperatures, variable average annual precipitation patterns, sea level rise, extreme temperatures and precipitation, and extreme weather events such as tropical and extra-tropical cyclones, storm surges, flooding, and high wind events. In order to build more resilient projects, it is important to better understand the changing climate patterns influencing these events, associated risks, and potential next steps to mitigate these impacts.

5.1 Community Risk and Resiliency Act

The Community Risk and Resiliency Act (CRRA) was signed into law in 2014 and requires decisions regarding certain State permits and expenditures to consider impacts from extreme weather including storm surge, sea level rise, and flooding. The CRRA includes five major provisions:

- Official sea level rise projections;
- Consideration of future physical climate risk;
- Smart Growth Public Infrastructure Policy Act criteria;
- Guidance on natural resilience measures; and
- Model local laws concerning climate risk.

The CRRA also amends the State Smart Growth Public Infrastructure Policy Act, ECL Article 6, to add an additional smart growth criterion regarding mitigation of future climate physical risk (New York State, n.d.a).

5.1.1 6 New York Code of Rules and Regulations Part 490

The CRRA required NYSDEC to adopt regulations establishing science-based sea-level rise projections for the State by January 1, 2016. The purpose of 6 NYCRR Part 490 is to help to ensure that sea-level rise projections are incorporated into decision-making processes in a consistent, transparent manner and will contribute to regulatory certainty. The regulation established projections of sea-level rise in three specified geographic regions (Long Island, New York City and the Lower Hudson River upstream to Kingston, and the Mid-Hudson River from Kingston upstream to the federal dam at Troy) over four different time intervals (2020s, 2050s, and 2080s, and the year 2100) (New York State, n.d.b).

5.2 Affected Environment

This assessment of the potential physical climate risks focuses on the existing climate and projected trends for the Proposed Project for the following climate variables: temperature (average annual and extreme), precipitation (average annual and extreme), sea level rise, and other acute weather events such as tropical and extra-tropical cyclones, storm surge, flooding, and high wind events. Varying timescales are included throughout the discussion (e.g., specific year ranges versus more vague timescales such as “mid-century”), as well as varying regions (e.g., State and City), and are reflective of the data available from each different source. Projection data was gathered for a mid-century timeframe[4]

[4] The exact year or timeframe for “mid-century” may vary depending on the resource used, but generally includes the year 2050 or the timeframe between 2040-2060.

to reflect construction and closeout periods, as well as to align with the CLCPA and specific GHG emissions reduction goals set by the state for the 2030, 2040, and 2050 milestone years.

The publications and data sources used to perform the physical climate risk analysis were derived from a comprehensive selection of the most recent publicly available climate change scientific papers, studies, and models, and include the New York City Panel on Climate Change (NPCC) 2019 assessment report (NPCC, 2019), New York State Energy Research and Development Authority (NYSERDA) ClimAID 2014 updated report (NYSERDA, 2014), the Fourth National Climate Assessment (NCA4) Northeast chapter (Dupigny-Giroux et al., 2018), and the National Oceanic and Atmospheric Administration (NOAA) State Climate Summary for the State (Frankson et al., 2022). The resources and tools reflect current best practices and respected research, analysis, and reporting of historic, present, and projected climate data. Other independently authored, peer-reviewed resources were used for more specific regional information, where available (Colle et al., 2013; Comarazamy et al., 2020; Gonzaléz et al., 2019; Gornitz et al., 2019; Horton et al., 2014; NHC & NOAA, n.d.; NYC Emergency Management, 2022; Rosenzweig et al., 2011; USEPA, 2021; and Zeng et al., 2019).

5.2.1 Greenhouse Gas Emission Pathways

The Intergovernmental Panel on Climate Change (IPCC) is an international body that assesses, reports, and shares climate change science and policies. The synthesis report written by the IPCC contains their most comprehensive climate change work. The most recent report is the Synthesis Report of the IPCC Fifth Assessment Report (AR5), published in 2014. The IPCC Sixth Assessment Report (AR6) is expected to be released in 2022.

