A. INTRODUCTION

As discussed in the 2012 *City Environmental Quality Review (CEQR) Technical Manual*, increased concentrations of greenhouse gases (GHGs) in the atmosphere 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, the City has established sustainability initiatives and goals for both greatly reducing GHG emissions and adapting 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").[1] The *CEQR Technical Manual* requires that a project resulting in 350,000 square feet of development or more and other energy-intense projects quantify project-related GHG emissions and assess the project's consistency with the citywide GHG reduction goal. The City is also engaged in several initiatives to assess potential local effects 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 would result in the development of the Observation Wheel, Wheel Terminal Building, which would contain a ticketing, waiting, and loading and unloading area for the Wheel, restaurants, merchandizing, and theater and exhibition space at the North Site. The South Site would be developed with the St. George Retail Development, which would include a retail outlet center, a hotel, and a catering facility. Both sites would also include parking. The GHG emissions that would be generated as a result of the proposed project—and measures that would be implemented to limit those emissions—are presented in this chapter, along with an assessment of the proposed project's consistency with the citywide GHG reduction goal. The chapter also identifies measures that would be taken to increase the resilience of the proposed project to the potential effects of climate change.

PRINCIPAL CONCLUSIONS

The proposed project would result in annual GHG emissions of ~~20,067~~ 19,787 metric tons of CO_2e. Of that amount, approximately ~~8,374~~ 8,076 metric tons of CO_2e would be emitted by the proposed project as a result of grid electricity use and fuel consumption in on-site energy systems, while the remainder would be emitted as a result of project generated vehicle trips. The proposed project would strive to obtain the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) certification, including Platinum for the North Site and up to Silver for the South Site. Specific sustainable measures would be incorporated into the design and construction of the proposed project to qualify for LEED rating,

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

which would decrease the potential GHG emissions. Based on the sustainable measures that would be included, the proposed project would be consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*.

The proposed project's design would include features to improve resiliency to climate change, including sea level rise of up to 2 feet, which is within the likely range of sea level increase projected through the 2050s ~~for the end of the century~~ by the New York City Panel on Climate Change (NPCC).

NO CATERING FACILITY SCENARIO

It is possible that the project sites could be developed with a No Catering Facility Scenario. This scenario includes the same program on the North Site as the proposed project. On the South Site, this scenario removes the 20,000-square-foot catering facility and 5,000 square feet of back of house space. This space would be replaced with 25,000 square feet of retail space. The total square footage of this scenario is equal to the square footage of the proposed project. Based on the expected small decrease in vehicle trips associated with this scenario, as compared with the proposed project, and a very slight increase in heated floor area, it is anticipated that the GHG emissions under the No Catering Facility Scenario would not be significantly different from the GHG emissions for the proposed project.

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

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 (USEPA) is required to regulate GHGs under the Clean Air Act (CAA), and has already begun preparing regulations addressing newly manufactured vehicles and permitted large stationary sources. In addition, the American Recovery and Reinvestment Act of 2009 (ARRA, "economic stimulus package") funded actions and research that can lead to reduced GHG emissions, and 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 GHG capture and storage options.

U.S. Department of Transportation (USDOT) and USEPA have also established GHG emission standards and more stringent combined corporate average fuel economy (CAFE) standards for 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

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

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. 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. 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. The ten 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 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 targeted at adaptation to climate change impacts. For certain projects subject to CEQR, an analysis of the project's GHG emissions and an assessment of the project's consistency with the City's citywide emission reduction goal are required.

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 ten years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using a USEPA 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 sub-meters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a New York City Energy Code, which requires equipment installed during a renovation to meet current efficiency standards (in addition to the State code addressing new construction only).

A number of voluntary rating systems for energy efficiency and green building design have also been developed. For example, LEED is a benchmark for the design, construction, and operation of high performance green buildings that includes energy efficiency components. Another voluntary rating system is USEPA's *Energy Star*—a 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.

1 http://www.dec.ny.gov/energy/80930.html
2 New York State, 2009 New York State Energy Plan, December 2009.

C. 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. As required by the *CEQR Technical Manual*, this chapter presents the total 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.

