CHAPTER 16: GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

A. INTRODUCTION

As noted in the City Environmental Quality Review (CEQR) Technical Manual, increased concentrations of greenhouse gases (GHGs) are changing the global climate, resulting in 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 felt at the local level. Through PlaNYC, New York City's long-term sustainability program, and enhanced by OneNYC, the City advances sustainability initiatives and goals to both greatly reduce GHG emissions and increase the City's resilience to climate change. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal"). This goal was developed for the purpose of planning for an increase in population of almost one million residents while achieving significant greenhouse gas reductions. Subsequently, the City committed to an 80 percent reduction in greenhouse gases by the year 2050 ("80 x 50"). On November 13, 2014, the City Council passed a bill to reduce citywide greenhouse gas emissions by 80 percent by 2050 (INT. 378) and was codified as Local Law 66 of 2014 on December 14, 2014.

The contribution of a proposed project's GHG emissions to global GHG emissions is likely to be considered insignificant when measured against the scale and magnitude of global climate change. However, certain projects' contribution of GHG emissions still should be analyzed to determine their consistency with the City's GHG reduction goal, which is currently the most appropriate standard by which to analyze a project under CEQR. The GHG consistency assessment focuses on those projects that have the greatest potential to produce GHG emissions that may result in inconsistencies with the GHG reduction goal to a degree considered significant. The *CEQR Technical Manual* recommends that a GHG consistency assessment be conducted for any project resulting in 350,000 square feet (sf) or more of development, and other energy-intense projects.

The Proposed Actions are expected to facilitate the construction of new multi-unit residential buildings, commercial, community facility, and mixed-use buildings, which are expected to result in the development of approximately 3.27 million sf on 30 Projected Development Sites.[1] Therefore, a GHG consistency assessment is warranted. GHG emissions that would be generated as a result of the Proposed Actions are presented in this chapter, along with an assessment of the Proposed Actions' consistency with the citywide GHG reduction goal.

B. PRINCIPAL CONCLUSIONS

It is estimated that the reasonable worst case development scenario (RWCDS) associated with the Proposed Actions would result in approximately 23,730 total metric tons carbon dioxide equivalent (CO_2e) of annual emissions from building operations and 19,787 metric tons of CO_2e emissions from mobile sources annually, for an annual total of approximately 43,517 metric tons of CO_2e emissions.

[1] Pursuant to CEQR, the GHG assessment is based on total GHG emissions associated with a project, rather than the relative increment of a project's GHG emissions as compared to the No-Action scenario.

This represents less than 0.084 percent of the City's overall 2015 GHG emissions of approximately 52.0 million metric tons. It should also be noted that the estimated GHG emissions for the Proposed Actions conservatively do not account for any energy efficiency measures that may be implemented by individual developments on Projected and Potential Development Sites.

The Proposed Actions would advance New York City's GHG reduction goals by virtue of their nature and location, having a relatively strong transit access to this part of Staten Island. By revitalizing and reinforcing the rezoning area, which is served by the Staten Island Ferry (St. George Ferry Terminal), the MTA Staten Island Railway, and nine local bus routes the Proposed Actions support transit-oriented development in New York City. Further, the new buildings facilitated by the Proposed Actions, which would replace existing structures or vacant lots, would be subject to the New York City Energy Conservation Code (NYCECC), which governs performance requirements of heating, ventilation, and air conditioning systems, as well as the exterior building envelope of new buildings. In compliance with this code, new development resulting from the Proposed Actions must meet standards for energy efficiency. Therefore, the Proposed Actions would be consistent with the applicable City's emissions reduction goals of transit-oriented development and construction of new resource- and energy-efficient buildings.

Portions of the rezoning area are located within the existing 100- and 500-year flood zones, and therefore are susceptible to storm surge and coastal flooding. These portions are also located within the 100- and 500-year projections developed by the New York City Panel on Climate Change (NPCC) for the 2020s and 2050s. As most sites developed as a result of the Proposed Actions would not be controlled by the City, addressing resilience for those sites through the Proposed Actions is not practicable. However, all new private developments would still need to be designed in accordance with the New York City Building Code, which includes building code requirements for flood-resistant construction, including freeboard. As such, the Proposed Actions would be consistent with New York City policies regarding adaptation to climate change and no significant adverse climate change impacts would occur as a result of the Proposed Actions.