The IPCC highlights four Representative Concentration Pathways (RCPs) which describe future global emission scenarios. RCPs are utilized for making projections on climate change impacts based on the likely emission scenarios that will occur. The AR5 defines four RCPs: immediate stringent mitigation to lower GHG emissions and limit global warming below 2 degrees Celsius (°C) (3.6 degrees Fahrenheit [°F]) (RCP2.6), intermediate emissions mitigation to limit to 2°C of global warming (RCP4.5), high-intermediate emissions with emissions peaking in 2060 and declining for the rest of the century (RCP6.5), and extremely high emissions consistent with no policy changes to reduce emissions (RCP8.5).

RCP4.5 & RCP8.5 emissions scenarios are typically referenced in this document, as the RCP4.5 encompasses a scenario limiting global warming to 2°C (3.6°F), as outlined in the Paris agreement, and the RCP8.5 scenario encompasses one where there are increased physical risks due to extremely high emissions.

5.2.2 Temperature

5.2.2.1 Average Annual Temperature

Average annual temperatures have been rising steadily in the State and the City since the early 1900s. The average annual temperature of the State has risen almost 2.5°F since 1900, with 2012 as the hottest year on record (Frankson et al., 2022). The City has experienced a 3.63°F cumulative rise in average annual temperatures from 1901 to 2012, more than 1°F above the State average (Horton et al., 2014). While average annual temperatures are increasing across the State, much of the increased temperatures have been observed during spring and winter, with summer temperatures experiencing only a slight increase (Frankson et al., 2022).

Average annual temperatures within the State and the City are expected to continue increasing from the baseline average annual temperature of 54.6°F observed between 1971-2000 through the next century. Average annual temperatures within the City are expected to increase by 1.5°F to 3.2°F by 2040, as compared to the baseline, under RCP4.5 and RCP8.5, respectively. By 2050, temperatures could rise by approximately 3.1°F to 6.6°F above the baseline under the RCP4.5 and RCP8.5 emissions scenarios, respectively (Horton et al., 2014). Even under the lower emission scenario, the State average annual temperatures are still expected to exceed record levels (Frankson et al., 2022).

5.2.2.2 Extreme Heat

Extreme heat days within the State are typically defined as days with the maximum temperature exceeding 90°F, and heat waves are defined as an event with three or more consecutive days of extreme heat (Gonzaléz et al., 2019). Increases in average annual temperatures across the State and within the City have led to an increase in extreme heat events since the 1970s (Rosenzweig et al., 2011). As average annual temperatures continue to increase across the region, extreme heat events are also expected to increase (NPCC, 2019). Within the 2020s decade, there could be between two to 15 additional extreme heat days and up to three additional heat waves within the State under the RCP4.5 (lower) and RCP8.5 (higher) emissions scenarios, respectively. By 2050, there could be between ten to 44 additional extreme heat days and one to seven additional heat waves under the lower and higher emissions scenarios, respectively (Horton et al., 2014).

While the occurrence of extreme heat events can vary regionally across the State, more urban areas such as the City typically experience higher temperature extremes. Developed, urban areas tend to exacerbate the impacts of extreme heat due to increased areas of impervious and dark surfaces and lack of shade and tree cover. This effect of higher temperatures in urban environments than surrounding areas are referred to as "urban heat islands," and can result in temperatures approximately 1°F to 7°F warmer during the day and 2°F to 5°F warmer during the night (USEPA, 2021).

5.2.3 Precipitation

5.2.3.1 Average Annual Precipitation

Average annual precipitation increased across the State between 1900 to 2012 by more than 0.5 inches per decade, or approximately 5.8 inches cumulatively. Over the same time period, the City observed a larger increase in precipitation of approximately 0.8 inches per decade, or 8.4 inches cumulatively (Horton et al., 2014).