The analysis of GHG emissions that would be generated by the proposed project is based on the methodology presented in the *CEQR Technical Manual*. Emissions of GHGs associated with the proposed project have been quantified, including off-site emissions associated with on-site use of electricity, on-site emissions from heat and hot water systems, and emissions from motor vehicle trips attributable to the proposed project. GHG emissions that would result from construction of the proposed project are discussed as well.

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."

Carbon dioxide (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 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 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 CO_2 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 16-1**.

Table 16-1
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: IPCC, Climate Change 1995—Second Assessment Report.	

BUILDING OPERATIONAL EMISSIONS

Emissions from electricity and on-site fossil fuel use were calculated using the "carbon intensity factors" provided in the *CEQR Technical Manual* (Table 18-3) by use type and the approximate floor areas for the various components of the proposed project, as shown in **Table 16-2**. For all of the proposed buildings the carbon intensity factor for commercial uses was applied. For the parking structures, since no emission intensity is provided in the *CEQR Technical Manual*, the annual energy intensity of 27,400 British Thermal Units (Btu) per gsf was assumed (provided in the 2001 *CEQR Technical Manual* Table 3N-1). It was assumed that the proposed parking energy use would consist of electricity use for lighting, ventilation, and minor operational needs (ramps, booths). The electricity emission factor of 82.9 kg CO_2e per gigajoule (GJ) [1] was used to calculate GHG emissions from the electricity use associated with the proposed parking.

Table 16-2
Building Floor Area and Type for GHG Analysis

	Approximate Size (gsf)	Use Type	Carbon Intensity (kg CO_2e/sf)
Wheel Terminal Building[1]	~~120,000~~ 95,100	Commercial	9.43
Destination Retail Space	340,000	Commercial	9.43
Catering Facility	20,000	Commercial	9.43
Hotel	130,000	Commercial	9.43
Parking[2]	~~882,900~~ 856,700	Other	2.54

Notes:
1. The electricity that would be consumed to operate the Observation Wheel is not included here. Emissions associated with the Observation Wheel were calculated based on electricity consumption projections specific for the wheel, as discussed in the text.
2. The GHG intensity for parking was calculated based on an energy intensity of 27,400 Btu/gsf/year (provided in only the earlier version of the *CEQR Technical Manual*, 2001, Table 3N-1) and assuming all energy use is electricity, with an emission factor of 82.9 kg $_{CO2}$e per GJ (PlaNYC, Inventory of New York City Greenhouse Gas Emissions, December 2012).

Source: The GHG intensity for the commercial uses was obtained from the *CEQR Technical Manual*, Table 18-3.

The projected annual electricity consumption for the Wheel of 1.7 million kWh per year was provided by the project's design and operations expert and is based on experience with other

[1] PlaNYC, Inventory of New York City Greenhouse Gas Emissions, December 2012.

observation wheels and the anticipated demand specific to the New York Wheel. The emission factor for electricity was consistent with that used for calculating parking emissions.

MOBILE SOURCE EMISSIONS

The number of annual motorized vehicle trips and miles traveled by mode (cars, taxis, trucks, and tour buses) that would be generated by the proposed project was calculated using the transportation planning assumptions developed for the analysis presented in Chapter 14, "Transportation." The assumptions used in the calculation of annual trips and vehicle miles traveled (VMT) include average daily weekday person trips and delivery trips, the percentage of vehicle trips by mode, and the average vehicle occupancy. Travel distances shown in Table 18-4 and Table 18-5 of the *CEQR Technical Manual* for "Other NYC", i.e. boroughs other than Manhattan, were used to calculate annual vehicle miles traveled by personal vehicles and taxis. The average one-way 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 project car, taxi, and truck GHG emissions attributable to the proposed project.

Emissions from tour buses were calculated using the assumptions from Chapter 14, to calculate annual bus trips. The VMT for the buses was developed by calculating a weighted average travel distance to the project site from existing tour bus terminals at each of the trip origins, discussed in Chapter 14. The weighted average distance was calculated to be 20.3 miles. The average fuel efficiency for buses of 7.2 miles per gallon (mpg) was obtained from the *National Transportation Statistics.*[1] The GHG emission factors were based on the diesel fuel carbon content,[2] assuming that all carbon is transformed to CO_2, resulting in emission factors of 10,186 g $_{CO2}$ per gallon of diesel. Tour bus VMT are included in the VMT for trucks, in **Table 16-3**.