C. RECOGNIZED GREENHOUSE GASES

GHGs are those gaseous constituents of the atmosphere, both natural and 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. This property causes the general warming of the Earth's atmosphere, or the "greenhouse effect." Some GHGs, such as carbon dioxide, occur naturally and are emitted into the atmosphere through natural processes and human activities. The principal GHGs emitted as a result of human activities are described below.

CARBON DIOXIDE (CO_2)

Carbon dioxide (CO_2) enters the atmosphere via the combustion of fossil fuels (oil, natural gas, and coal), solid waste, trees, and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle. Although not the GHG with the strongest effect per molecule, CO_2 is by far the most abundant and, therefore, the most influential GHG.

METHANE (CH_4)

Methane (CH_4) is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices, as well as by the decay of organic waste in municipal solid waste landfills. Methane, in addition to nitrous oxide (noted below), play an important role since the removal processes for these compounds are limited and they have a relatively high impact on global climate change as compared to an equal quantity of CO_2.

NITROUS OXIDE (N_2O)

Nitrous oxide (N_2O) is emitted during agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste.

FLUORINATED GASES

Hydrofluorocarbons, perfluorocarbons, and Sulfur hexafluoride are powerful synthetic greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone depleting substances (e.g., chlorofluorocarbons [CFCs], hydrochlorofluorocarbons [HCFCs], and halons). These gases are typically emitted in smaller quantities. However, because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (High GWP gases).

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of an Environmental Impact Statement (EIS): CO_2, N_2O, Methane, Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF_6). This analysis focused on CO_2, N_2O, and methane as there are no significant direct or indirect sources of HFCs, PFCs, or SF_6 associated with the Proposed Actions.

GHGs differ in their ability to trap heat. To compare emissions of GHGs, compilers use a weighting factor called a Global Warming Potential (GWP), where the heat trapping ability of one metric ton (1,000 kilograms (kg)) of CO_2 is taken as the standard, and emissions are expressed in terms of CO_2 equivalents (CO_2e), but can also be expressed in terms of carbon equivalents. The GWPs for the main GHGs are presented in Table 16-1.

Table 16-1: Global Warming Potential for Primary Greenhouse Gases

Greenhouse Gas	Common Sources	Global Warming Potential
CO_2- Carbon Dioxide	Fossil fuel combustion, forest clearing, cement production	1
CH_4-Methane	Landfills, production and distribution of natural gas and petroleum, anaerobic digestion, rice cultivation, fossil fuel combustion	21
N_2O- Nitrous Oxide	Fossil fuel combustion, fertilizers, nylon production, manure	310
HFC's-Hydrofluorocarbons	Refrigeration gases, aluminum smelting, semiconductor manufacturing	140-11,700*
PFC's-Perfluorocarbons	Aluminum production, semiconductor manufacturing	6,500-9,200*
SF_6-Sulfur Hexafluoride	Electrical transmissions and distribution systems, circuit breakers, magnesium production	23,900

Source(s): *CEQR Technical Manual (2014).*
Notes: *Since the Second Assessment Report (SAR) was published in 1995, the International Panel on Climate Change (IPCC) has published updated GWP values in its Fifth Assessment Report (AR5) that reflect new information on atmospheric lifetimes of greenhouse gases and an improved calculation of the radiative forcing of CO_2. However, GWP values from the SAR are still used by international convention to maintain consistency in GHG reporting, including by the United States when reporting under the United Nations Framework Convention on Climate Change.*
**The GWPs of HFCs and PFCs vary depending on the specific compound emitted. A full list of these GWPs is available at https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html.*

