3.9 Greenhouse Gas Emissions and Climate Change

3.9.1 Introduction

This chapter evaluates the greenhouse gas (GHG) emissions that would be generated by the Proposed Project and its consistency with the citywide GHG reduction goals. Since a project's impact on climate change comes from the GHG emissions over the fully lifecycle a project, GHG emissions from both construction and operation of the Proposed Project is evaluated in this chapter. Per the *City Environmental Quality Review (CEQR) Technical Manual*, evaluation of GHG emissions serves as a proxy for evaluating the Proposed Project's impact on climate change. This chapter also evaluates the resilience of the Proposed Project to climate conditions throughout the lifetime of the project.

As discussed in the *CEQR Technical Manual*, climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be experienced at the local level. The City of New York's sustainable development policy, starting with PlaNYC, and continued and enhanced in OneNYC, established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change in the City.

3.9.2 Principal Conclusions

The Proposed Project would not introduce any substantial new buildings or other uses which would require electricity use, fuel consumption, or generate transportation needs. While the Proposed Project would include a permanent pump station to prevent flooding on the dry side of the flood barrier system, the proposed pump station would be operated only during storm events and would not represent a substantial increase in energy demand. Therefore, consistency with the efficient buildings goal, clean power goal, and transit-oriented development and sustainable transportation goal defined in *CEQR Technical Manual* as part of the City's GHG reduction goal would not be relevant for the Proposed Project. Since the Proposed Project would not result in substantial carbon dioxide equivalent (CO_2e) emissions once in operation, the quantified analysis of CO_2e emissions focuses on construction of the Proposed Project.

The total fossil fuel use in all forms associated with construction under the Proposed Action condition would result in up to approximately 44,442 metric tons of CO_2e emissions. Potential measures for reductions of emissions from construction of the Proposed Project are under consideration and may include the use of biodiesel, expanded use of recycled steel and aluminum, as well as expanded construction waste reduction.

3.9.3 Regulatory Context

3.9.3.1 Pollutants of Concern

GHGs are those gaseous constituents of the atmosphere, both driven by natural processes and human activity (anthropogenic), that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. The general warming of the Earth's atmosphere caused by this phenomenon is known as the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), methane, and ozone are the primary GHGs in the Earth's atmosphere.

There are also a number of entirely anthropogenic GHGs in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (and contribute to the "ozone hole"). Since these compounds are being replaced and phased out due to the 1987 Montreal Protocol, there is no need to address them in GHG assessments for most projects. Although ozone itself is also a major GHG, it does not need to be assessed as such at the project level since it is a rapidly reacting chemical and efforts are ongoing to reduce ozone concentrations as a criteria pollutant. Similarly, water vapor is of great importance to global climate change, but is not directly of concern as an emitted pollutant since the negligible quantities emitted from anthropogenic sources are inconsequential.

CO_2 is the primary pollutant of concern from anthropogenic sources. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, therefore, the most influential GHG. CO_2 is emitted from any combustion process (both natural and anthropogenic); from some industrial processes such as the manufacture of cement, mineral production, metal production, and the use of petroleum-based products; from volcanic eruptions; and from the decay of organic matter. CO_2 is removed ("sequestered") from the lower atmosphere by natural processes such as photosynthesis and uptake by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and N_2O also play an important role since the removal processes for these compounds are limited and because they have a relatively high impact on global climate change as compared with an equal quantity of CO_2. Emissions of these compounds, therefore, are included in GHG emissions analyses when the potential for substantial emission of these gases exists.

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of a GHG analysis: CO_2, N_2O, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses mostly on CO_2, N_2O, and methane, and there are no significant direct or indirect sources of HFCs, PFCs, or SF_6 associated with the Proposed Project.

To present a complete inventory of all GHGs, component emissions are added together and presented as CO_2e emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global

warming potential (GWP). GWPs account for the lifetime and the radiative forcing[1] of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed in this section are presented in **Table 3.9-1**.