Table 16-3
Annual Vehicle Miles Traveled (VMT)

Use	Personal Vehicles	Taxis	Trucks
Observation Wheel[1]	1,210,048	492,350	420,920[1]
Destination Retail Space	~~11,666,463~~ 11,639,706	1,910,852	1,233,989
Quality Restaurant	1,535,448	283,578	102,942
Catering Facility	1,074,560	161,067	2,774
Open Space	~~60,462~~ 96,445	0	~~1,370~~ 2,186
Hotel	571,305	178,509	166,440
Totals	**~~16,091,528~~ 16,127,512**	**3,026,356**	**~~1,928,435~~ 1,929,251**

Note: 1. Annual truck VMT for the Observation Wheel includes the annual tour bus VMT.
Source: Based on traffic planning assumptions made for Chapter 14, "Transportation."

[1] U.S. Department of Transportation, Research and Innovative Technology Administration (RITA), Bureau of Transportation Statistics, *National Transportation Statistics*, Table 4-15, updated April 2012, http://www.bts.gov/publications/national_transportation_statistics/.

[2] The Code of Federal Regulations (40 CFR 600.113).

USEPA 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, as per the *CEQR Technical Manual* guidance, the well-to-pump emissions are not considered in the analysis for the proposed project. The projected annual vehicle miles traveled, forming the basis for the GHG emissions calculations from mobile sources, are presented in **Table 16-3**.

As discussed in Chapter 1, "Project Description," a new waterborne transit landing may be pursued as a third project component that would not be specifically tied to either the North or South Site developments. This potential waterborne transit would allow an additional means of travel to the project sites from potential landings in Manhattan, Brooklyn, Queens, and New Jersey. The currently available information on the expected number of waterborne transit trips and routes is insufficient for the calculation of waterborne transit GHG emissions. With potential waterborne transit service, the personal vehicle, taxi, and tour bus trips could potentially be less than projected. Moreover, it is estimated that 80 percent of the person trips would originate from Manhattan, which does not have a direct roadway connection to Staten Island. With waterborne transit service, a new direct link would be established, and due to the likely decrease in overall vehicle trips, and a reduction of trips that involve long routes, VMT would be lower than shown in **Table 16-3**. Therefore, with waterborne transit service, the mobile source emissions would likely be lower than calculated in this chapter, assuming no waterborne transit service.

CONSTRUCTION EMISSIONS

GHG emissions from construction include both direct emissions, such as emissions from construction equipment and delivery trucks, and emissions embedded in the production of materials, such as emissions from the production of steel, rebar, aluminum, and cement used for construction. Emissions associated with construction have not been estimated explicitly for the proposed project, as the construction of the project and extraction and production of construction materials is not likely to be a significant portion of the GHG emissions associated with the project. As discussed in Section D, to the extent practicable, emissions during construction would be minimized. An effort would be made to specify locally produced, sustainable, or recycled materials and construction waste would be diverted from landfill.

EMISSIONS FROM SOLID WASTE MANAGEMENT

The proposed project would not 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.

D. PROJECTED GHG EMISSIONS FROM THE PROPOSED PROJECT

BUILDING OPERATIONAL EMISSIONS

The GHG emissions from the proposed project building energy use and electricity use for the Wheel are presented in detail in **Table 16-4**. The energy savings that would be achieved through the various sustainability measures that would be implemented (discussed below) are not

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

accounted for in the GHG emissions calculated, as detailed modeling would be needed to quantify these benefits. Therefore, the emissions presented before, associated with the proposed buildings, are conservatively high, since the energy intensity of new energy-efficient buildings is generally lower than the citywide average presented in the *CEQR Technical Manual*.

Table 16-4
Annual Building Operational Emissions

Use	GHG Emissions (metric tons of CO_2e)
Observation Wheel	507
Wheel Terminal Building	~~1,132~~ 897
Destination Retail Space	3,206
Catering Facility	189
Hotel	1,226
Parking	~~2,114~~ 2,051
Total	**~~8,374~~ 8,076**

MOBILE SOURCE EMISSIONS

The detailed mobile-source GHG emissions from each component of the development that would occur as a result of the proposed project are presented in **Table 16-5**.