D. METHODOLOGY

GREENHOUSE GAS EMISSIONS

New York City determined that consideration of GHG emissions is appropriate under CEQR for at least certain projects for several reasons: (a) greenhouse gas emission levels may be directly affected by a project's effect on energy use; (b) the U.S. Supreme Court has upheld the determination that carbon dioxide, one of the main greenhouse gases, is an air pollutant, subject to regulation as defined by the Clean Air Act; and (c) Local Law 22 of 2008 codified PlaNYC's citywide GHG emissions reduction goal of 30 percent below 2005 levels by 2030; (d) Local Law 66 of 2014 codified the City's longer-term goal to reduce GHG emissions to 80 percent below 2005 levels by 2050, and has published a study evaluating the potential for achieving that goal. In accordance with the *CEQR Technical Manual*, the GHG consistency assessment focuses on Proposed Actions that would result in development of 350,000 sf or greater and other energy-intense projects. The Proposed Actions are projected to result in approximately 3.27 million sf of residential, commercial, industrial, community facility and mixed use development at 30 Projected Development Sites.

A project's GHG emissions can generally be assessed in two steps: the first would be to estimate the GHG emissions resulting from the Proposed Actions and the second would be to examine the Proposed Actions in terms of the qualitative goals for reducing GHG emissions, as defined in the *CEQR Technical Manual*. A project's emissions are estimated with respect to the following main emissions sources: on-site operational emissions (direct and indirect); mobile source emissions (direct and indirect); and, when applicable, construction emissions and emissions from solid waste management. After the emissions are estimated, the source of GHG emissions are examined in terms of goals for reducing GHG emissions using qualitative considerations. As defined in the *CEQR Technical Manual*, the qualitative goals that should be assessed, as relevant to the Proposed Actions are: (1) pursuing transit-oriented development; (2) generating clean, renewable power; (3) constructing new

resource- and energy-efficient buildings and/or improving the efficiency of existing buildings; and (4) encouraging sustainable transportation.

Operational emissions and mobile source emissions were considered for this analysis. Pursuant to *CEQR Technical Manual* methodology, the assessment is based on the total GHG emissions associated with the Proposed Actions, rather than the relative increment of the Proposed Actions' GHG emissions as compared to the No-Action condition. Given the lack of specific construction sequences and data for the Projected Development Sites, and as the construction phase is not likely to be a significant part of total emissions resulting from the Proposed Actions, emissions associated with construction of the Proposed Actions have been described qualitatively based on other similar analyses for large building construction. Similarly, because the Proposed Actions are not expected to fundamentally change the City's solid waste management system, an estimate of emissions from solid waste management is not warranted.

BUILDING OPERATIONAL EMISSIONS

According to the *CEQR Technical Manual*, for projects such as a proposed rezoning action, where the action would result in construction on sites that are not under the control of an applicant and where details such as the specific fuel type to be used are unknown, annual GHG emissions should be estimated based on a project's anticipated future floor area. Table 18-5 of the *CEQR Technical Manual* provides the carbon intensities of New York City building types, which were used to calculate annual operations emissions of the Proposed Actions' RWCDS Projected Development Sites.

MOBILE SOURCE EMISSIONS

The number of annual weekday vehicle trips by mode (cars, taxis, and trucks) that would be generated by the Proposed Actions was calculated using the transportation planning assumptions developed for the traffic analysis and presented in Chapter 14, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips by use, the percentage of vehicle trips by mode, and the average vehicle occupancy. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturdays. Average one-way trip distances as shown in Tables 18-6 and 18-7 of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars and taxis. The average truck trip was assumed to be 38 miles as per the *CEQR Technical Manual*. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type.

The projected annual vehicle miles traveled under the RWCDS for the Proposed Actions, forming the basis for the GHG emissions calculations from mobile sources, are summarized in Table 16-2. The mobile GHG emissions calculator was used to obtain an estimate of car, taxi, and truck GHG emissions attributable to the Proposed Actions.

