Chapter 16: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

This chapter evaluates the Proposed Actions' potential to result in greenhouse gas (GHG) emissions and their consistency with citywide GHG reduction goals.

The 2021 *City Environmental Quality Review (CEQR) Technical Manual* recognizes that climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be experienced at the local level. New York City's sustainable development policy, starting with PlaNYC that was continued and enhanced alongside the OneNYC polices, 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 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 conducting an environmental impact statement (EIS) and would be expected to result in 350,000 square feet (sf) or more of development and/or consist of other energy-intense projects. The Proposed Action would result in approximately 23.5 million sf of developed floor area on projected development sites under the With Action condition. Accordingly, a GHG consistency assessment was performed for the Proposed Actions.

Since portions of the Proposed Actions will result in development sites being constructed and operated within coastal areas and on the water, the potential effects of global climate change on these development sites have been considered. Therefore, future potential climate conditions are reviewed in the context of the impact of climate change, and the implications for the Proposed Actions and its potential environmental consequences are discussed.

PRINCIPAL CONCLUSIONS

The building energy use and vehicle use associated with the Proposed Actions would result in up to approximately 153~~148~~ thousand metric tons of carbon dioxide equivalent (CO_2e) emissions per year in the 2035 With Action condition. These emissions are expected to decrease or be eliminated as New York State and New York City target 100 percent renewable electricity. Additionally, approximately 96 thousand metric tons of CO_2e per year are associated with vehicle emissions based on projected vehicle fleets for future years; however, these estimates conservatively do not include increased percentage of electric vehicles due to market behavior, and thus the GHG emissions from mobile sources in the 2035 With Action condition are expected to be lower.

The Proposed Actions involve zoning changes that would primarily affect privately owned properties. Decisions regarding construction and building design for those sites, which would affect energy use and GHG emissions, would be made by the property developers in accordance with the City's building code requirements in effect at the time. The City is addressing citywide building energy efficiency and other GHG-related design questions through its ongoing long-term GHG policy development and implementation process.

A description of construction activities is provided in Chapter 20, "Construction." Consistent with CEQR practice, emissions associated with construction have not been estimated explicitly for the Proposed Actions. 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 operational emissions over approximately 5 to 10 years. The *CEQR Technical Manual* defines five goals by which a project's consistency with the City's emission reduction goal is evaluated: (1) efficient buildings; (2) clean power; (3) sustainable transportation; (4) construction operation emissions; and (5) building materials carbon intensity.

The Proposed Actions would be designed to comply with New York City's carbon intensity limits for the 2035–2039 period specified by New York City Department of Buildings (DOB). Furthermore, development sites will be required at a minimum to achieve the energy efficiency requirements of the New York City Building Code under the New York City Energy Conservation Code (NYCECC), consistent with the NYStretch Energy Code within the 2020 Energy Conservation Code of New York State (2020 ECCNYS). The Proposed Actions would implement any measures required under such programs, as legally applicable. Therefore, the Proposed Actions would support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

The Proposed Actions would also support other GHG goals by virtue of their proximity to public transportation and their inclusion of carbon-free/low-carbon transportation infrastructure such as bicycle, e-mobility support, and electric vehicle charging infrastructure, as required by the City; meeting regulations to avoid of the use of fossil fuels for on-site combustion sources; construction air quality controls; and the fact that as a matter of course, construction in New York City uses recycled steel and lower-carbon cement alternatives. All of these factors demonstrate that the Proposed Actions supports the GHG reduction goal.

Therefore, based on the commitment to energy efficiency and by virtue of location and nature, the Proposed Actions would be consistent with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

B. GREENHOUSE GAS 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. The general warming of the Earth's atmosphere caused by this phenomenon is known as the

"greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide (N_2O), methane, and ozone are the primary GHGs in the Earth's atmosphere.

There are also a number of entirely anthropogenic GHGs in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which also damage the stratospheric ozone layer (and contribute to the "ozone hole"). Since these compounds are being replaced and phased out due to the 1987 Montreal Protocol, significant emissions of these substances are not anticipated and there is no need to address them in GHG assessments for most projects. Although ozone itself is also a major GHG, it does not need to be assessed as such at the project level since it is a rapidly reacting chemical and efforts are ongoing to reduce ozone concentrations as a criteria pollutant (see Chapter 15, "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, consistent with *CEQR Technical Manual* guidelines.

