Chapter 17: Greenhouse Gas Emissions

A. INTRODUCTION

This chapter addresses the greenhouse gas (GHG) emissions that would be generated by the proposed project and measures that could be implemented to limit those emissions, as well as measures that could be taken to increase the proposed project's resilience to the potential effects of climate change.

There is general consensus in the scientific community that the global climate is changing as a result of increased concentrations of GHGs in the atmosphere. GHGs are those gaseous constituents of the atmosphere, from both natural and anthropogenic emission sources (i.e., resulting from the influence of human beings), that absorb infrared radiation (heat) emitted from the earth's surface, the atmosphere, and clouds. This property causes the general warming of the earth's atmosphere, or the "greenhouse effect."

As discussed in the *City Environmental Quality Review (CEQR) Technical Manual*, climate change could 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 felt at the local level. Through PlaNYC, the City has established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change in the City.

Per the *CEQR Technical Manual*, the citywide 2030 GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The *CEQR Technical Manual* recommends that a GHG consistency assessment be conducted for any project resulting in 350,000 square feet (sf) of development or more and other energy-intense projects. The proposed project would result in over one million gross square feet (gsf) of developed floor area and would include substantial energy systems. Accordingly, A GHG consistency assessment is provided. In addition, given the coastal location of the proposed project, an assessment of the proposed project's resilience in the face of future climate conditions is provided as well.

PRINCIPAL CONCLUSIONS

The project will be designed to meet New York City Energy Conservation Code requirements and is committed to reducing energy consumption. The building energy use and the vehicle use associated with the proposed project are estimated to result in up to approximately 34,000 metric tons of carbon dioxide equivalent (CO_2e) emissions per year. The proposed project is committed to achieving energy efficiency commensurate with achieving certification under the Leadership in Energy and Environmental Design (LEED) system or equivalent for Buildings 1 through 5 and Building 8, and Buildings 6 and 7 would meet the energy requirements of the Enterprise Green Communities Criteria or equivalent. The LEED certified or equivalent requirements would reduce energy expenditure by at least 10 percent as compared to baseline buildings meeting the New York City Energy Conservation Code requirements, and the Enterprise Green Communities Criteria or equivalent would require a 15 percent improvement in energy

performance over the baseline. Energy efficiency design measures could potentially reduce building energy and associated emissions by up to roughly 40 percent by including energy efficiency and other design options. Additional GHG emissions associated with the production of materials to be used by the proposed project could also be reduced by the selection of lower-carbon alternatives where practicable. The proximity of the proposed project to public transportation also contributes to energy efficiency.

Based on the above commitment to energy efficiency and the design and location of the proposed project, the proposed project would be consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*.

In addition, the proposed project is being designed to meet all current building code requirements regarding potential flooding elevations and would comply with applicable building code requirements in the future. The Applicant is also committed to elevating critical infrastructure and to design flood protection measures for critical infrastructure that is required to be at ground or subgrade levels so as to prepare for future severe storm flood levels which would exceed current conditions due to sea level rise.

B. GHG EMISSIONS

POLLUTANTS OF CONCERN

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." Water vapor, carbon dioxide (CO_2), nitrous oxide, methane, and ozone are the primary greenhouse gases in the Earth's atmosphere.

There are also a number of entirely anthropogenic (resulting from human activity) greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (contributing 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 project-related GHG assessments for most projects. Although ozone itself is also a major greenhouse gas, 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 (see Chapter 16, "Air Quality").

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 nitrous oxide also 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. 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 an Environmental Impact Statement (EIS): CO_2, nitrous oxide (N_2O), methane, Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF_6). This analysis focuses mostly on CO_2, N_2O, and methane. 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 carbon dioxide equivalent (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 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 here are presented in **Table 17-1**.

Table 17-1
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

Source: *2012 CEQR Technical Manual*
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.

POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS FOR REDUCING GHG EMISSIONS

As a result of the growing consensus that human activity resulting in GHG emissions has the potential to profoundly impact the earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both global and local measures addressing energy consumption and production, land use, and other sectors. Although the U.S. has not ratified the international agreements which set emissions targets for GHGs, in a step toward the development of national climate change regulation, the U.S. has committed to reducing emissions to 17 percent lower than 2005 levels by 2020 and to 83 percent lower than 2005 levels by 2050 (pending legislation) via the Copenhagen Accord.[1] Without legislation focused on this goal, the U.S. Environmental Protection Agency (EPA) is required to regulate greenhouse gases under the Clean Air Act (CAA), and has already begun preparing and implementing regulations. For example, on

[1] Todd Stern, U.S. Special Envoy for Climate Change, letter to Mr. Yvo de Boer, UNFCCC, January 28, 2010.

March 27, 2012, EPA proposed a Carbon Pollution Standard for New Power Plants that would, for the first time, set national limits on the amount of carbon pollution that power plants can emit. EPA expects to expand this program in the future to limit emissions from additional stationary source. In coordination with the National Highway Traffic Safety Administration (NHTSA), EPA has also begun to regulate GHG emissions from newly manufactured on-road vehicles. In addition, EPA regulates transportation fuels via the Renewable Fuel Standard program, which will phase in a requirement for the inclusion of renewable fuels increasing annually up to 36.0 billion gallons in 2022.

There are also regional, state, and local efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, establishing a goal of reducing GHG emissions in New York State by 80 percent, compared to 1990 levels, by 2050, and creating a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal (that effort is currently under way[1]). The 2009 New York State Energy Plan[2] outlines the state's energy goals and provides strategies and recommendations for meeting those goals (a new plan will be published on or before March 15, 2013). The state's goals include:

- Implementing programs to reduce electricity use by 15 percent below 2015 forecasts;
- Updating the energy code and enacting product efficiency standards;
- Reducing vehicle miles traveled by expanding alternative transportation options; and
- Implementing programs to increase the proportion of electricity generated from renewable resources to 30 percent of electricity demand by 2015.

New York State has also developed regulations to cap and reduce CO_2 emissions from power plants to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of 10 northeastern and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit, gradually reducing emissions to 10 percent below the 2009 levels by 2018. The 10 RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments worldwide, including New York City, are participating in the Cities for Climate Protection™ (CCP) campaign and have committed to adopting policies and implementing quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability. New York City's long-term sustainability program, PlaNYC 2030, includes GHG emissions reduction goals, 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 was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[3] The City has also announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050, and is currently engaged in the preparation of a plan to achieve that goal. For certain projects subject to CEQR (e.g., projects with 350,000 gsf or more of development or other energy intense projects), an analysis of the projects' contribution of GHG emissions is required to determine their consistency with the City's citywide reduction goal,

[1] http://www.dec.ny.gov/energy/80930.html

[2] New York State, *2009 New York State Energy Plan*, December 2009.

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

which is currently the most appropriate standard by which to analyze a project under CEQR, and is therefore applied in this chapter.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in new and existing buildings, in accordance with PlaNYC. The laws require owners of existing buildings larger than 50,000 sf to conduct energy efficiency audits every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using an EPA online tool. By 2025, commercial buildings over 50,000 sf will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Code, which along with the New York State Energy Conservation Code (as updated in 2010), requires equipment installed during a renovation to meet current efficiency standards.

A number of benchmarks for energy efficiency and "green building" design have also been developed. For example, the LEED system is a benchmark for the design, construction, and operation of high performance "green buildings" that includes energy efficiency components. Similarly, the Enterprise Green Communities Criteria identify "green building" criteria for affordable housing, including energy efficiency design measures.

EPA's Energy Star is a voluntary labeling program designed to identify and promote the construction of new energy efficient buildings, facilities, and homes and the purchase of energy efficient appliances, heating and cooling systems, office equipment, lighting, home electronics, and building envelopes.