Table 3.9-1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur Hexafluoride (SF_6)	23,900

Note: The GWPs presented above are based on the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) to maintain consistency in GHG reporting. The IPCC has since published updated GWP values that reflect new information on atmospheric lifetimes of GHGs and an improved calculation of the radiative forcing of CO_2. In some instances, if combined emission factors were used from updated modeling tools, some slightly different GWP may have been used for this study. Since the emissions of GHGs other than CO_2 represent a very minor component of the emissions, these differences are negligible.
Source: *CEQR Technical Manual*

3.9.3.2 Policy, Regulations, Standards, and Benchmarks for GHG Emissions

Federal and Interstate Policies

Given that GHG emissions resulting from human activity have the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing global, regional, state, and local measures addressing energy consumption and production, land use, and other activities. Although the U.S. has not ratified the international agreements that set emissions targets for GHGs, in December 2015 the U.S. signed the international Paris Agreement[2] that pledged deep cuts in emissions, with a stated goal of reducing annual emissions to levels that would be between 26 and 28 percent lower than 2005 levels by 2025.[3] On January 20, 2021, President Biden signed an executive order to bring the United States back into the Paris Agreement.

Regardless of the Paris Agreement, EPA is required to regulate GHGs under the Clean Air Act and has begun preparing and implementing regulations. In coordination with the National Highway Traffic Safety Administration (NHTSA), EPA currently regulates GHG emissions from newly manufactured on-road vehicles. In addition, EPA regulates transportation fuels via the Renewable Fuel Standard (RFS) program, which phased in requirements for the inclusion of renewable fuels that increased annually up to a total of

[1] *Radiative forcing* is a measure of the influence a gas has in altering the balance of incoming and outgoing energy in the Earth-atmosphere system and is an index of the importance of the gas as a GHG.

[2] Conference of the Parties, 21st Session. *Adoption of The Paris Agreement, decision -/CP.21*. Paris, December 12, 2015.

[3] United States of America*. Intended Nationally Determined Contributions (INDCs)* as submitted. March 31, 2015.

36.0 billion gallons by 2022. On December 1, 2022, EPA announced a proposed rule to establish the required fuel volumes and percentage standards for 2023, 2024, and 2025, as well as important modifications to strengthen and expand the RFS program. EPA issued the Affordable Clean Energy rule on June 19, 2019, which establishes emissions reduction measures accepted as best technology for power plants and focuses on energy efficiency improvements in place of direct emissions reduction measures.

Furthermore, a number of states have joined forces to fight climate change. Under the Regional Greenhouse Gas Initiative (RGGI), 11 northeastern and Mid-Atlantic states (including New York State) have committed to regulate the amount of CO_2that power plants are allowed to emit, gradually reducing annual emissions to half the 2009 levels by 2020, and reducing an additional 30 percent from 2020 to 2030.

New York State Policies

On a state level, the New York State Energy Plan outlines the State's energy goals and provides strategies and recommendations for meeting those goals. The latest version of the plan was published in June 2015. The plan outlines a vision for transforming the State's energy sector that would result in increased energy efficiency (both demand and supply), increased carbon-free power production and cleaner transportation, in addition to achieving other goals not related to GHG emissions. The 2015 plan also establishes new targets: (1) reducing GHG emissions in New York State by 40 percent, compared with 1990 levels, by 2030; (2) providing 50 percent of electricity generation in New York State from renewable sources by 2030; and (3) increasing building energy efficiency gains by 600 trillion British thermal units (BTU) by 2030.

In April 2019, New York State enacted the Climate Leadership and Community Protection Act (CLCPA) to impose a mandate that statewide GHG emissions be reduced by 40 percent by 2030 and 85 percent by 2050, compared with 1990 levels. The legislation charges the New York State Department of Environmental Conservation (NYSDEC) with establishing quantified GHG emission limits consistent with the statutory mandates, along with agency regulations to achieve those limits (in accordance with a scope prepared by a newly created body called the New York State Climate Action Council) and ensure that significant portions of investments are made in disadvantaged communities. The statute also calls for increasing generation from renewable energy,

Pursuant to these requirements, the New York State Climate Action Council prepared and approved a scoping plan on December 19, 2022. As part of this effort, New York State is now seeking to achieve some of the emission reduction goals via local and regional planning and projects through its Cleaner Greener Communities and Climate Smart Communities programs.

On December 29, 2022, New York State also announced the adoption of California's GHG vehicle standards, the Advanced Clean Cars II Rule, which are at least as strict as the federal standards and would require all new passenger cars and trucks sold in New York State to be zero-emissions by 2035.