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

The *CEQR Technical Manual* lists six GHGs that could potentially be included in the scope of a GHG analysis: CO_2, N_2O, methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). This analysis focuses primarily 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 Actions.

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 weighed by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing[1] of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6 and therefore has a much lower GWP). The GWPs for the main GHGs discussed here are presented in **Table 16-1**.

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

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

Note: The GWPs presented above are based on the Intergovernmental Panel on Climate Change's (IPCC) Second Assessment Report (SAR) to maintain consistency in GHG reporting. The IPCC has since published updated GWP values that reflect new information on atmospheric lifetimes of GHGs and an improved calculation of the radiative forcing of CO_2. In some instances, if combined emission factors were used from updated modeling tools, some slightly different GWP may have been used for this study. Since the emissions of GHGs other than CO_2 represent a very minor component of the emissions, these differences are negligible.
Source: 2021 *CEQR Technical Manual*

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

NATIONAL POLICIES

Because 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 taken 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 that set emissions targets for GHGs, in December 2015, the U.S. signed the international Paris Agreement[2] that pledged deep cuts in emissions, with a stated goal of reducing annual emissions to levels that would be between 26 and 28 percent lower than 2005 levels by 2025.[3] On January 20, 2025, the President of the United States signed an executive order to withdraw the United States out of the Paris Agreement.

Regardless of the Paris Agreement, the United States Environmental Protection Agency (EPA) is required to regulate GHGs under the Clean Air Act and has begun preparing and implementing regulations. In coordination with the National Highway Traffic Safety Administration (NHTSA), EPA currently regulates GHG emissions from newly manufactured on-road vehicles. In addition, EPA regulates transportation fuels via the Renewable Fuel Standard (RFS) program, which phased in requirements for the inclusion of renewable fuels that increased annually up to a total of 36.0 billion gallons by 2022. On December 1, 2022, EPA announced a proposed rule to establish the required fuel volumes and percentage standards for 2023, 2024, and 2025, as well as important modifications to strengthen and expand the RFS program. EPA issued the Affordable

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

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

Clean Energy rule June 19, 2019, which establishes emissions reduction measures accepted as best technology for power plants and focuses on energy efficiency improvements in place of direct emissions reduction measures.

REGIONAL AND NEW YORK STATE POLICIES

There are also regional 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 with 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; an interim draft plan has been published.[4]

The New York State Energy Plan outlines the State's energy goals and provides strategies and recommendations for meeting those goals. The latest version of the plan was published in June 2015 and last amended in April 2020. The plan outlines a vision for transforming the state's energy sector that would result in increased energy efficiency (both demand and supply), increased carbon-free power production, and cleaner transportation, in addition to achieving other goals not related to GHG emissions. The plan also established the following targets: (1) reducing GHG emissions in New York State by 40 percent, compared with 1990 levels, by 2030; (2) providing 50 percent of electricity generation in the state from renewable sources by 2030; and (3) increasing building energy efficiency gains by 600 trillion British thermal units (Btu) by 2030.

In 2019, New York State enacted the Climate Leadership and Community Protection Act (CLCPA) to achieve the GHG reductions goals established in the New York State Energy Plan as well as expanding on them by establishing statewide GHG emission limits to achieve new long-term goals to reduce statewide GHG by 100 percent, compared with 1990 levels by 2050, and provide 100 percent of electricity generation in the state from renewable sources by 2040. The legislation charges the New York State Climate Action Council with establishing statewide GHG emission limits and agency regulations to reduce emissions, increase investments in renewable energy sources, and ensure that significant portions of investments are made in disadvantaged communities. Pursuant to these requirements, the New York State Climate Action Council prepared and approved a scoping plan outlining recommendations for attaining the GHG emission limits and reduction goals on December 19, 2022.

The State is now seeking to achieve some of the emission reduction goals via local and regional planning and projects through its Cleaner Greener Communities and Climate Smart Communities programs. New York State has also adopted California's GHG vehicle standards (which are at least as strict as the federal standards).