METHODOLOGY

Although the contribution of any single project's emissions to climate change is infinitesimal, the combined GHG emissions from all human activity are severely impacting 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 generated by the proposed project is based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs from the proposed project have been quantified, including off-site emissions associated with use of electricity, on-site emissions from heat and hot water systems, and emissions from vehicle use attributable to the proposed project. GHG emissions that would result from construction and renovation of the proposed project are discussed as well.

CO_2 is the primary pollutant of concern from anthropogenic emission sources and is accounted for in the analysis of emissions from all development projects. GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as metric tons of carbon dioxide equivalent (CO_2e) emissions per year (see "Pollutants of Concern," above).

BUILDING OPERATIONAL EMISSIONS

Emissions due to electricity and fuel oil use were developed using estimates of energy consumption developed specifically for the proposed project by the project engineers and the emission factors referenced in the 2010 inventory of GHG emissions for New York City.[1] The energy consumption rates are estimated at 190,283 and 160,917 million British thermal units (BTU) per year of natural gas and electricity, respectively.

MOBILE SOURCE EMISSIONS

The number of annual weekday vehicle trips by mode (cars, taxis, trucks, and ambulances) that would be generated by the proposed project was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 15, "Transportation." The assumptions used in the calculation include average daily weekday person trips and delivery trips by proposed use, the percentage of vehicle trips by mode, and the average vehicle occupancy. To calculate annual totals, Saturday and Sunday trips for all uses were assumed to be five percent of weekday trips. Travel distances shown in Table 18-4 of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. The average truck trip was assumed to be 38 miles, as per the *CEQR Technical Manual*. Table 18-6 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator was used to obtain an estimate of car, taxi, and truck GHG emissions attributable to the projects.

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are more than 20 percent of the tailpipe emissions.[2] Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial 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, and as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis for the proposed project. The assessment of tailpipe emissions only is in accordance with the *CEQR Technical Manual* guidance on assessing GHG emissions and the methodology used in developing the New York City GHG inventory, which is the basis of the GHG reduction goal.

The projected annual vehicle miles traveled for the proposed land uses, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 17-2**.

Table 17-2
Annual Vehicle Miles Traveled (miles per year, 2022)

Use	Passenger Vehicle	Taxi	Truck	*Total*
Residential	14,947,546	955,861	1,734,511	*17,637,918*
Supermarket	203,437	354,252	109,244	*666,933*
Local Retail	121,034	357,655	139,960	*618,649*
Open Space	8,904	0	610	*9,514*
Total	**15,280,920**	**1,667,768**	**1,984,325**	***18,933,014***

[1] The City of New York Mayor's Office of Long-Term Planning and Sustainability, *Inventory of New York City Greenhouse Gas Emissions*, December 2012.

[2] Environmental Protection Agency, *MOVES2004 Energy and Emission Inputs*, Draft Report, EPA420-P-05-003, March 2005.

CONSTRUCTION EMISSIONS

Emissions associated with construction have not been estimated explicitly for the project, but analyses of similar projects 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) are equivalent to the total emissions from the operation of the projects over approximately 5 to 10 years.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The proposed project would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

PROJECTED GHG EMISSIONS FROM THE PROPOSED PROJECT

BUILDING OPERATIONAL EMISSIONS

The fuel consumption, emission factors, and resulting GHG emissions from the proposed project are presented in detail in **Table 17-3**. Note that these represent a baseline estimate of building energy consumption without accounting for the proposed project's commitment to energy efficiency, which would reduce energy expenditure by at least 10 percent and could potentially reduce building energy and associated emissions by up to roughly 40 percent by including energy efficiency and other design options. (See discussion below, "Elements of the Proposed Project that would Reduce GHG Emissions.")

Table 17-3
Building Operational Emissions (2022)

	Natural Gas	Electricity
Annual Fuel Consumption (million Btu)	192,011	160,917
Emission Factor (metric tons/million Btu) *	0.0532	0.0874
GHG Emissions (metric tons CO_2e/year)	10,115	14,069
Total	***24,276***	
Note: * From PlaNYC inventory (for 2011)		

MOBILE SOURCE EMISSIONS

The detailed mobile source related GHG emissions from each of the project components are presented in detail in **Table 17-4**.