Average annual precipitation within the State and the City is expected to continue rising throughout the century under both low and high emissions scenarios. When compared to the 1971 to 2020 baseline of 49.7 inches, the City precipitation is projected to rise between one percent to 13 percent by mid-century (Horton et al., 2014). A majority of this precipitation increase is expected to occur over the winter months, and projections estimate a possible ten percent to 15 percent increase in the City, and a 15 percent to 20 percent rise in the State for winter precipitation alone (Frankson et al., 2022; Horton et al., 2014).

5.2.3.2 Extreme Precipitation

Extreme precipitation in the State is commonly defined as days with one inch or more of precipitation; however, it can also be measured as two and four inches depending on the region (Horton et al., 2014). Extreme precipitation can occur throughout the year and comes from a variety of sources, such as thunderstorms, hurricanes and tropical cyclones, or snowstorms. Between 1971 to 2000, the State annually experienced an average of 13 extreme precipitation events over one inch, three extreme precipitation events over two inches and less than one extreme precipitation event over four inches (Horton et al., 2014). The average number of two-inch extreme precipitation events has risen since 1995 (Frankson et al., 2022).

Extreme precipitation events in the State are expected to rise under both RCP4.5 and RCP8.5, along with an increase in the duration of the event and intensity. Within the City specifically, one-inch extreme precipitation events could range from 13 to 17 events, while two-inch events could reach three to five occurrences by mid-century (Horton et al., 2014).

5.2.4 Sea Level Rise

The coastal regions of the State have experienced rising sea levels of approximately 13 inches since 1880, nearly double the global average sea level rise of approximately seven inches (Frankson et al., 2022; Gornitz et al., 2019). Since 1900, decadal changes in these regions have averaged between 0.9 inches to 1.5 inches per decade, varying by region (Horton et al., 2014). The above average rate of sea level rise in the State is thought to be due to several factors such as thermal expansion, glacial isostatic adjustment (GIA), and gravitational responses from Antarctic ice melt (Gornitz et al., 2019). A majority of the experienced sea level rise is a result of thermal expansions of the ocean due to rising temperatures; however, ice melt is also a key factor (Horton et al., 2014). Sea level rise can also exacerbate the intensity and frequency of tidal flooding and storm surge events.

Sea level rise is expected to continue due to an increase in ocean thermal expansion, GIA, and ice loss in ice sheets, glaciers, and ice caps, as well as a decrease in land water storage (Horton et al., 2014). Projections indicate the potential for additional sea level rise of 12 to 48 inches by 2100, with the State and the City expected to experience an above average increase (Frankson et al., 2022; Horton et al., 2014). Projections under 6 NYCRR Part 490 indicate

NYC itself could see an eight to 30 inches increase in sea levels by 2050, as compared to the 2000 to 2004 average baseline.

5.2.5 Acute Weather Events

5.2.5.1 Hurricanes

Hurricanes are tropical cyclones (low pressure systems that develop over warm waters with organized deep convection, closed wind circulation, and a well-defined center) that occur in the Northern Hemisphere east of the Greenwich Meridian, in which the maximum sustained surface wind speed reaches 74 miles per hour (mph) or above (NOAA, n.d.a). Hurricane events are regarded as the most impactful storms experienced by coastal regions within the State, along with nor'easter storms. Hurricanes typically occur between July and October and bring extreme precipitation, wind, inland flooding, and storm surges throughout the State. Recently, the State felt the damaging impacts of Hurricanes Irene, Lee, and Sandy, which all occurred between 2011 to 2012. While tropical storms are an irregular occurrence within the inland regions of the State, Hurricane Irene resulted in a 500-year flood across the state (Horton et al., 2014).

Projected trends in hurricane occurrence throughout the State are currently inconclusive due to several factors, one being individual storm path variability. While it is currently difficult to predict how hurricanes will impact the State in the future, it is likely that these storms will increase in intensity (Horton et al., 2014).