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 nine northeastern and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit, gradually reducing annual emissions to half the 2009 levels by 2020 and reducing an additional 30 percent from 2020 to 2030. The 67th quarterly RGGI allowance auction was

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

announced to be held on March 12, 2025 with the deadline for submission on January 29, 2025. The RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

NEW YORK CITY POLICIES

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 comprehensive plan for a sustainable and resilient New York City, which began as PlaNYC 2030 in 2007 and continued to evolve as *OneNYC*, with the inclusion of more ambitious GHG emissions reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. In April 2023, New York City published *PlaNYC: Getting Sustainability Done*—the latest outline of the City's strategies to achieve its sustainability goals. The goal to reduce city-wide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[5] The City has also announced a longer-term goal of reducing emissions to 80 percent below 2005 levels by 2050 ("80 by 50"), which was codified by Local Law 66 of 2014, and has published a study evaluating the potential for achieving that goal. More recently, under the *OneNYC 2050* report and continued in *PlaNYC*, the City announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025 and achieving net-zero city-wide GHG emissions by 2050.

In December 2009, the New York City Council enacted four laws addressing energy efficiency in large 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 and retro-commissioning 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 NYCECC, which along with the Energy Conservation Construction Code of New York State (as updated in 2020), requires equipment installed during a renovation to meet current efficiency standards.

To achieve the GHG reduction goals, the City continues to convene Technical Working Groups to analyze the GHG reduction pathways from the building sector, power, transportation, and solid waste sectors to develop action plans for these sectors and achieve its GHG reduction goals. The members of the Technical Working Groups develop and recommend data analysis, interim metrics and indicators, voluntary actions, and potential mandates to effectively achieve these goals. In 2016, the City published the building sector Technical Working Group report, which included commitments by the City

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

to change to building energy code and take other measures aimed at substantially reducing GHG emissions.

In May 2019, the New York City Council enacted the Climate Mobilization Act (CMA), including Local Law 97 of 2019 (LL97), which targets GHG emissions associated with building energy consumption. For most buildings that exceed 25,000 gsf (excluding electricity/steam generation facilities, rent-regulated accommodations, places of public worship, and City-owned properties), the City has established annual building emission limits beginning in 2024 and would require the owner of a covered building to submit annual reports demonstrating the building is in compliance with the current GHG emission limits. For buildings not covered under the GHG emissions limits, owners may either demonstrate compliance with the current limits or implement specified energy conservation measures where applicable. In 2023, the New York City Department of Buildings adopted maximum carbon intensity factors for buildings through 2050 by Energy Star Portfolio Manager (ESPM) property type.[6] Under the 2023 rule, a building's emissions limit would be estimated using the appropriate carbon intensity factor for each property type and the floor area of that property type. Maximum carbon intensity factors would decrease over time until 2050, where all covered buildings are required to demonstrate that the systems would have no direct GHG emissions.

As part of the CMA, Local Laws 92 and 94 of 2019 (LL92 and LL94) would include requirements for all new construction and any building that would undergo major modification of the rooftop requiring a permit to utilize available roofing space for the installation of either a green roof or a solar photovoltaic system generating at least 4kW, or a combination of the two.

In addition, Local Law 154 of 2021 (LL154) established GHG emission limits that would prohibit fossil fuel systems in new buildings and major renovations where an application for approval of construction documents would be required (DOB threshold for alterations) emitting 25 kilograms or more of CO_2 per million Btu of energy.

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. 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

Climate change is driven by the collective contributions of diverse individual sources of emissions to global atmospheric GHG concentrations. Identifying potential GHG emissions from a proposed action can help decision makers identify practicable opportunities to reduce GHG emissions and ensure consistency with policies aimed at reducing overall emissions. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there

[6] Rule of the City of New York, 1 RCNY §103-14. Requirements for Reporting Annual Greenhouse Gas Emissions for Covered Buildings.

are no established thresholds for assessing the significance of a project's contribution to climate change.

As detailed above, this chapter presents the total GHG emissions potentially associated with the Proposed Actions and identifies measures that would be implemented and measures that are still under consideration to limit emissions. (Note that this differs from most other technical areas in that it does not account for only the increment between the condition with and without the Proposed Actions.) Consistent with the *CEQR Technical Manual*, the focus of this analysis is on the total emissions associated with the Proposed Actions, and on the effect of measures to reduce those emissions.

Estimates of potential GHG emissions associated with the Proposed Actions are based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs from the Proposed Actions have been quantified, including off-site emissions associated with use of electricity to power on-site heat and hot water systems and other building operations, and emissions from vehicle use associated with the Proposed Actions.

Consistent with *CEQR* practice for potential developments where no developer has been identified and no specific development plan has been established, emissions associated with construction of the Proposed Actions have not been estimated explicitly for the Proposed Actions; however, 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 operational emissions over approximately 5 to 10 years.