Table 17-4
Annual Mobile Source Emissions (metric tons CO_2e, 2022)

Use	Passenger Vehicle	Taxi	Truck	*Total*
Residential	5,683	324	2,650	8,657
Supermarket	77	120	167	364
Local Retail	46	121	214	381
Open Space	3	<1	<1	4
Total	***5,810***	***565***	***3,032***	***9,407***

SUMMARY

A summary of GHG emissions by source type is presented in **Table 17-5**. The operational emissions from building energy use include on-site emissions from fuel consumption as well as emissions associated with the production and delivery of the electricity to be used on-site. As described in the "Methodology" section above, construction emissions were not modeled explicitly, but are estimated to be equivalent to approximately 5 to 10 years of operational emissions, including both direct energy and emissions embedded in materials (extraction, production, and transport). The proposed project is not expected to fundamentally change the City's solid waste management system, and therefore emissions associated with solid waste are not presented.

Table 17-5
Summary of GHG Emissions (metric tons CO2e, 2022)

Source	Annual Emissions
Building Operations	24,276
Mobile	9,407
TOTAL	**33,682**

ELEMENTS OF THE PROPOSED PROJECT THAT WOULD REDUCE GHG EMISSIONS

The proposed project would include a number of sustainable design features which would, among other benefits, result in lower GHG emissions. In general, the dense nature of the proposed project and access to transit and existing roadways are both features consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of new development and with the PlaNYC goals as outlined in the *CEQR Technical Manual*. Some other consistent measures are described below.

BUILD EFFICIENT BUILDINGS

The proposed project is committed to achieving energy efficiency commensurate with achieving certification under the LEED system or equivalent for Buildings 1 through 5 and Building 8, and Buildings 6 and 7 would meet the energy requirements of the Enterprise Green Communities Criteria or equivalent. The LEED requirements or equivalent would reduce energy expenditure by at least 10 percent as compared to baseline buildings meeting the New York City Energy Conservation Code requirements, and the Enterprise Green Communities Criteria or equivalent would require a 15 percent improvement in energy performance over the baseline. Energy efficiency design measures could potentially reduce building energy and associated emissions by up to roughly 40 percent by including energy efficiency and other design options. The proposed project will also be designed to increase interior daylighting.

USE CLEAN POWER

Buildings may utilize natural gas, but fuel choice is uncertain at this time.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proposed project is located in an area supported by many transit buses and will support some additional ~~facilities~~ areas for bus layover. In addition, preliminary discussions have taken place between the Applicant and the Metropolitan Transportation Authority–New York City Transit (MTA–NYCT) on potentially increasing bus service and/or extending routes as the

project sites are occupied, subject to MTA-NYCT approval and fiscal and operating constraints. The site will include multi-use paths and will include bicycle storage as required by law.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction will include an extensive diesel emissions reduction program including diesel particle filters for large construction engines and other measures. These measures will reduce particulate matter emissions; while particulate matter is not included in the list of standard GHGs ("Kyoto gases"), recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Some recycled steel would likely be used as most steel used in construction is recycled. Similarly, it is likely that some fly ash or other cement replacements would be used. The proposed project would require the use of certified sustainable wood products for the boardwalk esplanade. Building materials extracted and/or manufactured within the region, and materials with recycled content will be used to the extent practicable.

CONCLUSION

The project will include some measures which would result in reductions in energy use and the use of sustainable transportation. Based on the above commitment to energy efficiency and the design and location of the proposed project, the proposed project would be consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*.

C. ADAPTATION TO CLIMATE CHANGE

Since most of the proposed project is located within the current 100-year floodplain (see Chapter 10, "Natural Resources," for a full description of the current flood conditions), the potential effects of global climate change on the proposed project have been considered.

Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in CEQR. However, the recently proposed revisions to the Waterfront Revitalization Program (WRP)[1] address climate change and sea level rise. If finalized, the WRP would require consideration of climate change and sea level rise in planning and design of waterfront development. As set forth in more detail in the *CEQR Technical Manual*, the provisions of the WRP are applied by the New York City Department of City Planning (DCP) and other city agencies when conducting environmental review. Since the proposed site is on the waterfront, the potential effects of global climate change on the proposed project are considered and measures that could be implemented as part of the project to improve its resilience to climate change are discussed.

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 representative from more than 20 federal agencies, with recommending policies and practices that can reinforce a national climate change adaptation strategy. A recent report by the Task Force included recommendations to build resilience to climate

[1] City of New York Department of City Planning, The New York City Waterfront Revitalization Program: Proposed Revisions for Public Review, March 2012, http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml

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.[1]

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 has prepared a final report of its findings and recommendations including protective and adaptive measures.[2] 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 will also include strategies for adapting to climate change. The 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.[3]

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,[4] updated in June 2013,[5] and has suggested approaches to create an effective adaptation program for critical infrastructure.[6] 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 ~~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. The NPCC projects that sea levels are likely to increase by ~~12~~11 to ~~23~~24 inches by the ~~end~~ middle of the century (2050s middle range, 25th to 75th percentile), with possible increase up to ~~55~~31 inches (high estimate, 90th percentile) ~~in the event of rapid ice melt~~. While the 2013 update did not include 2080s data,

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[1] The White House Council on Environmental Quality, Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National climate Change Adaptation Strategy, October, 2010.

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

[3] NYSERDA, New York State Climate Action Plan Interim Report, November, 2010.

[4] New York City Panel on Climate Change, *Climate Risk Information*, February 2009.

[5] New York City Panel on Climate Change, *Climate Risk Information 2013*, June 2013.

[6] 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.

based on 2009 NPCC report, sea levels could rise by up to 55 inches by 2080s. Local Law 42 of 2012 requires updates to climate projections at least every three years. In general, the probability of ~~higher~~ sea level~~s~~ rise is characterized as "extremely likely" (>95% probability of occurrence). ~~, but there is high uncertainty regarding the probability of a rapid ice melt scenario.~~ 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 ~~(excluding the rapid ice melt scenario)~~, and do not account for changes in storm frequency. Regardless of the frequency of the storms, the frequency of flooding events would increase because the sea level rise would result in flooding due to lesser storms, such that the current flood with 1 percent chance of occurring in any given year would have a 5 percent chance of occurring in any given year by mid-century, and higher by the end of the century.

In the wake of Hurricane Sandy, Mayor Bloomberg convened the Special Initiative for Rebuilding and Resiliency (SIRR) and charged it with analyzing the impacts of the storm on the city's buildings, infrastructure, and people; assessing the risks the city faces from climate change; and outlining ambitious, comprehensive, but achievable strategies for increasing resiliency citywide. The Mayor also asked SIRR to develop proposals for rebuilding the areas hardest hit by Sandy—the Brooklyn-Queens Waterfront, the East and South Shores of Staten Island, South Queens, Southern Brooklyn, and Southern Manhattan. SIRR published the City's resiliency policy, entitled *A Stronger, More Resilient New York*, in June 2013. Although the plan outlines a general approach for coastal protection throughout the city, the plan does not yet outline specific measures in the area of the proposed project.

~~The New York City Green Code Task force has also recommended strategies for addressing climate change resilience in buildings and for improving stormwater management.[1] 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 develop flood maps that reflect projected sea level rise and increases in coastal flooding through 2080 and 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*[2], and a *Sustainable Stormwater Management Plan.*[3] Many of the strategies discussed in these plans would improve the City's resilience to climate change.

