Chapter 17: Climate Change and Greenhouse Gas Emissions

A. INTRODUCTION

The Phased Redevelopment of Governors Island (the Proposed Project) would expand and improve considerable amounts of publicly accessible open space on the Island, retenant a number of historic structures, and introduce new uses and buildings in two designated development zones. As described in Chapter 2, "Analytical Framework," two potential development scenarios—the Mixed-Use Option (MUO) and the University/Research Option (URO)—have been identified for the Later Phases—Island Redevelopment component of the Proposed Project, which would result in up to 3 million square feet of new development.

There is general consensus in the scientific community that the global climate is changing as a result of increased concentrations of greenhouse gases (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," which in turn affects sea level and global and local climate, resulting in changes in many environmental and human systems.

Through PlaNYC, the City has established initiatives and goals for both greatly reducing GHG emissions and adapting to climate change in New York City. The goal to reduce citywide GHG emissions 30 percent below 2005 levels by 2030 was codified in Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[1] Per the 2010 *CEQR Technical Manual,* the significance of a project's contribution to GHG emissions is assessed by examining the projected emissions and assessing the project in relation to qualitative goals for reducing GHG emissions outlined in the *CEQR Technical Manual*, and thus assessing the project's consistency with the GHG reduction goal.

The City is also engaged in several initiatives to assess potential local impacts of global climate change and develop strategies to make existing and proposed infrastructure and development citywide more resilient to the effects of climate change. The Proposed Project includes improvements that would increase the Island's resilience to current weather conditions and to some extent, the potential effects of climate change. Additional strategies for protecting infrastructure and the future buildings associated with Later Phases-Island Redevelopment component of the Proposed Project have also been identified—as needed, these would be implemented based on future regulations and guidance.

This chapter discusses the emissions of GHGs that would potentially result from the Proposed Project, the measures that could be implemented to reduce those emissions, as well as the measures that would be taken to increase the Proposed Project resilience to the potential effects of climate change.

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

B. PRINCIPAL CONCLUSIONS

As discussed in the following sections, the building energy use and transportation associated with the Proposed Project (Phase 1 and Later Phases combined) would result in approximately 52,761 metric tons of carbon dioxide equivalent (CO_2e) emissions per year with the URO, which was determined to result in more GHG emissions than the MUO, due to the more intensive energy consumption expected from academic and research uses, and the greater number of total projected vehicle trips. Emissions from Phase 1 stem only from transportation to and from the Proposed Project since Phase 1 would not include any new buildings. As the number of trips to and from the Proposed Project in the Later Phases would far exceed the number of trips in Phase 1, emissions for Phase 1 would be well below the calculated emissions for the full project.

The Master Plan has accounted for the projected 2-foot sea level rise reducing the Island's vulnerability to storm surges as compared to existing conditions, by designing the new topography on the island for Phase 1 at 4 feet above the current 1-in-100 year flood levels, including an additional 2 feet to elevate tree roots above saltwater levels during severe storms. In addition, saltwater tolerant plant species will be used in low lying areas where practicable.

The Later Phases-Island Redevelopment has not yet been designed in detail. However, the final design will incorporate design measures such as raising the grade and/or protective measures such as storm barriers and sealed critical infrastructure designed to accommodate a 2-foot increase in the 1-in-100 year storm level by the end of the century, or the most recent appropriate level based on the best information available at the time final designs are made. As detailed local climate change projections become available and are adopted into the City's infrastructure design criteria, such criteria would be incorporated into the Later Phases-Island Redevelopment component of the Proposed Project.

The vast majority of the greenhouse gas emissions would be associated with building use and with ferry service which would need to be expanded to accommodate the uses in the Later Phases. The Development Areas will be designed to incorporate climate resilience and energy efficiency measures in the future when undertaking detailed design. The Trust and/or future applicant will analyze the climate resilience of the Development Areas and the GHG emissions from building and the ferry service in the Later Phases as part of future environmental review, and will ensure that the implementation of the Later Phases are developed in a manner consistent with the GHG reduction goal.