Analysis of the GHG emissions associated with building energy usage is based on the 2035-2039 carbon intensity of electricity as specified in LL97. Emissions from transportation conservatively apply the emission factors for the 2035 analysis year. Since vehicular emission factors will also continue to decrease in future years as vehicle engine efficiency increases and emissions standards continue to decrease, the Proposed Actions would result in lower emissions in future years.

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 CO_2e emissions per year (see "Pollutants of Concern," above).

BUILDING OPERATIONAL EMISSIONS

Estimates of GHG emissions from building energy use were prepared ~~using fossil fuel and electricity consumption estimates for development sites~~ in Chapter 13, "Energy," under two design scenarios ~~and~~ (presented in Table~~s~~ 13-2 and 13-3): 1) assuming a development site would be developed early and would use a natural gas-fired heating and hot water systems; and 2) assuming a development site would be designed as a fully electrified building. The maximum GHG emissions between the two scenarios are conservatively assumed. Overall, the projected development sites are anticipated to consume up to 1,403,655~~1,289,440~~ MMBtu of energy each year under the fossil fuel

scenario—with 400,560~~361,234~~ MMBtu associated with fossil fuel and 293,977,947~~272,030,350~~ kWh (1,003,095~~928,206~~ MMBtu) associated with electricity consumption. In the event that the Proposed Developments would utilize fully electric systems, the Proposed Actions are anticipated to consume up to 1,197,771 MMBtu (351,031,939 kWh) of electricity each year.

As the City phases out fossil fuels for new buildings under LL154 of 2021, development sites may submit applications of construction documents before 2028—when all buildings would be prohibited to use any substance that emits 25 kg CO_2e/MMBtu ~~is prohibited~~ or greater. Based on the conceptual RWCDS construction schedule, construction activities would be spread out over a period of approximately 10 years and only approximately 13 projected development sites are anticipated to begin construction before 2028 with the assumption that the remaining development sites would be prohibited from utilizing fossil fuel systems. However, this analysis conservatively assumes each development site would use a natural gas-fired HVAC and hot water system—resulting in the maximum potential GHG emissions. Emissions were compared to the total emissions prepared using building carbon intensity by use type as detailed in by DOB. Building carbon intensities for the periods 2035–2039 and 2040–2049 were considered. ~~Additionally, the potential for fully electric buildings were considered. In the event that the Proposed Developments would utilize fully electric systems, the Proposed Actions are anticipated to consume up to 290,728,861 kWh per year.~~

MOBILE SOURCE EMISSIONS

The numbers of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated in the With Action condition were calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 14, "Transportation." The assumptions used in the calculation include average daily person trips and delivery trips by proposed use, the percentage of vehicle trips by mode, and the average vehicle occupancy. Travel distances shown in Table 18-5 and 18-6 and associated text of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-7 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type and the mobile GHG emissions calculator provided with the manual was used to estimate GHG emissions from all trips attributable to the Proposed Actions in the With Action condition. Since the mobile GHG emissions calculator does not assume an increased percentage of electric vehicles in the regional vehicle fleet, the GHG vehicle emissions with the Proposed Actions are expected to be less as New York State implements new zero emission vehicle sale and lease requirements beginning in 2035.

Based on the latest fuel lifecycle model from Argonne National Laboratory,[7] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 22 percent to the GHG emissions from gasoline and 25 percent from diesel. 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 development, and as per the

[7] Based on GREET1_2024 model from Argonne National Laboratory.

CEQR Technical Manual guidance, the well-to-pump emissions are not considered in the analysis. 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 total annual vehicle miles traveled by roadway type, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 16-2**.

Table 16-2
Vehicle Miles Traveled per Year
Proposed Actions

Roadway Type	Passenger	Taxi	Truck
Proposed Actions			
Local	24,304,408	561,785	7,951,189
Arterial	49,824,036	1,151,660	16,299,938
Interstate/Expressway	47,393,595	1,095,482	15,504,819
Total	121,522,039	2,808,927	39,755,947

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 20, "Construction." Consistent with CEQR practice, emissions associated with construction have not been estimated explicitly for the Proposed Actions, 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 operational emissions over approximately 5 to 10 years.

EMISSIONS FROM SOLID WASTE MANAGEMENT

As detailed in Chapter 12, "Solid Waste and Sanitation Services," the Proposed Actions would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from the Proposed Actions' solid waste generation, transportation, treatment, and disposal are not quantified.