New York City Policies

The City of New York long-term comprehensive plan for a sustainable and resilient City of New York, which began as *PlaNYC* 2030 in 2007, and continues to evolve today as *OneNYC*, includes GHG emissions

reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act.[4] The City of New York subsequently announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050 ("80 by 50"), which was codified by Local Law 66 of 2014. More recently, as part of *OneNYC*, the City of New York has announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025 and achieving carbon neutrality by 2050.

3.9.3.3 Resilience to Climate Change

The New York State Sea Level Rise Task Force was created by the New York State Legislature in 2007 to assess potential impacts on the state's coastlines from rising seas and increased storm surge. The Task Force prepared a report of its findings and recommendations including protective and adaptive measures.[5] The recommendations are as follows: to provide more protective standards for coastal development, wetlands protection, shoreline armoring, and post-storm recovery; to implement adaptive measures for habitats; integrate climate change adaptation strategies into state environmental plans; and amend local and state regulations or statutes to respond to climate change. The Task Force also recommended the formal adoption of projections of sea-level rise.

The New York State Climate Action Plan Interim Report identified a number of policy options and actions that could increase the climate change resilience of natural systems, the built environment, and key economic sectors—focusing on agriculture, vulnerable coastal zones, ecosystems, water resources, energy infrastructure, public health, telecommunications and information infrastructure, and transportation.[6] New York State's Community Risk and Resiliency Act (CRRA)[7] requires that applicants for certain State programs demonstrate that they have taken into account future physical climate risks from storm surges, sea-level rise and flooding, and required NYSDEC to establish official State sea-level rise projections. In February 2017, NYSDEC adopted a rule (6 NYCRR Part 490) defining the existing projections for use. These projections provide the basis for State adaptation decisions and are available for use by all decision makers. CRRA applies to specific State permitting, funding and regulatory decisions, including the following: smart growth assessments; funding for wastewater treatment plants; siting of hazardous waste facilities; design and construction of petroleum and chemical bulk storage facilities; oil and gas drilling; and State acquisition of open space.

In the City of New York, the Climate Change Adaptation Task Force is tasked with fostering collaboration and cooperation between public and private organizations working to build the resilience of the City's critical infrastructure against rising seas, higher temperatures, and changing precipitation patterns. The

[4] Administrative Code of the City of New York, §24-803.

[5] New York State Sea Level Rise Task Force. *Report to the Legislature*. December 2010.

[6] NYSERDA. *New York State Climate Action Plan Interim Report*. November 2010.

[7] *Community Risk and Resiliency Act.* Chapter 355, NY Laws of 2014. April 9, 2013. Signed September 22, 2014.

Task Force is composed of over 57 City and State agencies, public authorities, and companies that operate, regulate, or maintain critical infrastructure in the City of New York. Led by the Mayor's Office of Climate and Environmental Justice, the Task Force works together to assess risks, prioritize strategies, and examine how standards and regulations may need to be adjusted in response to a changing climate.

To assist the Task Force, the New York City Panel on Climate Change (NPCC) has prepared a set of climate change projections for the region of the City of New York[8] which was subsequently updated,[9,10] adopted by NYSDEC (under 6 NYCRR Part 490), and has suggested approaches to create an effective adaptation program for critical infrastructure. Revised projections for New York City were subsequently published in June 2024.[11] The NPCC includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as well as representatives from the insurance and legal sectors. The climate change projections include a summary of baseline and projected climate conditions throughout the 21st century including heat waves and cold events, intense precipitation and droughts, sea-level rise, and coastal storm levels and frequency. NPCC projected that sea levels are likely to increase by up to 30 inches by the 2050s and up to 75 inches by the end of the century (more detailed ranges and timescales are available).[12] In general, the probability of increased sea levels is characterized as "extremely likely," but there is uncertainty regarding the various levels projected and timescale. Intense hurricanes are characterized as "more likely than not" to increase in intensity and/or frequency, and the likelihood of changes in other large storms ("Nor'easters") are characterized as unknown. Therefore, the projections for future 100-year coastal storm surge levels for the City of New York include only sea-level rise at this time, and do not account for changes in storm frequency.

The New York City Green Code Task Force also has recommended strategies for addressing climate change resilience in buildings and for improving storm water management.[13] Some of the recommendations call for further study, while others could serve as the basis for revisions to building code requirements. Notably, one recommendation was to require new developments within the projected future "100-year" floodplain (the area that would potentially be flooded in a severe coastal storm with a probability of 1-in-100 of occurring in any given year) to meet the same standards as buildings in the current "100-year" flood hazard zone.