5.2.5.2 Extratropical Cyclones

Extratropical cyclones are storms that form due to contrasts in temperature between air masses (NOAA, n.d.a; NPS, 2019). Extratropical cyclone winds can vary greatly in speed, ranging from 10 mph to hurricane force winds (NOAA, n.d.b; NPS, 2019). Extratropical cyclones are a natural part of the State climate and typically include nor'easters, blizzards, and other low pressure systems that bring precipitation. Nor'easter storms are regarded as one of the most impactful extratropical cyclones, and can generate extreme precipitation (rain or snow), hurricane-force winds, and extreme cold (Frankson et al., 2022; Horton et al., 2014). In 2016, a nor'easter dropped more than 30 inches of snow in parts of the City, and areas of the State have experienced over 60 inches of snow from extratropical cyclone events within the last 10 years (Frankson et al., 2022). Extreme precipitation and storm surge from nor'easters have also caused inland and coastal flooding. These storms often last longer than hurricanes, which increases the potential for flooding, wind damage, and costal erosion (Horton et al., 2014).

Projections for the frequency of extratropical cyclones in the State and the Northeast are uncertain due to the temporal, geographic, and seasonal variability around these storms; however, the intensity of these storms is projected to increase (Dupingy-Giroux et al., 2018; Frankson et al., 2022; Gonzalez et al., 2019). While projections for the intensity and frequency of extratropical cyclones are uncertain, recent research suggests extratropical cyclone impacts could potentially move further west, causing impacts over a larger region of the State (Colle et al., 2013; Horton et al., 2014).

5.2.5.3 Storm Surge

Storm surges are defined as an excess rise of water above the predicted tide, caused by a storm (NHC & NOAA, n.d.). While a variety of storms can cause a storm surge, tropical cyclones produce the largest surges. Nor'easters are another cause of storm surge, which occur more frequently and typically cause longer lasting storm surges than tropical cyclones. Hurricane Sandy most recently had the largest storm surge impact on the City and the State out of all storms in 2012. (Horton et al., 2014).

Projections are currently uncertain about how these storms will change in the future as a result of climate change (Horton et al., 2014). Nor'easter storms moving west would cause storm surge impacts over a larger region of the State (Colle et al., 2013; Horton et al., 2014). An increase in sea-level rise will also exacerbate the magnitude of impacts and increase the area affected by storm-surge events.

5.2.5.4 Flooding

The three main causes of flooding in the State are extreme precipitation, storm surge, and snowmelt. Flooding has occurred throughout the State during all times of the year; but is most common during the spring in north and central portion of the State due to snowmelt, while southern portion of the State and urban areas have more frequent floods during summer and fall due to tropical cyclones and less permeable surfaces. However, an increase in recent tropical cyclones have caused inland flooding across the State, as well (Frankson et al., 2022; Horton et al., 2014). Historic trends indicate coastal floods across the State and within the City typically occur once every 10 years (Horton et al., 2014). Some coastal regions within the City have seen an increase in tidal flooding, reaching as much as 15 days per year twice since 2008 (Frankson et al., 2022).

Due to an expected increase in extreme precipitation and sea level rise, as well as an increase in the intensity of tropical cyclones, it is expected that flooding events will occur more frequently within the State and the City. Sea-level rise by itself could increase the average coastal flood event from once per decade to once every three years within the City. NOAA sea level rise models indicate tidal floods are projected to increase drastically within the coastal regions of the City, potentially experiencing tidal floods 50 to 170 days per year (Frankson et al., 2022). The City's coastal regions are also projected to experience an increase in the frequency 100-year floods, potentially occurring 1.5 to 4.5 times more often than current conditions by 2050, and 100-year flood heights within these regions could reach 0.7 to 2.5 feet higher by 2050 (Horton et al., 2014). These flood projections only consider sea-level rise and do not take any expected increases in extreme precipitation or tropical storms into account.