Overall, strategies and guidelines for addressing the effects of climate change are rapidly being developed on all levels of government. However, there are currently no specific requirements or accepted recommendations for development projects in New York City. However, the recently proposed revisions to the WRP, if finalized, would require consideration of climate change and sea level rise in planning and design of waterfront development. As set forth in more detail in

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

[2] New York City, New York City Green Infrastructure Plan, September 2010.

[3] New York City, Sustainable Stormwater Management Plan, December 2008.

the City's *CEQR Technical Manual*, the provisions of the WRP are applied by DEP and other city agencies when conducting environmental review. The proposed WRP revisions, among other provisions,[1] would require waterfront developments to:

- Consider potential risks related to coastal flooding to features specific to the project, including but not limited to critical electrical and mechanical systems, residential living areas, and public access areas;
- Minimize losses from flooding and erosion by employing non-structural and structural management measures appropriate to the condition and site, the use of the property to be protected, and the surrounding area;
- Integrate consideration of the latest New York City projections of climate change and sea level rise (as published by the NPCC, or any successor thereof) into the planning and design of projects in the city's Coastal Zone;
- Incorporate design techniques in projects that address the potential risks identified and/or which enhance the capacity to incorporate adaptive techniques in the future. Climate resilience techniques should aim to protect lives, minimize damage to systems and natural resources, prevent loss of property, and, if practicable, promote economic growth and provide additional benefits such as provision of public space and intertidal habitat;
- The project should also provide a qualitative analysis of potential adverse impacts on existing resources (including ecological systems, public access, visual quality, water-dependent uses, infrastructure, and adjacent properties) as a result of the anticipated effects of climate change;
- Projects that involve construction of new structures directly in the water or at the water line should be designed to protect inland structures and uses from flooding and storm surge when appropriate and practicable;
- As appropriate and to the extent practicable:
  - Promote the greening of the waterfront with a variety of plant material for aesthetic and ecological benefit;
  - Use water- and salt-tolerant plantings in areas subject to flooding and salt spray;
  - Maximize water-absorption functions of planted areas;
  - Preserve and enhance natural shoreline edges;
  - Design shoreline edges that foster a rich marine habitat; and
  - Design sites that anticipate the effects of climate change, such as sea level rise and storm surges.

Climate change considerations may be incorporated into state and/or local laws prior to the development of the proposed project, and any development would be constructed to meet or exceed the codes in effect at the time of construction. Nonetheless, since the proposed project is located within the current 100-year floodplain ~~1 in 100 flood zone~~, climate change considerations and measures that could be implemented to increase climate resilience are discussed, addressing the above proposed WRP measures as applicable.

[1] Full details of the requirements can be found at http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml; the most relevant details are in Policy Six.

RESILIENCE OF THE PROPOSED PROJECT TO CLIMATE CHANGE

In reviewing the potential climate related impacts and resilience measures discussed above, the only issue for which the project can prepare, within its context and location, is potential future flooding, *i.e.*, designing the project to withstand and recover from flooding and to ensure that hazardous materials and other potentially dangerous items would not end up in floodwaters. This section discusses the project's approach to these items.