C. GHG EMISSIONS

POLLUTANTS OF CONCERN

The GHGs identified for analysis in the *CEQR Technical Manual* include the six internationally recognized GHGs regulated under the Kyoto Protocol (an international agreement adopted in 1997 that is linked to the United Nations Framework Convention on Climate Change): carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 is the primary pollutant of concern from anthropogenic emission sources and is accounted for in any analysis of emissions from 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, consistent with the New York City annual inventory.[1] CO_2e is a sum which includes the quantity of each GHG weighted by its effectiveness as a GHG 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). The GWP accounts for the lifetime and the radiative forcing of each gas 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 are presented in **Table 17-1**.[2]

Table 17-1
Global Warming Potential (GWP) for Major GHGs

Compound	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

Sources: IPCC, Climate Change 1995—The Science of Climate Change: Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change, 1996.

* The GWPs of HFCs and PFCs vary depending on the specific compound emitted. A full list of these GWPs is available in—

EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2008*, Table ES-1, www.epa.gov/climatechange/emissions/usinventoryreport.html

POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS

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.

In the U.S., The Energy Independence and Security Act of 2007 includes provisions for increasing the production of clean renewable fuels, increasing the efficiency of products, buildings, and vehicles, and for promoting research on greenhouse gas capture and storage options. The American Recovery and Reinvestment Act of 2009 (ARRA, "economic stimulus package") funds actions and research that can lead to reduced GHG emissions.

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, in June 2009 the U.S. House of Representatives passed the American Clean Energy and Security Act (ACES, "cap and trade bill"). The proposed legislation would place a national cap on GHG emissions, resulting in the gradual reduction of emission from large sources (accounting for approximately 85 percent of the U.S. GHG emissions) to 17 percent lower than 2005 levels by 2020 and to 83 percent lower than

[1] Mayor's Office of Long-Term Planning and Sustainability, *Inventory of New York City Greenhouse Gas Emissions*, September 2010.

[2] Following standard protocol for greenhouse gas inventories, and consistent with New York City's GHG inventory, the GWP factors from IPCC's Second Assessment Report (1996) are used. These GWP factors are specified for use for national GHG inventories under the Kyoto Protocol.

2005 levels by 2050. The U.S. has committed to this level of emissions reduction (pending legislation) via the Copenhagen Accord.[1] Although this legislative activity is still in progress, without such legislation EPA would be required to regulate greenhouse gases under the Clean Air Act (CAA), and has already begun preparing regulations. In May 2010, EPA issued a final rule (effective August 2010) to tailor the applicability criteria for stationary sources subject to permitting requirements under the CAA, which sets thresholds for GHG emissions that define when permits are required for new and existing industrial facilities under the New Source Review Prevention of Significant Deterioration (PSD) and title V Operating Permit programs.

In March 2009, the U.S. Department of Transportation (USDOT) set combined corporate average fuel economy (CAFE) standards for light duty vehicles for the 2011 model year (MY). In June 2009, EPA granted California a previously denied waiver to regulate vehicular GHG emissions, allowing 19 other states (representing 40 percent of the light-duty vehicle market, including New York) to adopt the California mobile source GHG emissions standards. In April 2010, EPA and USDOT established the first GHG emission standards and more stringent CAFE standards for MY 2012 through 2016 light-duty vehicles. The agencies also proposed the first-ever program to reduce GHG emissions and improve fuel efficiency of medium- and heavy-duty vehicles, such as large pickup trucks and vans, semi trucks, and vocational vehicles. These regulations will all serve to reduce vehicular GHG emissions over time.

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 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[2]). The 2009 New York State Energy Plan,[3] outlines the state's energy goals and provides strategies and recommendations for meeting those goals. 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 in order 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. The regional emissions cap for power plants will be held constant through 2014, and then gradually reduced to 10 percent below the initial cap through 2018. Each power source with a generating capacity of 25 megawatts or more must purchase a tradable CO_2 emission allowance for each ton of CO_2 it emits. 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

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

[2] http://www.nyclimatechange.us/

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

quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability.

New York City has a long-term sustainability program, PlaNYC 2030, which includes GHG emissions reduction goals, specific initiatives that can result in emission reductions and initiatives targeted at adaptation to climate change impacts. For certain projects subject to CEQR, an analysis of the project's contribution of GHG emissions is required to determine their consistency with the City's citywide reduction goal. This approach is applied to the Proposed Project in this chapter. The City will also determine potential strategies to reduce citywide GHG emissions by 80 percent below 2005 levels by 2050.[1]

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 square feet 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 square feet 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 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 United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) system is a benchmark for the design, construction, and operation of high performance green buildings that includes energy efficiency components. 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 to climate change is infinitesimal, the combined GHG emissions from all human activity are believed to have a severe adverse impact on 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 GHG emissions potentially associated with the Proposed Project and identifies the measures that would be implemented and measures that are still under consideration to limit the emissions. Since the energy use and vehicle use associated with the URO would be greater than with MUO, this analysis focuses on the emissions with the URO.