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[8] New York City Panel on Climate Change. *Climate Change Adaptation in New York City: Building a Risk Management Response*. Annals of the New York Academy of Sciences, May 2010.

[9] New York City Panel on Climate Change. *Climate Risk Information 2013: Observations, Climate Change Projections, and Maps*. June 2013.

[10] New York City Panel on Climate Change. *New York City Panel on Climate Change 2019 Report*. Ann. N.Y. Acad. Sci. 1439. March 2019.

[11] New York City Pannel on Climate Change. *NPCC4: New York City climate risk information 2022—observations and projections*. Ann N.Y. Acad. Sci. 15116. June 2024.

[12] In 2024, the NPCC published updated sea level rise projections that anticipate up to 23 inches by 2023 and up to 65 inches by the end of the century.

[13] New York City Green Codes Task Force. *Recommendations to New York City Building Code*. February 2010.

After enactment of the federal Coastal Zone Management Act (CZMA), the New York State Department of State (NYSDOS) developed a Coastal Management Plan (CMP) in accordance with the Waterfront Revitalization and Coastal Resources Act in 1981, with the objective of achieving a balance between economic development and preservation. The program is also directed at minimizing significant adverse effects to ecological systems, erosion, and flood hazards. The City of New York's Waterfront Revitalization Program (WRP) is the primary tool for guiding the development in the coastal zone in the five boroughs. The WRP is comprised of 10 principal policies that are directed at improving public access to the waterfront; reducing damage from flooding and other water-related disasters; protecting water quality, sensitive habitats, such as wetlands, and the aquatic ecosystem; reusing abandoned waterfront structures; and promoting development with appropriate land uses. The Proposed Project is aligned within the NYSDOS designated Coastal Zone and is therefore subject to review under City and State coastal zone management policies. A detailed assessment of the Proposed Project's consistency with New York City's WRP is summarized in Chapter 3.1, "Land Use, Zoning, and Public Policy," and is provided in greater detail in **Appendix C**.

Climate change considerations and measures that would be implemented to increase climate resilience are discussed below. Additionally, climate change considerations may be incorporated into state and/or local laws prior to the Proposed Project.

3.9.4 Methodology

Climate change is driven by the collective contributions of diverse individual sources of emissions to global atmospheric GHG concentrations. Identifying potential GHG emissions from a proposed action can help decision makers identify practicable opportunities to reduce GHG emissions and ensure consistency with policies aimed at reducing overall emissions. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter presents the total GHG emissions potentially associated with the Proposed Project and identifies measures that would be implemented and measures that are still under consideration to limit emissions. Note that this differs from most other technical areas in that it does not account for only the increment between the condition with and without the Proposed Project. Accounting for incremental emissions would require speculation regarding where potential future development (both residential and commercial) would occur and the future conditions for existing uses in a No Action condition if flood protection elements are not built at this location, what energy use and efficiency might be like for those alternatives and other related considerations. The focus is therefore on the total emissions associated with the Proposed Project, and on the effect of measures to reduce those emissions.

3.9.4.1 GHG Emissions

Since there will be no substantial operational mobile sources (e.g., traffic) or stationary sources (e.g., fossil-fuel fired heating, ventilation, and air conditioning systems) generated by the Proposed Project, the

Proposed Project's GHG emissions are primarily associated with construction. While the Proposed Project would include a permanent pump station to prevent flooding on the dry side of the flood barrier system, the proposed pump station would be operated during storm events and would not represent a substantial increase in energy demand.

Furthermore, as discussed in Chapter 3.11, "Construction," the Proposed Project is anticipated to have a construction schedule duration of more than two years and would be considered long-term. Therefore, GHG emissions associated with construction are assessed quantitatively. Construction emissions include emissions from on-road trips, on-site non-road engines, and materials extraction, production, and transport. A description of construction activities, an analysis of the GHG emissions associated with construction, as well as a qualitative discussion of the total lifetime emissions from construction and operation (a combined lifecycle analysis) of the Proposed Project is provided in Chapter 3.11, "Construction." Note that since there would be no substantial energy use associated with operations post construction, construction emissions represent the total lifetime emissions associated with the Proposed Project. However, a qualitative discussion of the potential indirect impacts to citywide GHG emissions.

Although the contribution of any single project's emissions to climate change is generally infinitesimal, the combined GHG emissions from all human activity have been found to significantly impact global climate. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter presents the total GHG emissions potentially associated with the Proposed Project and identifies measures that would be implemented and measures that are still under consideration to limit emissions.