Table 16-2: Proposed Actions' (RWCDS) Annual Vehicle Miles Traveled (miles per year)

Use	Passenger Vehicles	Taxis	Trucks	Total
Residential	18,218,396	221,542	2,242,131	20,682,069
Retail	4,959,232	1,948,270	1,050,253	7,957,755
Office	7,983,266	14,744	1,011,162	9,009,201
Restaurant	2,543,177	0	871,105	3,414,282
Community Facility	919,612	0	37,321	956,934
TOTAL	**34,623,682**	**2,184,585**	**5,211,973**	**42,020,240**

CONSTRUCTION EMISSIONS

Consistent with common CEQR practice, emissions associated with construction under the RWCDS have not been estimated explicitly for the Proposed Actions, but analyses prepared for other development projects in New York City[2] have shown that construction emissions (both direct and emissions embedded in the production of materials, including on-site construction equipment, delivery trucks, and upstream emissions from the production of steel, rebar, aluminum, and cement used for construction) would be equivalent to the total operational emissions from the operation of the buildings over approximately five to ten years. Annualized emissions associated with construction were found to represent approximately five to 10 percent of the overall annual emissions for such projects.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The Proposed Actions would not change the City's solid waste management system. Therefore, pursuant to *CEQR Technical Manual* guidance, GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

CLIMATE CHANGE

According to the *CEQR Technical Manual*, depending on a project's sensitivity, location, and useful life, it may be appropriate to provide a qualitative discussion of the potential effects of climate change on a proposed project in environmental review. Rising sea levels and increases in storm surge and coastal flooding are the most immediate threats in New York City for which site-specific conditions can be assessed, and an analysis of climate change may be deemed warranted for projects at sites located within the existing 100- or 500-year flood zone.

Based on the Federal Emergency Management Agency (FEMA) Preliminary Flood Insurance Rate Maps (FIRMs) issued in 2015 and the NPCC projected sea level rises, portions of the rezoning area are located within the existing 100- and 500-year flood zones, and portions are also located within the NPCC 100-and 500-year projections for the 2020s and 2050s. Therefore, portions of the rezoning area are susceptible to storm surge and coastal flooding, and an assessment of climate change is warranted.

[2] Examples include GHG analyses prepared for the EISs for Riverside Center, and the Domino Sugar Rezoning.

E. PROJECTED GREENHOUSE GAS (GHG) EMISSIONS FROM THE PROPOSED ACTIONS

OPERATIONAL EMISSIONS

Table 16-3 displays the estimated GHG emissions associated with the operational emissions of the Projected Development Sites resulting from the Proposed Actions under the RWCDS. As shown in the table, operational GHG emissions are estimated to be approximately 23,730 metric tons of carbon dioxide equivalents. This represents less than 0.046 percent of the City's overall 2015 GHG emissions of approximately 52.0 million metric tons.[3] It should be noted that the estimated GHG emissions for the Proposed Actions conservatively do not account for any energy efficiency measures that may be implemented by individual developments on Projected Development Sites.

Table 16-3: Annual Operational Emissions—RWCDS Projected Development Sites

Building Type	CTM Carbon Intensity Rates [kg Carbon Dioxide Equivalent/sq.ft]	RWCDS Projected Sites Floor Area (sq.ft)	GHG Emissions (kg)	GHG Emissions (metric tons)
Commercial	9.43	618,583	5,833,238	5,833
Industrial	23.18	0	0	0
Institutional	11.42	84,678	967,023	967
Large Residential	6.59	2,568,971	16,929,519	16,930
Small Residential	4.52	0	0	0
Total Operational GHG Emissions		**3,272,232**	**23,729,780**	**23,730**

Note(s):
Commercial = Office, Retail, Restaurant.
Institutional = All Community Facility uses.
1 metric ton = 1,000 kg.

MOBILE SOURCE EMISSIONS

The number of annual weekday motorized vehicle trips by mode (cars, taxis and trucks) that would be generated by the Projected Development Sites under the Proposed Actions was calculated using the transportation planning assumptions developed for the traffic analysis and presented in Chapter 14, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips by proposed use, the percentage of vehicle trips by mode, and the average vehicle occupancy. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturdays. As stated in Section D, "Methodology," above, annual vehicle miles traveled by cars, taxis, and trucks were calculated in accordance with *CEQR Technical Manual* guidance. As presented in Table 16-2 above, it is estimated that the vehicle trips generated by the Projected Development Sites under the Proposed Actions would travel a total of 42,020,240 miles annually; annual passenger vehicle miles would total 34,623,682, annual taxi vehicle miles would total 2,184,585, and annual truck trip miles would total 5,211,973.