The analysis of GHG emissions that would be generated by the Proposed Project is based on the methodology presented in the *2010 CEQR Technical Manual*. Emissions of GHGs from the development associated with the URO have been quantified, including off-site emissions associated with use of electricity on-site, on-site emissions from heat and hot water systems, and

[1] *A Greener Greater New York*, PlaNYC Update, April 2011.

emissions from transportation attributable to the Proposed Project. GHG emissions that would result from construction the Proposed Project are also discussed.

BUILDING OPERATIONAL EMISSIONS

Emissions due energy use by the Proposed Project were developed using carbon intensity factors by building type shown in the 2010 *CEQR Technical Manual* (Table 18-3) and the gross floor area by use for the URO shown in Table 2-1. These estimates represent the reasonable worst case GHG emissions. The *CEQR Technical Manual* large residential building (defined as greater than 4 families) carbon intensity factor was used to calculate the CO_2 emissions associated with the housing and hotel uses, the institutional building carbon intensity factor was used to calculate the CO_2 emissions associated with the research, academic, cultural, and public school uses, and the commercial building carbon intensity factor was used to calculate CO_2 emissions from the service retail, restaurant, and office uses. The CO_2 emissions from the maintenance, support, and other uses was not quantified, as the extent to which these uses would be heated or have a typical residential, commercial, institutional or industrial energy use profile is not known.

MOBILE SOURCE EMISSIONS

The number of annual weekday and weekend trips to the ferry terminals (Battery Maritime Building, in Manhattan, and Pier 6, in Brooklyn) by mode (cars, taxis, trucks) that would be generated by the Proposed Project was calculated using the transportation planning assumptions developed for this GEIS. The assumptions used in the calculation include average daily weekday and weekend person trips and delivery trips by proposed use (research, student dorm, faculty housing, office, etc), the absentee rate, the percentage of vehicle trips by mode, and the average vehicle occupancy. Travel distances shown in the 2010 *CEQR Technical Manual* (Table 18-4) were used in the calculations of annual vehicle miles traveled by cars and taxis. In accordance with the 2010 *CEQR Technical Manual*, the average truck trip was assumed to be 38 miles. The 2010 *CEQR Technical Manual* (Table 18-6) was used to determine the percentage of vehicle miles traveled by road type and the 2010 *CEQR Technical Manual* mobile GHG emissions calculator was used to obtain the total estimated vehicle GHG emissions attributable to the project.

The total person trips for all uses were determined to estimate the GHG emissions from ferry trips from the Battery Maritime Building (BMB) and Pier 6 to Governors Island, estimated at 23.9 million annual person trips (see Chapter 15, "Transportation"). GHG emissions for ferries were based on a fuel consumption rate of 0.064 gallons per passenger mile,[1] a trip distance of 0.6 miles, and the emission factor for marine diesel reported by U.S. Energy and Information Administration.[2]

Up to two school buses, with an average occupancy of 19 passengers would be generated by the school use. The annual school bus GHG emissions of 8.13 metric tons of CO_2e per bus were based on PlaNYC inventory and related information.

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[1] Calculated using data from APTA, *2011 Public Transportation Fact Book*, Table 27: Rail Modes and Ferry Boat National Totals—Report Year 2009. http://www.apta.com/resources/statistics/Documents/FactBook/APTA_2011_Fact_Book.pdf

[2] U.S. Energy Information Administration, http://www.eia.doe.gov/oiaf/1605/coefficients.html, accessed August 2011.

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are approximately 22 percent of the tailpipe emissions.[1] 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, they are not considered in the analysis for the Proposed Project. The assessment of tailpipe emissions only is in accordance with the 2010 *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, forming the basis for the greenhouse gas calculations, are presented in **Table 17-2**. The school bus emissions were calculated directly from the number of buses that would serve the school.