5.2.5.5 High Wind Events

While high winds can occur because of differences in air pressure systems, high wind events within the State are most typically associated with tropical cyclones, nor'easters, and thunderstorms, all of which have the potential to create extreme wind speeds (NYC Emergency Management, 2022; Zeng et al., 2019). This means that high wind events can occur throughout the entire year across the State. While tropical cyclones bring about the strongest winds, nor'easters typically have a longer duration and the ability to produce hurricane-force winds, and also occur more frequently. Existing science behind wind patterns and speed can be complex, and the scientific consensus on observed historic trends is uncertain. However, some recent studies have indicated an eight percent global decrease in wind speed between 1980 to 2010, and another study found a global increase in wind speed of 0.4 miles per hour (mph) between 2010 to 2019 (Zeng et al., 2019).

Projections indicate the potential for high wind events to become more intense by mid-century due to rising temperatures causing storms to grow stronger, but the science is uncertain and there are many variables that could affect wind speeds, patterns, and high wind events (Frankson et al., 2022; Horton et al., 2014; Rosenzweig et al., 2011). The City's maximum gusts are projected to potentially reach up to 110 mph, a 30 mph rise from the historic maximum recorded between 1973 to 2017 (Comarazamy et al., 2020).

5.3 Environmental Impacts

Projected climate change trends indicate the potential for future physical climate risks from increasing temperatures (both average annual and extreme heat events), increasing precipitation (both average annual and extreme precipitation events), sea level rise, and unpredictable frequency and increasing intensity of tropical and extra-tropical storms, as well as the associated impacts to storm surge, flooding, and high wind events as a result of these predicted climate trends. Analysis and mitigation of these risks is required by the CLCPA, the CRRA, as well as NYSDEC regulations and guidance.

5.3.1 Future Climate Risk without Project

In the Future without Project condition, the Proposed Project would not occur. Current uses in the Project Area by the existing marine operator would continue, and the DOT function at the site would be relocated to Red Hook Container Terminal in Red Hook, Brooklyn. Adjacent to the Project Area at SBMT, the Empire Wind 1 Project's underground cables and onshore substation would be constructed and then would operate. The land uses and zoning for the Project Area would remain unchanged. The existing uses in the Project Area would remain unchanged, resulting in continued underutilization of the site. There would be no changes to GHG emissions within the Project Area and no additional physical climate risk beyond what would be experienced from current activities. See Section 1.3 (Project Description) of the SBMT Environmental Analysis for more information about the Empire Wind 1 Project.

5.3.2 Future with Project

The following sections describe the potential physical risks that may be experienced for public health and disadvantaged communities, natural resources, and public services and infrastructure within the Project Area due to current and projected climate change conditions.

5.3.2.1 Public Health & Disadvantaged Communities

5.3.2.1.1 Public Health

Health impacts from climate change vary across communities and depend on social, socioeconomic, demographic, and other societal factors, as well as community adaptation efforts and the underlying vulnerability of individuals. Climate change related impacts have already begun affecting the health and well-being of residents throughout the State and the City. In 2013, extreme temperatures caused 133 deaths within the City, and studies predict extreme heat-related deaths could increase by 50 to 100 additional deaths per million people by 2050 (Horton et al., 2014). Climate change is affecting local air quality through increases in ground ozone levels, pollen and other allergens, and increased humidity casing indoor mold growth, and instances of morbidity and mortality related to air pollution have been increasing. Wildfire smoke is another hazard affecting air quality within the State and the City. Wildfire smoke can travel thousands of miles, sending air pollution downwind. The State and the City have experienced air pollution from wildfires most recently in 2016, 2018, and 2021. (Dupingy-Giroux et al., 2018; Hung et al., 2020; Wu et al., 2018). Increased occurrences of foodborne, waterborne, and vector-borne diseases are expected due to projected increases in precipitation and temperatures (Dupingy-Giroux et al., 2018; Horton et al., 2014). Extreme weather events such as flooding, extreme precipitation, and tropical and extra-tropical cyclones pose physical injury risk as well as mental health risks, and can also shut down and limit access to key emergency services and health facilities (Dupingy-Giroux et al., 2018; Zimmerman et al., 2019).