The mobile GHG emissions calculator was used to obtain an estimate of car, taxi, and truck GHG emissions attributable to the Proposed Actions. As shown Table 16-4, annual mobile source

[3] City of New York Inventory of New York City's Greenhouse Gas Emissions, April 2017, by Cventure LLC, Cathy Pasion, Mikael Amar, and Yun Zhou, Mayor's Office of Sustainability, New York, 2017.

emissions related to the Proposed Actions would result in approximately 19,787 metric tons of carbon dioxide equivalents.

Table 16-4: Annual Mobile Source Emissions for 2030–RWCDS

Carbon Dioxide Equivalent (CO_2e) Emissions (metric tons/year)				
Road Type	**Passenger Vehicles**	**Taxis**	**Trucks**	**Total**
Local	2,724.29	154.37	1,967.42	4,846.08
Arterial	5,253.50	296.67	3,436.72	8,986.89
Interstate/Expressway	3,529.25	195.88	2,228.56	5,953.69
TOTAL	**11,507.04**	**646.92**	**7,632.70**	**19,787**

SUMMARY

The total projected GHG emissions from the Projected Development Sites under the Proposed Actions are shown in Table 16-5 below. The estimated total of 43,517 metric tons of GHG emissions is comprised of 23,730 metric tons of CO2e from operational emissions and 19,787 metric tons of CO2e from mobile source emissions, and is approximately 0.084 percent of New York City's 2015 annual total of 52.0 million metric tons. As noted above, the estimated operational GHG emissions for the Proposed Actions conservatively do not include any additional energy efficiency measures that may be implemented by individual developments on Projected Development Sites. As described in Section D, "Methodology," above, construction emissions were not modeled explicitly, but are estimated to be equivalent to approximately five to ten years of operational emissions, including both direct energy and emissions embedded in materials (extraction, production, and transport). The Proposed Actions are not expected to change the City's solid waste management system, and therefore emissions associated with solid waste are not presented.

Table 16-5: Summary of Total Annual GHG Emissions from Projected Development Sites Under the Proposed Actions

Emissions Source	CO_2e Emissions (metric tons)
Operations	23,730
Mobile Sources	19,787
Total	**43,517**

CONSISTENCY WITH THE GHG REDUCTION GOAL

According to the *CEQR Technical Manual*, the assessment of consistency with the City GHG reduction goal should answer the following question: "Is the project consistent with the goal of reducing GHG emissions, specifically the attainment of the City's established GHG reduction goal of reducing citywide GHG emissions by 30 percent below 2005 levels by 2030?" To determine consistency with the City's overall GHG reduction goal, one is to assess consistency with the four major goals as cited in the *CEQR Technical Manual*, as relevant to the project:

- Pursue transit-oriented development;

- Generate clean renewable power through replacement of inefficient power plants with state-of-the-art technology and expanding the use of clean distributed generation (not applicable in the case of the Proposed Actions);

- Construct new resource- and energy-efficient buildings (including the use of sustainable construction materials and practices) and improve the efficiency of existing buildings; and

- Encourage sustainable transportation through improving public transit, improving the efficiency of private vehicles, and decreasing the carbon intensity of fuels.

The Proposed Actions show consistency with these goals in that:

- The proposed rezoning area is well served by public transportation. The area is close to the Staten Island Ferry (St. George Ferry Terminal), the MTA Staten Island Railway, and nine local bus routes. The Proposed Actions would allow increases in density along selected corridors to expand opportunities for affordable housing, as well as directing higher densities to areas that can accommodate future growth, such as those close to rail and bus lines. The Proposed Actions would also map new commercial overlays to incentivize mixed-use development, facilitate active streetscapes, and encourage new retail development to support the anticipated residential development in the area. By collocating retail, office and residential uses, trips can be combined and transit is a more viable transportation mode. By revitalizing and reinforcing the rezoning area, which is well-served by transit facilities and services, the Proposed Actions support transit-oriented development in New York City.