The analysis of GHG emissions that would be associated with construction of the Proposed Project is based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs from the construction activity and materials have been quantified, including on-site emissions from engines, emissions from vehicle use, and emissions associated with materials extraction, production, and transport.

A description of construction activities is provided in Chapter 3.11, "Construction." The analysis is based on the projected activity and materials developed for the Proposed Project. Under the Proposed Action Conditions, fill and other materials will be delivered via a combination of trucks and barges, using tugboats.

On-Site Equipment and Truck Idle Emissions

A detailed schedule for the use of non-road construction engines and, optionally, tug boats to support a partial barging of materials, was developed, as described in Chapter 3.11, "Construction." The detailed data, including the number, type, power rating, and hours of operation for all construction engines was coupled with fuel consumption rate data from the NONROAD module within EPA's MOVES model to estimate total fuel consumption throughout the duration of the construction activities.

Under the Proposed Action condition, non-road construction engines (including on-site maneuvering of trugboats) and on-site truck idling (of ready-mix concrete truck and other necessary idling) are estimated to require approximately 2.4 million gallons of diesel, 131 thousand gallons of gasoline, and 15 thousand gallons of propane throughout the duration of construction.

Transportation Emissions

The total number of construction worker trips was estimated using the construction schedule. As discussed in Chapter 3.11, "Construction," the total number of worker-days was multiplied by the vehicle mode share of 29 percent, divided by an average vehicle occupancy of 1.18 (per the project's transportation study), and multiplied by an average round-trip distance of 25.3 miles (based on the average trip to work distance for the New York Metropolitan Council [NYMTC] area)[14] to obtain a total personal vehicle miles traveled (VMT) of 2.3 million miles. Vehicle emission factors between 2025 and 2030 for Manhattan from EPA's MOVES model (with average emission factors within the range of 270 to 321 grams CO_2e per mile) were then used to calculate total emissions.

General deliveries (fuel, potable water, and other miscellaneous materials) were assumed to travel 100 miles round-trip. Concrete was assumed to be delivered from nearby concrete batch plants at a distance of approximately 6.4 miles in each direction (ready-mix concrete needs to be delivered within a short time, and other materials required in concrete processing are available locally). It is expected that large volumes of soil (over 100,000 cubic yards) may be required for construction. Imported materials to be used either below or as (a part of) the clean cover layer is conservatively assumed to be delivered from outside the City. Exported debris would travel anywhere from 30 to 200 miles, depending on type of contamination or intended reuse/disposal. An average round-trip distance of 40 miles was estimated for both exported debris and imported soil. The trips, distances, and resulting total VMT for the Proposed Project are summarized in **Table 3.9-2**. Similar to personal vehicles as described above, truck emission factors between 2025 and 2030 for Manhattan were derived from EPA's MOVES model (with average emission factors within the range of 1,763 to 1,864 grams CO_2e per mile) and then used to calculate total emissions.

Table 3.9-2
Total Construction Truck Trips and Distances

Type	Trips	Distance (round-trip miles)	Vehicle Miles Traveled
Concrete and Pump Trucks	22,557	12.8	288,730
Dump Truck Delivery and Removal	34,346	40	1,373,840
General and Material Delivery	125,257	100	12,525,700
		Total	**14,188,270**

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are more than 20 percent of the tailpipe emissions.[15] While upstream emissions (emissions associated with production, processing,

[14] NYSDOT. *2009 NHTS, New York State Add-On*. Key Tables. "Table 3: Average Travel Day Person-Trip Length by Mode and Purpose," trip-to work distance for SOV in NYMTC 10-county area. 2011.

[15] 1 EPA. *MOVES2004 Energy and Emission Inputs*. Draft Report, EPA420-P-05-003. March 2005.

and transportation) of all fuels are included in NYSDEC's estimates of statewide GHG emissions and are important to consider when comparing the emissions associated with the consumption of different fuels, fuel alternatives are not being considered for the Proposed Project. Therefore, the well-to-pump emissions are not considered in the analysis, in accordance with the *CEQR Technical Manual* guidance on assessing GHG emissions. Furthermore, the exclusions of well-to-pump emissions is consistent with the methodology used in developing the New York City GHG inventory, which is the basis of the City's GHG reduction goal for individual projects.