In 2007, the Federal Emergency Management Agency (FEMA) ~~has~~ identified the flood elevation of 10.8 feet National Geodetic Vertical Datum (NGVD) 1929 (or 8.1 feet Queens Borough Highway Datum, or QBHD)[1] as the elevation of the current 100-year floodplain.[2] ~~level at which there is a 1 percent chance of flooding in any given year (the 1 in 100 flood) in this area More recently, FEMA has re-evaluated existing flood elevations and released Advisory Base Flood Elevations (ABFEs) indicating that base flood elevation for the WF Parcel would be 11.4 to 13.4 feet QBHD, an approximately 5 foot increase over the currently applicable 1 in 100 flood elevation at the WF Parcel.~~ FEMA released ~~Advisory Base Flood Elevations (ABFEs)~~ new preliminary work FIRMs in June 2013 that precede the future publication of new duly adopted FIRMs, representing the Best Available Flood Hazard Data (BAFHD) at this time, indicating that ~~base flood elevation~~ the current 100-year floodplain at the WF Parcel on the project site ~~would likely rise several~~ is approximately 3 feet above the currently applicable 100-year floodplain as set forth in the existing FEMA flood insurance rate maps (FIRMs)—11.4 feet QBHD. FEMA encourages communities to use the BAFHD when making decisions about floodplain management and post-Hurricane Sandy recovery efforts. In addition, the New York City Zoning Resolution is currently proposed to be amended to allow projects to continue to account for higher base flood elevations (BFEs) set forth in the preliminary work FIRMs for height and other zoning requirements. These BFEs are higher than previously permitted under the definition of base plane and base flood elevation in the Zoning Resolution, which referred to the existing 100-year floodplain as set forth in the existing FEMA FIRMs. In addition, the NPCC has projected that by ~~the end of the~~ mid-century sea level will rise by 1.0 to ~~1.9~~ 2.0 feet (2050s middle range, 25th to 75th percentile), ~~with~~ and by 2080s up to up to 55 inches,[3] resulting in a future 100-year floodplain of up to 16 feet QBHD.~~a higher level of up to 4.6 feet in the event of rapid ice melt.~~

~~The Applicant will likely raise the base plane of the proposed buildings to a higher elevation to maintain compliance with zoning and construction codes, which are based off of base flood elevation.~~ Under the currently contemplated plans accounting for the preliminary work FIRMs, the finished floor elevations for the residential and retail uses proposed for the WF Parcel along the East River would be about 3 feet above the BAFHD. Based on the above data, any subgrade project systems would be lower than current severe flooding event levels, and in future conditions, severe flood levels could reach the ground floor levels of all buildings. ~~Regarding residential elevations, the vast majority of residential units will~~ Under the plans accounting for the BAFHD, the proposed project would be ~~well~~ above the projected ~~future~~ mid-century 100-year flood elevation. ~~1 in 100 flood levels. The residential uses closest to the 1 in 100 flood~~

[1] FEMA maps round this number to 11 feet NGVD, which is equivalent to 8.3 QBHD.

[2] FEMA, Flood Insurance Study—City of New York, 340497V000A, Revised September 5, 2007.

[3] While the NPCC 2013 update does not yet include 2080s data, the mid-range levels for 2020s and 2050s are equivalent to the previously projected "rapid ice melt" scenario.

~~elevation the proposed townhouses on the WF Parcel and on the Eastern Parcel~~ The proposed project would be approximately 3 feet above current 1-in-100 flood level (BAFHD), which would still be above the projected sea level rise central estimate of 1.0 to ~~1.9~~ 2.0 feet by mid-century, but may be within the range of end-of-century 100-year flood levels. The proposed buildings would be flood-proofed and would utilize flood barriers on an as needed basis (i.e., before predicted severe storm events). In the event that BAFHD are updated by FEMA prior to construction that raises the projected base flood elevation, the proposed project would comply with these flood elevations if required by the *New York City Building Code*. ~~Building lobbies and the ground floor retail spaces, which are approximately 2 inches above the current ABFE 1-in-100 flood elevation, would be flood-proofed and would utilize temporary flood barriers, installed on an as needed basis (i.e., in preparation for predicted severe storm events); this could protect lobbies and subgrade areas from flooding in severe storms in the near future (current conditions).~~

The proposed project is being designed to meet all current building code requirements regarding potential flooding elevations and would comply with applicable building code requirements in the future. Moreover, the proposed project is taking a proactive approach to planning infrastructure resilience to flooding in general, including future sea level rise. The Applicant is also committed to elevating critical infrastructure above the ~~1 in~~ 100-year flood elevation or, in cases where infrastructure is required to be at lower levels by building code, to be sealed. To the extent practicable and feasible, the proposed project would elevate emergency generators, fuel pumps, and water, electricity, and gas distribution well above future flood levels and flood-protect those utility connections and fuel tanks that are required to be at lower elevations. ✷