- The Proposed Actions utilize the existing urban infrastructure and would facilitate the development of vacant and underutilized sites.

- By applying Mandatory Inclusionary Housing (MIH) to portions of the Study Area, the Proposed Actions would provide affordable housing opportunities for New Yorkers at a range of income levels and would enhance the quality of life for residents and the community.

- The new buildings facilitated by the Proposed Actions, which would replace existing structures or vacant lots, would be subject to the NYCECC, which comprises the 2016 Energy Conservation Construction Codes of New York State (ECCCNYS) in addition to a series of local laws. The NYCECC governs performance requirements of heating, ventilation, and air conditioning systems, as well as the exterior building envelope of new buildings. In compliance with this code, new development resulting from the Proposed Actions must meet standards for energy efficiency.

- The Proposed Actions would not substantially involve energy-intensive uses such as data centers or web hosting facilities, nor would they remove a source of energy generation. For these reasons, the Proposed Actions would not result in a significant adverse impact on energy systems.

In conclusion, it is expected that there will be no significant adverse GHG impacts resulting from the Proposed Actions. The Proposed Actions are consistent with the City's longer term goal of reducing GHG emissions to 80 percent below 2005 levels by 2050.

F. ADAPTATION TO CLIMATE CHANGE

Since the Projected and Potential Development Sites with the Proposed Actions will be constructed and operated within a coastal floodplain, the potential effects of global climate change on the Proposed Actions have been considered. Standards for analysis of the effects of climate change on a proposed project are still being developed and have not yet been defined in CEQR. However, the Waterfront Revitalization Program (WRP)[4] addresses climate change and sea level rise. The WRP requires consideration of climate change and sea level rise in planning and design of waterfront developments. As set forth in more detail in the *CEQR Technical Manual*, the provisions of the revised WRP are applied by the New York City Department of City Planning (DCP) and other city agencies when conducting environmental review. Since some of the sites included in the Proposed Actions (Bay Street Corridor and the Stapleton Waterfront Phase III Sites) are on or near the waterfront, the potential effects of global climate change on the Projected and Potential Development Sites within these areas are considered, and measures that could be implemented to improve resilience to climate change are identified.

G. DEVELOPMENT OF POLICY TO IMPROVE CLIMATE CHANGE RESILIENCE

In recognition of the important role that the federal government has to play to address adaptation to climate change, a federal executive order signed October 5, 2009 charged the Interagency Climate Change Adaptation Task Force, composed of representatives from more than 20 federal agencies, with recommending policies and practices that can reinforce a national climate change adaptation strategy. The 2011 progress report by the Task Force included recommendations to build resilience to climate change in communities by integrating adaptation considerations into national programs that affect communities, facilitating the incorporation of climate change risks into insurance mechanisms, and addressing additional cross-cutting issues, such as strengthening resilience of coastal, ocean, and Great Lakes communities.[5]

In February 2013, federal agencies released a Climate Action Plan[6] for the first time, outlining a plan for resiliency that includes building stronger and safer infrastructure through agency support in investment, developing standards, and other measures. The plan was followed by an executive order[7] in November 2013 directing agencies to prepare the Nation for impending impacts on the environment brought by climate change and to implement risk management strategies to lessen the harm done by these impacts on the Nation.

In January 2015, a Presidential executive order was issued[8] requiring that federal actions use natural systems and approaches where possible when developing adaptation alternatives for consideration, and redefining the floodplain elevation as either future projected levels; the level that results from adding two feet (or three feet for critical actions) to the current base flood elevation; the "500-year"

[4] City of New York Department of City Planning. *The New York City Waterfront Revitalization Program*. October 30, 2013. Approved by NY State February 3, 2016.
[5] The White House Council on Environmental Quality. Progress Report of the Interagency Climate Change Adaption Task Force: Federal Actions for a Climate Resilient Nation. October, 2011.
[6] Executive Office of the President. *The President's Climate Action Plan*, June 2013.
[7] The White House. Executive Order [13653] – Preparing the United States for the Impacts of Climate Change, November 1, 2013.
[8] The White House. Executive Order [13690] – Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. January 30, 2015.

elevation (elevation of the flood with 0.2 percent probability in any given year); or the level obtained via other methods yet to be developed.