During construction, workers exposed to the elements outdoors could be exposed to climate change-related public health impacts, such as poor air quality and extreme heat events, which could occur regardless of Proposed Project activities. The Proposed Project would not significantly contribute to any adverse impacts to public health due to climate change.

5.3.2.1.2 Disadvantaged Communities

The CLCPA seeks to ensure that disadvantaged communities are not disproportionately burdened. The CLCPA defines disadvantaged communities as "communities that bear burdens of negative public health effects, environmental pollution, impacts of climate change, and possess certain socioeconomic criteria, or comprise high-concentrations of low- and moderate- income households." Exposure to harmful environmental pollutants can cause adverse health effects which increase community vulnerability during extreme events. Access to important infrastructure such as air conditioning and electricity during extreme heat events is often limited for disadvantaged communities (Dupingy-Giroux et al., 2018). As climate change impacts occur more frequently and with higher intensity, disadvantaged communities are expected to face greater impacts than other communities. Some of these impacts include, but are not limited to, increased damages in flooding due to low-lying housing, older infrastructure, and non-permeable surfaces; less reliable access to electricity during extreme temperatures and storms; less reliable access to public infrastructure/transit; and more extreme temperatures due to the effects of urban heat islands and less green space.

While the Proposed Project does not overlap with any disadvantaged communities, Census Tract 2 (also identified as Census Tract 36047000200) is located adjacent to the Project Area and is designated a Draft Disadvantaged Community (New York State, 2022b). The American Community Survey 2014-2019 5-year estimates indicate this community has a population of 1,167 (U.S. Census Bureau, 2019). This census tract experiences an Environmental Burden 97 percent higher than other census tracts statewide. This is primarily driven by existing land use in the area (industrial and power generation), potential for projected extreme heat risk, and existing pollution burden associated with high traffic and air quality concerns. This census tract also has a Population Vulnerability 89 percent higher than other census tracts statewide, primarily driven by high percentages of residents without health insurance, limited English proficiency, and a high Latino/a or Hispanic population (New York State, 2022b).

The estimated criteria pollutant emissions and GHG in terms of CO_2e associated with the Proposed Project are summarized in **Table 2-1** for both short-term construction activities and operational activities during staging period (Phase 1) and long-term operational Phase 2 period, respectively. Under the long-term Phase 2, the Proposed Project would minimize air pollutant emissions, including GHG emissions, by using electric power for building heating via the

HVAC system and by using alternative lower-GWP refrigerants instead of using the existing natural gas lines to the existing SBMT facility.

The Environmental Justice (EJ) analysis, included in Section 3.3 (Socioeconomic Conditions and Environmental Justice), establishes that the Proposed Project would not result in any disproportionately high and adverse effects on minority and low-income populations, and would be in compliance with all applicable state regulations related to EJ. As such, the Applicant's EJ analysis fulfills the disadvantaged communities component of the CLCPA.

5.3.2.2 Natural Resources

Natural resources within and surrounding the Project Area have already been exposed to the impacts of climate change and are expected to continue experiencing worsening impacts. The frequency of drought events within the State could double by 2050, reducing freshwater resources across the state (Dupingy-Giroux et al., 2018; Gonzaléz et al., 2019). Extreme precipitation events have the potential to cause flooding and an increase in soil erosion throughout the State, especially in coastal areas. These events can also increase stormwater runoff, contaminating local waterways and degrading water quality. Sea level rise is also expected to cause erosion of coastal lands while contaminating freshwater sources, wetlands, and other ecosystems (Gowda et al., 2018).