PROJECTED GHG EMISSIONS

BUILDING OPERATIONAL EMISSIONS

The projected annual energy consumption, emission factors, and resulting GHG emissions from the development sites are presented in **Table 16-3**. The analysis presents the total emissions after construction.

Table 16-3
Annual Building Operational Emissions
Proposed Actions

Fuel Type	Annual Energy Consumption	Emission Factor (kg CO_2e / MMBtu)	Annual GHG Emissions (metric tons CO_2e)
Natural Gas	400,560 ~~361,234~~ MMBtu	53.11	21,274 ~~19,185~~
Electricity	293,977,947 ~~272,030,350~~ kWh	35.61	35,721 ~~33,054~~
		TOTAL:	**56,995 ~~52,239~~**

Notes:
Totals may not sum due to rounding.
[1] GHG emissions for the Proposed Actions were estimated using projected annual energy consumption, and emissions factors from EPA's eGRID database for the future 70 percent renewable energy electric grid.

Additionally, the estimated building emission limits for the development sites were estimated using the building floor area, emission intensity, and resulting GHG emissions from each of the uses for the Proposed Actions (presented in detail in **Table 16-4**). GHG emission limits were estimated based on the 2035–2039 emission intensity as specified in LL97. Consequently, the Proposed Actions would result in annual emissions below the emission limits under LL97 before 2039. As New York State achieves its renewable energy goals under the CLCPA for a zero emissions electric grid by 2040, the GHG emissions from building energy usage by the development sites would be reduced from 56,995~~52,239~~ metric ton CO_2e per year to 21,274~~19,185~~ metric ton CO_2e per year. However, in the event New York State does not achieve its renewable energy goals, further emission reductions may be necessary to comply with New York City's building emission limits through 2050.

Table 16-4
Annual Building Operational Emissions
Proposed Actions

Source Use	Building Area (gsf)	Carbon Intensity Limit[1] (kg CO_2e / gsf - year)		Annual GHG Emissions (metric tons CO_2e)	
		2035-2039	2040-2049	2035-2039	2040-2049
Residential	16,632,900	0.0027	0.0021	44,779	34,143
Local Retail	911,053	0.0012	0.0002	1,108	160
Life Science	345,707	0.0078	0.0052	2,709	1,806
Office	4,373,824	0.0017	0.0006	7,227	2,545
Community Center	291,784	0.0029	0.0019	833	556
Manufacturing	930,150	0.0010	0.0005	908	473
			TOTAL:	**57,563**	**39,682**

Notes:
Totals may not sum due to rounding.
[1] GHG emissions for the Proposed Actions were estimated using the carbon intensity limits for the 2035-2039 and 2040-2049 time periods.

MOBILE SOURCE EMISSIONS

The mobile-source-related GHG emissions from the Proposed Actions are presented in detail in **Table 16-5**.

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

Phase	Passenger Vehicle	Taxi	Truck	Total
Residential	11,320	165	16,547	28,032
Local Retail	10,130	0	4,772	14,901
Life Science	513	10	1,603	2,127
Office	14,404	743	20,281	35,159
Community Center	163	74	1,694	1,930
Manufacturing	1,533	62	12,474	14,069
Total Proposed Actions	**38,064**	**784**	**57,371**	**96,218**
Note: Totals may not sum due to rounding.				

In addition to the direct emissions included in the analysis, an additional approximately 22 percent would be emitted upstream, associated with fuel extraction, production, and delivery.

SUMMARY

A summary of GHG emissions for the Proposed Actions is presented in **Table 16-6**. Emissions associated with mobile sources represent approximately 63 percent of the total emissions, and building energy emissions represent approximately 37 percent of the total. Note that if new buildings were to be constructed elsewhere to accommodate the same number of units and space for other uses, the emissions from the use of electricity, energy for heating and hot water, and vehicle use could equal or exceed those estimated for the Proposed Actions, depending on their location, access to transit, building type, and energy efficiency measures. The Proposed Actions are not expected to fundamentally change the City's solid waste management system, and therefore, emissions associated with solid waste are not presented.