Table 16-5
Annual Mobile Source Emissions (metric tons CO_2e)

Use	Personal Vehicles	Taxis	Trucks	Totals
Observation Wheel[1]	555	201	608[1]	1,364
Destination Retail	5,341	782	2,016	8,140
Quality Restaurant	705	116	168	989
Catering Facility	493	66	5	564
Open Space	~~28~~ 44	0	~~2~~ 4	~~30~~ 48
Hotel	262	73	272	607
Total	**~~7,384~~ 7,400**	**1,238**	**~~3,071~~ 3,073**	**~~11,694~~ 11,711**
Notes: 1. Truck emissions for the Observation Wheel include the emissions for tour buses.				

SUMMARY

The proposed project would result in annual GHG emissions of ~~20,067~~ 19,787 metric tons of CO_2e. Of that amount, approximately ~~11,694~~ 11,711 metric tons of CO_2e would be emitted by the proposed project as a result of fuel consumption for vehicle trips generated by the proposed project. A total of ~~8,374~~ 8,076 metric tons of CO_2e would be emitted as a result of grid electricity use and on-site fuel use for energy systems.

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. These operational emissions are conservatively high, as they do not account for the energy efficiency and emissions savings that would result from the implementation of sustainable measures described below.

E. ELEMENTS OF THE PROPOSED PROJECT THAT WOULD REDUCE GHG EMISSIONS

The proposed project would include a number of sustainable design features that would lower GHG emissions, both on the North and South Sites. These features are discussed in this section, assessing the consistency of the proposed project with the GHG reduction goal as outlined in the *CEQR Technical Manual*. In addition, a sustainability exhibition is planned within the Wheel Terminal Building. Cornell's Center for Sustainable Global Enterprise would be involved in the exhibit planning, maintaining the objective of a high-tech, state-of-the-art exhibition on innovation and sustainability to showcase a range of topics, including: green building and design, next-generation green materials, and low- and no-carbon energy technologies.

BUILD EFFICIENT BUILDINGS

NORTH SITE

The North Site design would be aimed at achieving LEED Platinum Certification. The following sustainable design elements would be incorporated:

- Energy efficient building envelope, which would reduce cooling and heating requirements.
- Installation of high-efficiency heating, ventilation, and air conditioning (HVAC) systems and generators.
- Incorporation of skylights that would promote the infiltration of daylight into the Wheel Terminal Building, while north- and east-facing glazing would reduce solar heat gain.
- High efficiency glazing would be specified for the Wheel Terminal Building to minimize heat loss during cold months and heat gain during warm months.
- Motion sensors for lighting and climate control.
- Third party building commissioning would be conducted to ensure energy performance.
- Construction and design guidelines to facilitate sustainable build-out would be specified for tenants.
- Green roofs would be incorporated on the Wheel Terminal Building and parking structure. Vegetated roofs would cover all roof areas (~~almost~~ 5 acres), except those with skylights, walking paths, and photovoltaic (PV) cells. Green roofs help control stormwater runoff and provide a natural cooling barrier for the building.
- Use of low impact development for stormwater design.
- Use of water conserving fixtures that exceed building code requirements.
- Water efficient landscape.
- Storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic and metals).

Other possible sustainable measures considered for the design of the Wheel Terminal Building and the North Site include the reduction of energy demand using peak shaving or load shifting strategies, use of super insulation, where applicable, and where opportunities exist, reuse of gray water and/or collection and reuse of rainwater. Although green roofs are proposed and hardscape would be a small component of the roof design, high-albedo roofing and paving materials would be incorporated where possible.

SOUTH SITE

The South Site design would be aimed at achieving up to LEED Silver Certification. The following sustainable design elements would be incorporated:

- Energy efficient building envelopes, which would reduce cooling and heating requirements.
- Motion sensors for lighting and climate control, and efficient directed exterior lighting.
- Construction and design guidelines to facilitate sustainable design for build-out would be specified for tenants.
- Green roofs would be incorporated on approximately 3 acres of the South Site buildings.
- Use of low impact development for stormwater design.
- Water efficient landscape.
- Storage and collection of recyclables (including paper, corrugated cardboard, glass, plastic and metals).

In addition, high efficiency glazing may be specified to minimize heat loss.