Table 17-2
Annual Vehicle Miles Traveled
University/Research Option (miles per year)

Use	Car		Taxi		Truck	
	BMB	Pier 6	BMB	Pier 6	BMB	Pier 6
Park	788,254	1,320,068	217,955	1,237,564	0	0
Research	131,422	350,526	130,170	328,618	261,744	610,736
Academic	257,049	685,597	254,601	642,747	96,341	224,797
Student Dorm	380,757	493,614	252,546	525,417	286,501	668,502
Faculty Housing	45,245	50,651	24,822	56,556	47,585	111,032
Hotel	85,041	365,305	142,451	399,370	174,762	407,778
Conference Center	296,518	1,133,375	440,082	1,062,539	640,794	1,495,186
Office	61,124	163,028	60,541	152,838	168,697	393,627
Cultural	40,611	67,250	12,382	63,047	24,966	58,254
K-12 Student	75,769	44,839	46,289	42,036	0	0
K-12 Staff	3,572	9,528	3,538	8,933	208,278	485,982
TOTAL	**2,165,362**	**4,683,781**	**1,585,378**	**4,519,665**	**1,909,669**	**4,455,893**

CONSTRUCTION EMISSIONS

Emissions associated with construction have not been estimated explicitly, but other similar analyses 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 project 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, in accordance with the 2010 *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

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

PROJECTED GHG EMISSIONS FROM THE PROPOSED PROJECT

BUILDING OPERATIONAL EMISSIONS

The floor areas by use for the potential development scenario under the URO, the emission factors applied (carbon intensity of NYC buildings) and resulting GHG emissions are presented in **Table 17-3**.

Table 17-3
Building Operational Emissions University/Research Option

Use	Building Area (sf)	Carbon Intensity of NYC Buildings (kg CO_2e/gsf)	GHG Emissions (metric tons CO_2e)
Research	400,000	11.42	4,568
Academic	450,000	11.42	5,139
Faculty Housing	200,000	6.59	1,318
Student Dorms	850,000	6.59	5,602
Conference Center/Hotel	500,000	6.59	3,295
Office	175,000	9.43	1,650
Service Retail/Restaurant	75,000	9.43	707
Cultural	60,000	11.42	685
Public School (K-12)	150,000	11.42	1,713
TOTAL	**3,000,000**	**N/A**	**24,677**

Notes:
The CO_2 emissions from the maintenance, support, and other uses was not quantified, as the extent to which these uses would be heated or have a typical residential, commercial, institutional or industrial energy use profile is not known.

MOBILE SOURCE EMISSIONS

The mobile source related GHG emissions are presented in detail in **Table 17-4**. The type of ferries that would provide additional passenger service for the Island, their route, capacity, frequency of operation, and fuel consumption rates are not know at this time, and therefore, the estimate of emissions from ferries is based on national averages. The GHG emissions from the passenger ferries constitute 33 percent of the GHG emissions from mobile sources and 18 percent of the overall quantified GHG emissions associated with the Proposed Project. Note that GHG emissions from the transport of freight by ferry was not included in this analysis, as the information required for a quantified estimate is not available at this time.

CONSTRUCTION EMISSIONS

Construction emissions were not explicitly quantified. An estimated range is presented, as described in the "Methodology" section.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The Proposed Project would not fundamentally change the City's solid waste management system. Therefore, emissions from solid waste management were not quantified.

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

Use	Passenger Vehicle	Taxi	Truck	Total
Park	854	470	0	**1,324**
Research	364	308	1,469	**2,141**
Academic	711	603	541	**1,855**
Student Dorm	615	514	1,608	**2,737**
Faculty Housing	66	54	267	**388**
Hotel	352	367	981	**1,700**
Conference Center	1,108	1,006	3,596	**5,710**
Office	169	143	947	**1,259**
Cultural	78	53	140	**271**
K-12 Student	78	53	16	**147**
K-12 Staff	10	8	1,169	**1,187**
Ferry				**9,365**
Total				**28,084**

SUMMARY

A summary of GHG emissions for the Proposed Project is presented in **Table 17-5**. Note that if the proposed buildings were to be constructed elsewhere to accommodate the same uses, the emissions from the use of electricity, energy for heating and hot water, and vehicle use could equal or exceed those of the proposed projects, depending on their location, access to transit, building type, and energy efficiency measures.