A large majority of the Project Area is built out or paved and contains minimal natural resources that are already degraded as a result of previous development and climate change. As such, the Proposed Project would not contribute to climate-related impacts on natural resources within the Project Area.

5.3.2.3 Public Infrastructure & Services

Public infrastructure and other public services already experience impacts from climate change, and climate change is expected to add stress to existing infrastructure that is already aging and near the end of its service life. High wind events can damage power lines leading to electrical outages, down trees, and cause flying debris that can disrupt transportation and telecommunication infrastructure, and cause damage to buildings, structures, and vehicles (NYC Emergency Management, 2022; Zimmerman et al., 2019). Extreme heat is projected to increase consumer demand for electricity, straining the energy grid and leading to local black or brown outs, as well as increase water demand and deteriorate public roads and transit infrastructure. Flooding from extreme precipitation events, storm surges, and sea level rise have the potential to damage ports, cause power outages, damage public roads and halt travel, and flood public transit systems leaving them inoperable for extended periods of time. These impacts can also disrupt emergency services that are at high demand during damaging events, which can cut off communities and impact their ability to function (Zimmerman et al., 2019).

While projections for sea level rise could reach up to 30 inches by 2050, the Project Area is not expected to experience significant damage, impediments to access, or complete inundation. Figure 5-2 and 5-3[5] show how a potential sea level rise of two feet and three feet, respectively, above mean higher high water (MHHW) may impact the Project Area. Under the lower emissions scenario, sea level rise would minimally impact the Project Area and is not expected to adversely impact Proposed Project construction and operations. Under the higher emissions scenario, there may be some flooding or mild inundation experienced on the north end of the Project Area and could result in equipment being stored in inundated areas. Although sea level rise impacts would be minimal within the Project Area, rising sea levels can also increase the potential for flooding from high tides and coastal storm events.

[5] Screenshots derived from the NOAA sea-level rise viewer, which does not have a scale or north arrow.

Figure 5-1. Project Area with 2 feet of sea level rise above current MHHW

Source: NOAA, 2022

Figure 5-2. Project Area with 3 feet of sea level rise above current MHHW

Source: NOAA, 2022

While the Proposed Project is not expected to contribute to climate-related impacts on public infrastructure and services, infrastructure damage from extreme weather events and flooding may impact the ability of workers to reach the Project Area or disrupt shipments of materials arriving by rail and roadway. However, these impacts would indirectly occur outside of the Project Area and would not be direct Proposed Project impacts.

5.4 Measures for Future Physical Climate Risk

The potential impacts of future physical climate risks associated with the Proposed Project were considered, and measures are included in the Proposed Project design to reduce the potential impact of these risks on the Proposed Project now and into the future, as discussed below. The Proposed Project has been designed to be consistent with guidance in the CRRA and the relevant sea-level rise projections in 6 NYCRR Part 490.

The Proposed Project would avoid and minimize future physical climate risks through planning and design. The equipment, as staged, will be designed to accommodate impacts from flooding, high wind, and other climate-related conditions such as severe storms. The O&M base and temporary facilities would be designed in compliance with New York City Building Codes (NYCBC), including the American Society of Engineers Flood Resistant Design and Construction (ASCE Standard 24). The service operating vessel (SOV) platform would be designed to be consistent with the existing pavement surface, and final elevations of the pavement surface and SOV platform would be coordinated during design development. Additionally, the geotechnical considerations for the length of spud piles for the crew transfer vessel (CTV) would account for future sea level rise and storm surge projections during design development.

The Proposed Project's future physical climate risk was considered, consistent with 6 NYCRR Part 490, the CLCPA, and the CRRA, and the Proposed Project design is not expected to contribute to future physical climate risks impacting public health and disadvantaged communities, natural resources, public infrastructure and services, and other private property.

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