Tug boats were assumed to travel to and from each reach of the Proposed Project once a day with a round trip distance of 15 miles. Tug boats would also deliver materials to the Proposed Project using approximately four trips per week for Reaches 2, 4, 5, and 6 while construction activities are projected to occur in the respective reach. Consequently, an additional 682 thousand gallons of diesel would be required for tug boats.

Material Emissions

Upstream emissions related to the production of construction materials were estimated based on the expected quantity of iron or steel and cement. Although other materials will be used, cement and metals have the largest embodied energy and direct GHG emissions associated with their production, and substantial quantities would be used for the Proposed Project.

The construction is estimated to require 6,994 metric tons of cement. An emission factor of 0.928 metric tons of CO_2e per metric ton of cement produced was applied to estimate emissions associated with energy consumption and process emissions for cement production.[16] The precise origin of cement for this project is unknown at this time.

The construction is estimated to require 1,874 metric tons of steel. An emission factor of 0.6 metric tons of CO_2e per metric ton of steel product produced was applied to estimate emissions associated with production energy consumption,[17] and 0.65 metric tons of CO_2e per metric ton of steel product produced for process emissions associated with iron and steel production was applied.[18]

3.9.4.2 Resilience to Climate Change

The WRP[19] addresses the Proposed Project's consistency with the City and State's climate change and sea-level rise projections. The WRP requires consideration of climate change and sea-level rise in planning and

[16] The Portland Cement Association, *Life Cycle Inventory of Portland Cement Manufacture*, 2006

[17] Arpad Horvath et al., Pavement Life-cycle Assessment Tool for Environmental and Economic Effects, Consortium on Green Design and Manufacturing, UC Berkeley, 2007.

[18] Based on 42.3 teragrams of CO2e emitted and 65,460 thousand tons produced; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2009, April 15, 2011

[19] City of New York Department of City Planning. *The New York City Waterfront Revitalization Program*. October 30, 2013. Approved by NY State Department of State, February 3, 2016.

design of development within the defined Coastal Zone Boundary. The Project Area and Protected Area are both within that zone. As set forth in more detail in the *CEQR Technical Manual*, the provisions of the WRP are also applied by the New York City Department of City Planning (NYCDCP) and other city agencies when conducting environmental review. The Proposed Project's consistency with WRP policies is described in Chapter 3.1, "Land Use, Zoning, and Public Policy," and **Appendix C**.

The Proposed Project's primary goal is to address the impacts from more frequent and intensive storm events and tidal surges, prioritizing design strategies that preserve the quality of life and livability in City spaces, and providing coastal storm flood risk reduction through a flood barrier system that is (1) integrated into the public realm; and (2) meets the design criteria for a 2050s 100-year storm event, inclusive of increased intensity and frequency of rainfall, coastal surge, and predicted sea level rise (corresponding to the 90th percentile projection for the 2050s).

To achieve this goal, the Proposed Project comprises passive structures (e.g., above-grade walls, below-grade concealed walls, etc.) with deployable structures at vehicle and pedestrian crossings such as streets and sidewalks, with a larger gate at the Route 9A/West Street crossing. In addition to the proposed flood barrier system, the Proposed Project would include drainage management and infrastructure improvement elements to address precipitation-related flooding from a simultaneous storm tide/rainfall event.

It is BPCA's objective that, once installed, the flood barrier system be accredited by FEMA. Accreditation requires a FEMA review of as-built plans and verification that the flood barrier system meets all pertinent requirements and in-practice can achieve acceptable risk reduction. Once approved, FEMA accreditation would remove the Project Area from the currently mapped flood zone, and property owners in the area, including those who have a federally backed mortgage, would no longer be required to obtain flood insurance.

Therefore, the potential effects of global climate change have been considered as part of the Proposed Project and a detailed assessment of the Proposed Project's resilience to climate change is not warranted.

3.9.5 Existing Conditions

According to current flood hazard projections,[20] the 100-year coastal storm surge could reach elevations between 11 and 14 feet NAVD88 within the Protected Area.[21] The highest projected storm surge elevations (14 feet NAVD88) are located at portions of the Battery Park City Esplanade at Albany Street and at the North Cove Marina. Inland locations east of West Street are projected to see storm surge

[20] FEMA. *Preliminary Flood Insurance Rate Map*. Panel 3604970203G. Release Date: 12/05/2013.