Table 17-5
Summary of Annual GHG Emissions (metric tons CO_2e)

Uses	Building Operational Emissions	Mobile Source Emissions	Total GHG Emissions
Park	N/A	1,324	1,324
Research	4,568	2,141	6,709
Academic	5,139	1,855	6,994
Faculty Housing	1,318	2,737	4,055
Student Dorms	5,602	388	5,990
Conference Center/Hotel	3,295	7,410	10,705
Office	1,650	1,259	2,909
Service Retail/Restaurant	707	N/A	707
Cultural	685	271	956
Public School (K-12)	1,713	1,334	3,047
Ferry	N/A	9,365	9,365
TOTAL	**24,677**	**28,084**	**52,761**

Notes:
The building operational energy use for the park is negligible. As discussed the service retail/restaurant use was assumed to be auxiliary to other uses and the mobile source emissions from service retail/restaurant use are therefore included in the emissions for the other uses.

As discussed, 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.

STRATEGIES THAT WOULD REDUCE GHG EMISSIONS FROM THE PROPOSED PROJECT

The public school proposed as part of the MUO would be built according to the New York City Green Schools Guide, published by the New York City School Construction Authority, which guides the sustainable design, construction, and operation of new schools, modernization projects, and school renovations in New York City.

The Proposed Project would accessible by ferry, with multiple subway and bus connections in Lower Manhattan, and will include a network of bike lanes, availability of indoor bicycle parking, and walkable streets.

For the park areas, the topography and Hills will reuse materials from demolished buildings and parking lots, keeping material out of landfills, avoiding the need to transport the spoils off the island, and reducing the need to import fill to the island.

Additional measures will be incorporated during the detailed design of the Later Phases—Island Redevelopment component of the Proposed Project, to ensure that the development will be consistent with the PlaNYC goals relating to building energy efficiency, sustainable transportation (including the use of ferries), the use of clean power, construction emissions, and building materials. These measures will be analyzed and reviewed in subsequent environmental review.

D. ADAPTATION TO CLIMATE CHANGE

Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in CEQR. Since the Proposed Project is located within the current 100-year floodplain, the potential effects of global climate change on the Proposed Project have been considered.

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 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 to state's coastlines from rising seas and increased storm surge. The Task Force has prepared a final report of

[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.

its findings and recommendations including protective and adaptive measures.[1] 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.[2]

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 and has suggested approaches to create an effective adaptation program for critical infrastructure.[3] 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 to 23 inches by the end of the century, with possible increase up to 55 inches in the event of rapid ice melt. In general, the probability of higher sea levels is characterized as "extremely likely", 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.

The New York City Green Code Task force has also recommended strategies for addressing climate change resilience in buildings and for improving stormwater management.[4] 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

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

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

[3] 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.

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

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 is evaluating adaptive strategies for City water and wastewater infrastructure. The City has already developed a *New York City Green Infrastructure Plan*[1], and a *Sustainable Stormwater Management Plan.*[2] 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.

Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in the 2010 *CEQR Technical Manual*. While qualitative guidance on addressing the effect of climate change is in the process of being developed at the national, state, and local levels, no specific requirements for development projects are available at this time. Climate change considerations may be incorporated into state and local laws prior to the redevelopment of the Island, and any future 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, climate change considerations and measures that would be implemented on the Island to increase climate resilience are discussed.

RESILIENCE TO CLIMATE CHANGE

The current 100-year floodplain is presently the only regulatory standard relating to elevation of new development. However, projected sea level rise will be accounted for in the development of the Proposed Project.

For the park areas, the Master Plan has accounted for the 2-foot projected sea level rise, as identified by NPCC, reducing the Island's vulnerability to storm surges as compared to existing conditions. The creation of new topography on the island is designed specifically to address this issue by raising the grade of most park areas to 4 feet above the current 1-in-100 year flood levels, accounting for the 2-foot sea level rise by the end of the century and an additional 2 feet to elevate tree roots above saltwater levels during severe storms. In addition, saltwater tolerant plant species will be used in low lying areas where practicable.

The buildings constructed in the Later Phases—Island Redevelopment would incorporate the most recent building code requirements available at the time of construction and consider any prudent guidance and information available. Since the Development Areas have not yet been designed in detail, it is unknown at this time how these areas will accommodate future sea level rise; however, the final design will incorporate design measures such as raising the grade and/or protective measures such as storm barriers and sealed critical infrastructure designed to accommodate a 2-foot increase in the 1-in-100 year storm level by the end of the century, or the most recent appropriate level based on the best information available at the time final designs are made. ✷

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

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