USE CLEAN POWER FOR WHEEL DEVELOPMENT

At the North Site, PV cells would be incorporated into the roof design. It is currently envisioned that the PV cells would be located above the roof of the parking structure, north of the proposed playground. The design team may also consider other options, such as the use of thin film applications, skylights, or canopies (where appropriate) that could generate additional electricity for the proposed Wheel Terminal Building use. To supplement the use of renewable energy, fuel from less GHG-intense fuels, specifically natural gas, would be used. The use of wind power is also proposed through a series of vertical axis wind turbines located on the roof above the parking structure. The power output would depend on the selection of turbines, as well as the design and the location of their installation. Further study is required to determine the most efficient installation and viability of wind power for this project.

ENHANCE AND USE TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The proposed project is easily accessed by both public transportation and walking and cycling routes from multiple entry points. Alternative-fuel and/or fuel-efficient parking security vehicles and courtesy shuttle buses would be included. As discussed, the addition of the potential waterborne transit would decrease the mobile source vehicle emissions, by providing a more direct and efficient access to the project for visitors to Staten Island from midtown Manhattan and other nearby locations in New York and New Jersey.

The proposed development on the North Site and South Site would also increase pedestrian connections between the waterfront and upland St. George, thereby increasing access to the North Shore Waterfront Esplanade from downtown St. George. At the North Site, pedestrian circulation between the waterfront and Richmond Terrace would be improved by the proposed pedestrian path that would start near Nicholas Street. Also, a new pedestrian path along the eastern portion of the site would provide a connection between Richmond Terrace and the Bank Street Entrance Plaza, discussed in Chapter 1, “Project Description.”

The South Site would be designed to maximize pedestrian access onto and through the site. There would be open pedestrian promenades traversing the South Site from Richmond Terrace to Bank Street and the waterfront. The main promenade would provide a visual connection

between the lower Ferry Terminal exit and the civic courtyard across Richmond Terrace. A pedestrian corridor would bring pedestrians across the site, connecting the Ferry Terminal's upper level and Bus Terminal to the open corridors of the retail development and provide pedestrian routes to the Stadium.

Bicycle circulation would also be encouraged at the project sites and would facilitate connectivity with bicycle paths on Richmond Terrace. A proposed bike path would be developed on the North Site that would start near Nicholas Street and would connect Richmond Terrace to the waterfront. In addition, Bank Street would be widened from a 24 foot to a 30 foot roadway and would include a bike lane from Jersey Street to the easternmost boundary of the North Site. On the North Site, bicycle parking would be provided in the parking structure. On the South Site, bicycle parking would be provided along the main north-south corridor near Bank Street. Bicycle storage and changing rooms for the proposed hotel employees would also be provided. In addition, designated on-site parking for alternative vehicles would be included at the South Site, and considered for the North Site. Provision of on-site charging stations for electric vehicles would be considered for the North Site. The parking would be sized to meet and not to exceed city requirements, and shared parking for commuters, facility employees, and visitors is anticipated. Roadway improvements and traffic signalization and coordination to improve traffic flow and support pedestrian and bicycle safety would likely be implemented.

REDUCE CONSTRUCTION OPERATION EMISSIONS

While particulate matter is not included in the list of standard greenhouse gasses, recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change. As detailed in Chapter 20, "Construction," a number of measures that would reduce particulate emissions during construction would be implemented, to the extent feasible, including: diesel equipment reduction, clean fuel (ULSD), best available tailpipe reduction technologies, use of new equipment, and fugitive dust control measures, and idling restrictions on-site. To further reduce GHG emissions during construction, the use of biofuels would be considered for the North Site.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

To limit the GHG emissions from emissions generated during extraction, production, and transport of construction materials, the following sustainable measures would be incorporated:

- Use of building materials with recycled content.
- Use of wood that is locally produced and/or certified in accordance with the Sustainable Forestry Initiative or the Forestry Stewardship Council's Principles and Criteria.
- Diversion of construction waste from landfill (reuse and/or recycle), applicable to the entire project, and anticipated to exceed 75 percent of the waste for the North Site.

In addition, the reuse of building materials and products, the use of building materials that are extracted and/or manufactured within the region, and the use of rapidly renewable building materials would be considered where opportunities exist. Where appropriate, cement replacements would be used, and the use of cement produced using lower-GHG fuel or concrete with optimized cement content would be considered where opportunities exist.