[21] On October 17, 2016, the FEMA and the City of New York announced plans to revise the FEMA flood maps based on a 2015 appeal by the City of New York of FEMA's flood risk calculations for the City of New York and the surrounding region. While revised flood maps have not yet been produced, the appeal generally identified potential reductions within portions of the region. Therefore, it is possible that the revised flood elevations may be lower than presented, and the resulting future flood elevations, inclusive of sea-level rise, may also be lower.

elevations up to 11 feet NAVD88. The official design flood elevation per the City of New York building code would be two feet above these elevations at each building within the Protected Area. As part of the design for the Proposed Project, baseline conditions were developed to estimate design waves, currents, and wave overtopping requirements. The FEMA 100-year stillwater level of 11.3 feet NAVD88 was selected and a sea level rise scenario of 2.5 feet (NPCC) was included within the design flood elevation—with a total design flood elevation of 13.8 feet NAVD88 for the Proposed Project. By the 2050s, the 100-year storm flood levels could reach 30 inches higher due to sea-level rise (per NPCC "High" scenario) according to NPCC projection data. Under this scenario, buildings within the Project Area could be subjected to flood elevations from 13.5 feet NAVD and up to approximately 16.5 feet NAVD88. By the end of the century, the 100-year storm flood levels could reach 75 inches higher (per NPCC "High" scenario), with flood elevations between approximately 17 and 20 feet NAVD88.

3.9.6 No Action Conditions

3.9.6.1 GHG Emissions

The No Action condition assumes that no new comprehensive flood barrier system is installed in the Project Area by the 2030 analysis year presented in this EIS and the Project Area would remain at risk from storm surges. Existing uses and potential future development (both residential and commercial) in the Project Area may need to perform additional resiliency planning or consider re-locating outside of the Project Area. Consequently, accounting for emissions under the No Action condition would require speculation about where potential development would occur, what the resiliency measures existing uses would undertake in the absence of the Proposed Project, and how energy usage would be impacted. Therefore, the GHG emissions analysis only considers the total emissions associated with the Proposed Action condition and the measures to reduce those emissions.

3.9.6.2 Resilience to Climate Change

In the absence of the Proposed Project, the existing areas, neighborhoods, and open spaces within the Protected Area would remain at risk from storm surges during major storm events. During a design coastal storm event, the Protected Area is expected to experience significant flood risk and potential impacts to human health and safety as well as damage to property and assets within Battery Park City and the surrounding areas.

3.9.7 Proposed Action Conditions

3.9.7.1 Construction GHG Emissions

On-Site Emissions

The GHG emissions from construction engines associated with the Proposed Project are presented in detail in **Table 3.9-3**.

Table 3.9-3
Total On-Site Emissions (metric ton CO_2e)

Vehicle Type	Emissions
Non-road	1,186
On-Site Truck Idle	275
Total	**1,461**

Transportation Emissions

The on-road GHG emissions from the construction of the Proposed Project are presented in detail in **Table 3.9-4**.

Table 3.9-4
Total Transportation Emissions (metric ton CO_2e)

Vehicle Type	Emissions
Passenger Vehicle	694
Truck	26,443
Tug Boat	7,019
Total	**34,155**

Material Emissions

The resulting GHG emissions from construction materials extraction, processing, and transport would be 6,490 metric tons CO_2e from cement and 2,334 metric tons CO_2e from steel.

Summary

A summary of GHG emissions by source type for the Proposed Project is presented in **Table 3.9-5**.

Table 3.9-5
Total Transportation Emissions (metric ton CO_2e)

Vehicle Type	Emissions
On-Site	1,461
Transportation	34,155
Material	8,825
Total	**44,442**

Total GHG emissions associated with the construction of the Proposed Project, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 44 thousand metric tons.

3.9.7.2 Resilience to Climate Change

As described in detail in Chapter 3.1, "Land Use, Zoning, and Public Policy," the Proposed Project would support the protection of existing land uses in the Project Area and the Study Area that would otherwise

continue to be subject to storm flooding. In addition, by enhancing the resiliency of infrastructure, the Proposed Project would support adopted public policies that apply to the Project Area, including those related to flood protection for existing uses in New York City's developed coastal zone, specifically portions of Lower Manhattan. Finally, it is concluded that the Proposed Project would be consistent with the policies of the New York City WRP and the New York State's CMP and would ensure a more resilient coastal zone for residents, employees, and visitors.