Table 16-6
Summary of Annual GHG Emissions Proposed Actions
(metric tons CO_2e)

Phase	Building Operations [1]	Mobile	*Total*
Residential	--	28,032	28,032
Local Retail	--	14,901	14,901
Life Science	--	2,127	2,127
Office	--	35,159	35,159
Community Center	--	1,930	1,930
Manufacturing	--	14,069	14,069
Total Proposed Actions	56,995 ~~52,239~~	96,218	153,213 ~~148,457~~

Note:
Totals may not sum due to rounding.
[1] GHG emissions for the Proposed Actions were estimated for the total development size of the projected development sites.

CONSISTENCY WITH THE CITYWIDE GHG REDUCTION GOALS

This section discusses the consistency of the Proposed Actions with the citywide GHG reduction goals as defined in the *CEQR Technical Manual*. Since the Proposed Actions

would not result in development under ongoing control of the City, specific decisions regarding construction and building design, which would affect energy use and GHG emissions, cannot be affected by the City within the scope of the Proposed Actions and would be made by developers under the building code requirements in effect at the time of development.

As part of its ongoing long-term GHG policy development and implementation process, the City has introduced citywide building energy efficiency requirements and limits on GHG emissions that would apply to the majority of existing and new buildings. However, some of the sites may require further specific energy efficiency measures beyond the code requirements if developers apply for U.S. Department of Housing and Urban Development (HUD) funding (described below). These sites would meet certain sustainable design requirements which would, among other benefits, result in lower GHG emissions—these features would be specified and required through the disposition and development contracts or other legally binding agreement between the City and the developer(s).

BUILD EFFICIENT BUILDINGS

For most of the sites, promotion of the GHG reduction goal through improved efficiency of site-specific building systems and similar measures cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions but would not otherwise be controlled by the City. In general, pursuing denser development, one of the objectives of the rezoning, would result in overall increased energy efficiency.

Some of the sites may require additional measures if developers apply for construction funding through HPD. These sites would be developed under HPD's affordable housing requirements, including certification under the EGC program per the HPD EGC Overlay. The EGC program certification for new buildings would require the implementation of a design aimed at reducing energy consumption and GHG emissions as compared with buildings designed to meet but not exceed the building code requirements; the program is currently designed to achieve a minimum of 15 percent reduction in energy expenditure relative to the requirements of the building code in effect at the time.

The EGC criteria also include mandatory and optional measures that would indirectly reduce GHG emissions such as water conservation.

USE CLEAN POWER

Some sites would be required to use natural gas due to E-Designations related to air quality (see Chapter 15, "Air Quality"). Natural gas has lower carbon content per unit of energy than other fuels, and thus reduces GHG emissions.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The Project Area would be supported by many transit options. These include the No. 7 subway line located at Vernon Blvd-Jackson Av, Hunters Point Av, and Court Sq stations, E/F/M subway lines located at Court Sq-23 Street station as well as express buses throughout the Project Area, and the Long Island Railroad station at the Long Island City

Terminal. The Project Area also includes Citi Bike stations, conventional bicycle paths, and two nearby ferry ports.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Promotion of the GHG reduction goal through construction specifications cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

Promotion of the GHG reduction goal through design specifications cannot be achieved within the scope of the Proposed Actions since sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City. However, some of the sites may require additional measures if developers apply for HUD funding through HPD. In such cases, the sites would be developed under the HPD affordable housing requirements, including certification under the EGC program per the HPD EGC Overlay, which includes some requirements and additional options for the use of materials with low carbon intensity within the points-based system.

C. RESILIENCE TO CLIMATE CHANGE

Since the Project Area is within current and future flood hazard zones, the potential effects of global climate change on the Proposed Actions have been considered.

Standards for analysis of the effects of climate change on a proposed project are still being developed and have not yet been defined in *CEQR*. However, the Waterfront Revitalization Program (WRP) addresses climate change and sea-level rise. The WRP requires consideration of climate change and sea-level rise in planning and design of development within the defined Coastal Zone Boundary (a substantial portion of the Project Area is within that zone). 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. The Proposed Actions' consistency with WRP policies is described in Chapter 2, "Land Use, Zoning, and Public Policy," and **Appendix C**.

DEVELOPMENT OF POLICY TO IMPROVE CLIMATE CHANGE RESILIENCE

The New York State Sea Level Rise Task Force was created to assess potential impacts on the state's coastlines from rising seas and increased storm surge. The Task Force prepared a report of its findings and recommendations including protective and adaptive measures.[8] The recommendations are to provide more protective standards for coastal development, wetlands protection, shoreline armoring, and post-storm recovery; 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.