F. RESILIENCE 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. However, the recently proposed revisions to the Waterfront

Revitalization Program (WRP)[1] address climate change and sea level rise, which, 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 the *CEQR Technical Manual*, the provisions of the WRP are applied by the Department of City Planning and other city agencies when conducting environmental review. The project sites are also located in an area that was affected by Hurricane Sandy. The storm made landfall in United States at the end of October 2012, with winds reaching 80 miles per hour. As Sandy resulted in a record storm surge for New York City, of almost 14 feet measured at Battery Park, it heightened awareness of the need to plan new waterfront development with climate resilience in mind. Since the project sites are on the waterfront, the potential effects of global climate change on the proposed project are considered and measures that would be implemented as part of the project to improve its resilience to climate change are identified.

DEVELOPMENT OF POLICY TO IMPROVE CLIMATE CHANGE RESILIENCE

In recognition of the important role that the federal government plays 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. 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.[2]

The New York State Sea Level Rise Task Force was created to assess potential impacts to 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.[3] 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.[4]

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

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[1] The NYC Waterfront Revitalization Program: Proposed Revisions for Public Review, March 2012, http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml.

[2] 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.

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

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

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 citywide 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, updated in June 2013,[2] 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 1211 to 2324 inches by the end middle of the century (2050s middle range, 25th to 75th percentile), with possible increase up to 5531 inches (high estimate, 90th percentile) in the event of rapid ice melt. While the 2013 update did not include 2080s data, based on 2009 NPCC report, sea levels could rise by up to 59 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 levels rise is characterized as "extremely likely" (>95 percent 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 eastern and southern shores of Staten Island, Southern 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.

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

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

[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.

~~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 has been working with the Federal Emergency Management Agency (FEMA) to revise the Flood Insurance Rate Maps (FIRMs) using detailed Light Detection and Ranging (LiDAR) data. Recently, FEMA released Advisory Base Flood Elevation (ABFE) maps for areas in New York City, including the project sites.~~

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*[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. Currently, standards and a framework for analysis of the effects of climate change on a proposed project are not included in the *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 construction of the proposed project, and any future development would be constructed to meet or exceed the codes in effect at the time of construction.

RESILIENCE <u>OF THE PROPOSED PROJECT</u> TO CLIMATE CHANGE

<u>Measures that may be implemented to make the proposed project more resilient to expected mid-century flood levels are described below. Given that the projections for sea level rise are changing, further measures to make the project area resilient to sea level rise beyond the 1 to 2 feet projected for mid-century will be investigated and implemented within the proposed project site to the extent practicable and needed in the future, considering the types of uses proposed. Some examples of additional protective measures that could be considered when the need arises include steel swing/hinged flood gates, flip-up hydraulic flood gates, manual flip-up flood gates, flood rated doors and windows, slide rail/stop plug systems, and portable walls. While the City has not yet undertaken the studies needed to select the most effective measure to offer flood protection to the area of Staten Island that includes the proposed project sites, some measures that may be undertaken by City agencies in the future include:</u>

- <u>Coastal edge elevation measures;</u>
- <u>Beach nourishment;</u>
- <u>Integrated flood protection and storm surge barriers, floodwalls, and levees.</u>

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[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.

NORTH SITE

The currently effective FIRM 100-year floodplain is the only regulatory standard relating to elevation of new development. However, as mentioned previously, the City has been working with FEMA to revise the FIRMs ~~and has recently released ABFE maps. It is anticipated that the ABFE maps would be adopted in the near future~~. On July 2, 2013, FEMA released the latest version of the Best Available Flood Hazard Data (BAFHD)—a draft product preceding the publication of new FIRMs. FEMA encourages communities to use the BAFHD when making decisions about floodplain management and post-Sandy recovery efforts, and these levels have been adopted by New York City for zoning purposes, allowing projects to account for higher base flood elevations for height and other zoning requirements.

Due to the projected effects of climate change, and the proposed North Site location within the floodplain, habitable space would be built two feet above the ~~ABFE~~ BAFHD 100-year floodplain. Therefore, the proposed design would offer resilience for up to 2 feet of future sea level rise (above the BAFHD), which is expected to occur by mid-century (2050s) ~~within the likely range of sea level rise projections made by NPCC~~. Storm surge would not be expected to significantly affect the structure or stability of the Wheel, since the platform and its deep-seated pilings would not be affected by flooding and ground softening that affects trees. A storm surge would potentially flood the proposed lower level of the Wheel Terminal Building and parking structure. While measures that would be implemented to minimize the potential effects of storm surge on these areas is still being evaluated, it is likely that all emergency equipment, including generators and diesel tanks would be housed in "bathtubs" designed to protect against major flooding. The North Site would include almost 5 acres of green roof. The proposed water capture system would absorb the rainwater and filter/purify it, releasing it on a controlled basis into the harbor as cleansed water.