The New York State Sea Level Rise Task Force was created 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.[9] The recommendations are 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.[10] New York State's Community Risk and Resiliency Act (CRRA)[11] requires that applicants to certain State programs demonstrate that they have taken into account future physical climate risks from storm surges, sea-level rise and flooding, and required the New York State Department of Environmental Conservation (DEC) to establish official State sea-level rise projections by January 1, 2016. These projections provide the basis for State adaptation decisions and are available for use by all decision makers. DEC published a draft on November 2, 2015, proposing to adopt existing projections for use (see discussion of NPCC below). CRRA applies to specific State permitting, funding and regulatory decisions, including 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 New York City, the Climate Change Adaptation Task Force is tasked with securing the City's critical infrastructure against rising seas, higher temperatures, and fluctuating water supplies projected to result from climate change. The Task Force is composed of over 35 New York City and State agencies, public authorities, and companies that operate, regulate, or maintain critical infrastructure in New York City. The approaches suggested for the City to create a city-wide adaptation program include ways 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 New York City region[12] which was subsequently updated,[13] and has suggested approaches to create an effective adaptation program for critical infrastructure. The NPCC includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as

[9] New York State Sea Level Rise Task Force. *Report to the Legislature*. December, 2010.
[10] NYSERDA. New York State Climate Action Plan. Interim Report. November, 2010.
[11] Community Risk and Resiliency Act. Chapter 355, NY Laws of 2014. April 9, 2013. Signed September 22, 2014.
[12] 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.
[13] New York City Panel on Climate Change. Climate Risk Information 2013: Observations, Climate Change Predictions, and Maps, June 2013.

well as representatives from the insurance and legal sectors. The climate change projections include a summary of previously published 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 in the range of 11 to 21 inches, with a higher end estimate of up to 30 inches by the 2050s; and in the range of 22 to 50 inches, with a higher end estimate of up to 75 inches by the end of the century (2100). In general, the probability of higher sea levels is characterized as "extremely likely," but there is uncertainty regarding the probability 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 1-in-100 coastal storm surge levels for New York City 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 has also recommended strategies for addressing climate change resilience in buildings and for improving storm water management.[14] 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 to meet the same standards as buildings in the current 100-year flood zone.

The City is currently working with the Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Maps (FIRMs) using the recently acquired detailed Light Detection and Ranging (LiDAR) data.

The New York City Department of Environmental Protection (DEP) is evaluating adaptive strategies for City water and wastewater infrastructure. The City has already developed a *New York City Green Infrastructure Plan,*[15] and a *Sustainable Stormwater Management Plan.*[16] Many of the strategies discussed in these plans would improve the City's resilience to climate change. While strategies and guidelines for addressing the effects of climate change are rapidly being developed on all levels of government, there are currently no specific requirements or accepted recommendations for development projects in New York City.

However, the recently approved revisions to the WRP require consideration of climate change and sea level rise in planning and design of waterfront development. As set forth in more detail in the City's *CEQR Technical Manual*, the provisions of the WRP are applied by city agencies when conducting environmental review, and are described in detail in Chapter 2, "Land Use, Zoning, and Public Policy."

The WRP Policies 6.1 and 6.2 require waterfront developments reviewed under CEQR to consider potential risks to the project related to coastal flooding, including critical electrical and mechanical systems, residential living areas, and public access areas. The policies further require that the developments incorporate design techniques to address these risks. Projects with new structures directly in the water or on the water line should be designed to protect the structures from flooding

[14] New York City Green Codes Task Force. *Recommendations to New York City Building Code*. February 2010.
[15] New York City. New York City Green Infrastructure Plan. September 2010.
[16] New York City. Sustainable Stormwater Management Plan. December 2008.

and storm surge. The shoreline waterfront and habitat should be protected with vegetation and other measures.