Climate change projections indicate that severe weather events will become more frequent. To ensure that the Observation Wheel would survive and not pose a threat during storms, the Wheel's structural designers have designed the Wheel to withstand a Category 3 storm and have stress tested the design in wind tunnel and other stress testing environments. According to the Wheel manufacturer, based on these studies, the New York Wheel could survive far greater stresses than those realized in Hurricane Sandy. The stable design of the Wheel, with four tubular legs firmly planted on a platform with deeply sunk pilings, would not require precautionary counter-balancing tie-downs the way a cantilevered design like the London Eye would require. Added precautions would be taken to super-secure all capsule doors. Once wind gusts of 40 miles per hour or greater are projected at a height of 33 feet over the base, the Wheel would be closed, and the drivers and stabilizers would be locked onto the rim to keep it steady. If there are riders aboard the Wheel when high winds are observed, the Wheel could be evacuated in up to 38 minutes at normal speed.

SOUTH SITE

According to the FEMA FIRM, both the 100-year and 500-year floodplain extend onto the proposed South Site. The currently effective FIRM 100-year floodplain elevation on much of the site is +7.8 feet referenced to the Staten Island Datum, or SID (+ 11 National Geodetic Vertical Datum [NGVD]), while the 500-year floodplain elevation is a couple feet higher. The ~~ABFE~~ BAFHD 100-year floodplain elevation on the east portion of the South Site ranges from +8.9 to 9.9 feet referenced to the SID. In addition, the South Site is located within close proximity to flood zone VE (wave action zone), where the FIRM elevations are higher at +9.9 feet (+13 NGVD), and ~~ABFE~~ BAFHD elevation is also higher at +13.9 feet. The western portion of the

South Site is located outside the 100-year, as well as the 500-year, FIRM and ~~ABFE~~ BAFHD floodplain. Due to the project's proximity to the waterfront and flood levels from Hurricane Sandy, which exceeded the FIRM 100-year floodplain on the project site and reached elevations of approximately +9 feet, the proposed project on the South Site would include measures to improve resilience to storm surge.

The proposed pedestrian access points, including access to retail, would be located at the lowest elevations on the project site on Bank Street above a minimum elevation of +11 feet, where possible. Additionally, flood barricades could be installed at the retail and garage entry points for additional protection of two feet, up to elevation +13 feet. Besides the retail stores with entrances on Bank Street (approximately 8 percent of the proposed retail development), the remainder of the retail and all of the hotel and catering uses are at least at +13 feet, which is above the ~~ABFE~~ BAFHD 100-year floodplain.

The strategy for the parking garage is to reduce the potential for any water to enter, especially at the lower level which is at an elevation of less than +6 feet, as well as to design the garage such that flooding projected beyond mid-century would not damage critical systems. Pedestrian access points on the lowest level of parking and the loading/MTA access driveway would all slope up to elevation of a minimum of +11 feet. There are no vehicle access points below +13.7 feet (on Wall Street) and the pedestrian access points would be at elevation +11 feet. Access to the MTA and Ferry terminal areas need to be below the flood elevation due to existing grades, and flood barricades would be deployed in these locations. The pedestrian garage access corridors would begin to slope down to the garage beyond the face of the project, and flood barricades could be deployed at these locations to provide an added layer of protection up to elevation +13 feet.

Generators and the substation for the proposed project would be located well above the floodplain, at a minimum elevation of +26 feet. Other equipment, such as the water and fuel tanks would be located within the 500-year floodplain, but waterproofed to protect against any potential damage.

By striving to incorporate reasonable strategies that would increase resilience to the likely projected effects of climate change through the 2050s, the proposed project would go beyond the legal requirements to address the potential effects of climate change on a project and would be consistent with the City's SIRR policy. As part of citywide efforts to improve coastal resiliency, it is anticipated that solutions for protecting the area over a longer time horizon will be developed before sea levels rise beyond 1 to 2 feet. ✷