Climate change considerations and measures that would be implemented to increase climate resilience are discussed below, addressing the above WRP measures as applicable. If additional climate change considerations are incorporated into state and/or local laws prior to the development of the Projected and Potential Development Sites, any development would be constructed to meet or exceed the codes in effect at the time of construction.

Developments on any of the Projected and Potential Development Sites within the floodplain, must also follow the 2014 New York City Building Code Appendix G "Flood-Resistant Construction". The objectives of the Building Code are similar to the climate change policies described above, including:

- Protecting human life;
- Minimizing damage to structures located in areas of special flood hazard; and
- Minimizing damage to public facilities and utilities.

H. RESILIENCE OF THE PROPOSED PROJECT TO CLIMATE CHANGE

To determine absolute elevations of flood waters that could affect the Proposed Actions, the 2015 FEMA preliminary Flood Insurance Rate Maps (FIRMs) [17] were consulted. The FIRMs denote the Special Flood Hazard Area (SFHA), also known as the 100-year floodplain, or the1% Annual Chance Floodplain. The SFHA includes two zones located within the area affected by the Proposed Actions: AE (1% annual chance floodplain, for which BFEs have been determined), and VE (1% annual chance velocity wave hazard area, in which wave action of 3 feet and higher is expected). The VE zone is located along the shoreline and encompasses piers extending from the shoreline. The Proposed Actions also include areas within the 500-year floodplain, or 0.2% annual chance floodplain, Shaded X flood zone. Across the AE zones, Base Flood Elevations range from 13 to 11 feet NAVD88 (North American Vertical Datum of 1988). Within the VE zones, Base Flood Elevations range from 17 to 12 feet NAVD88.

The FEMA Special Flood Hazard Area does not directly account for sea level increases from climate change. For climate change effects, the NPCC directs that these flood levels should be increased by 30 inches (NPCC 2050) for commercial uses and 75 inches (NPCC 2100) for critical infrastructure and residential uses.

As shown in Figure 9-5 of Chapter 9, "Natural Resources," the 100-year floodplain zone AE covers most of the southern half of the Bay Street Corridor and almost all of the Stapleton Waterfront Phase III Sites. The 100-year flood zone VE covers the extreme eastern edges of the Stapleton Waterfront Phase III Sites. The Canal Street Corridor and the City Disposition Sites are located outside the 500-year floodplain entirely.

[17] FEMA, Region II Coastal Analysis and Mapping Flood Hazard Mapping Tool http://www.region2coastal.com/view-flood-maps-data/what-is-my-bfe-address-lookup-tool/

Since most sites would be developed as a result of the Proposed Actions but would not otherwise be controlled by the City, addressing resilience for those sites through the Proposed Actions is not practicable. However, all new private developments would still need to be designed in accordance with the New York City Building Code, which includes building code requirements for flood-resistant construction, including freeboard.

The Stapleton Waterfront Phase III Sites are currently located within the Special Flood Hazard Area with Base Flood Elevations ranging from 13 feet to 12 feet NAVD88. Any sites located within a current or future designated Special Flood Hazard Area would be designed in accordance with the New York City Building Code requirements for flood-resistant construction. All residential units would be constructed above the designated Design Flood Elevation. All critical infrastructure such as generators, pumps, fuel storage, electrical and communications connections would be constructed above the appropriate Design Flood Elevations, or otherwise sealed or protected so as to be substantially impermeable to flooding. The City, through a future Land Disposition Agreement (LDA) for the Stapleton Waterfront Phase III Sites, could require a commitment to design the developments on these sites to accommodate potential flooding up to a future expected Design Flood Elevation based on projected Sea Level Rise projections.

All Projected and Potential Development Sites under the Proposed Actions with commercial space at elevations below current flood elevations will be dry-flood proofed to accommodate flooding up to the designated Design Flood Elevation.

Based on the above review, the Proposed Actions would be consistent with New York City policies regarding adaptation to climate change and no significant adverse climate change impacts would occur as a result of the Proposed Actions.