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

The New York State Climate Action Plan Interim Report identified a number of policy options and actions that could increase the climate change resilience of natural systems, the built environment, and key economic sectors—focusing on agriculture, vulnerable coastal zones, ecosystems, water resources, energy infrastructure, public health, telecommunications and information infrastructure, and transportation.[9] New York State's Community Risk and Resiliency Act (CRRA)[10] requires that applicants for certain state programs demonstrate that they have taken into account future physical climate risks from storm surges, sea-level rise and flooding, and required the New York State Department of Environmental Conservation (DEC) to establish official state sea-level rise projections by January 1, 2016. In February 2017, DEC adopted a revised draft rule (Part 490) defining the existing projections for use. These projections provide the basis for state adaptation decisions and are available for use by all decision makers. CRRA applies to specific state permitting, funding and regulatory decisions, including smart growth assessments; funding for wastewater treatment plants; siting of hazardous waste facilities; design and construction of petroleum and chemical bulk storage facilities; oil and gas drilling, and state acquisition of open space. DEC published draft implementation guidance on June 20, 2018, addressing sea level rise and increased precipitation. For non-tidal areas, DEC recommends that applicants adjust designs to account for peak flows under future conditions by multiplying relevant peak flow parameters currently used in hydraulic analysis (e.g., Q50), by a factor of 1.2 (i.e., increasing capacity by 20 percent).

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 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,[11] which was subsequently updated,[12] and has suggested approaches to create an effective adaptation program for critical infrastructure. The NPCC includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as well as representatives from the insurance and legal sectors. The climate change projections include a summary of previously published baseline and projected climate conditions throughout the 21st century including heat waves and cold events, intense precipitation and droughts, sea-level rise, and coastal storm levels and frequency. NPCC projected that sea levels are

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

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

[11] 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.

[12] New York City Panel on Climate Change. *New York City Panel on Climate Change 2015 Report*. Ann. N.Y. Acad. Sci. 1336. 2015.

likely to increase by up to 23 inches by the 2050s and up to 65 inches by the end of the century (more detailed ranges and timescales are available). In general, the probability of increased sea levels is characterized as "extremely likely," but there is uncertainty regarding the probability the various levels projected and timescale. Intense hurricanes are characterized as "more likely than not" to increase in intensity and/or frequency, and the likelihood of changes in other large storms ("Nor'easters") are characterized as unknown. Therefore, the projections for future 1-in-100 annual probability ("100-year") coastal storm surge levels for New York City include only sea-level rise at this time, and do not account for changes in storm frequency.

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

While strategies and guidelines for addressing the effects of climate change are being developed on all levels of government, there are currently no specific requirements or accepted recommendations for development projects in New York City. However, the recently approved revisions to the WRP require consideration of climate change and sea-level rise in planning and design of waterfront development. As set forth in more detail in the *CEQR Technical Manual*, the provisions of the WRP are applied by city agencies when conducting environmental review.

RESILIENCE OF THE PROPOSED ACTIONS TO CLIMATE CHANGE

SEA LEVEL RISE

According to current flood hazard projections,[14] 80, or close to two-thirds of the sites, are in current 1-in-100 or 1-in-500 coastal storm surge levels. Of these 80, 47 are in a 1-in-100 flood zone and 33 are in a 1-in-500 flood zone. The base flood elevation is 11 feet North American Vertical Datum of 1988 (NAVD88) for 35 sites and 12 feet for 12 sites. By the 2050s, 109 sites would be in a flood zone and by 2100, all sites would be in a flood zone. With sea-level rise, the base flood elevations could potentially increase by 75 inches to approximately 17 and 18 feet NAVD88 by the end of the century under the NPCC "High" scenario.

Because the projected development sites in the rezoning area are predominantly in private ownership, specific resilience measures that would be implemented for each site are not known. ~~Since most sites would be developed as a result of the Proposed Actions, but would not otherwise be controlled by the City, and because implementing specific resilience measures for each site prior to design while considering local street and utility~~

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

[14] FEMA. *Preliminary Flood Insurance Rate Map*. Panels 3604970089F and 3604970202F. Release Date: 1/30/2015.

~~elevations and the effect on existing buildings is not practicable, addressing resilience for those sites through the Proposed Actions is not practicable.~~ Resilience for the Project Area will be addressed in the future as part of the resilience process for the City overall. However, any building or structure within the current 1-in-100 flood zone would be designed and constructed in accordance with Appendix G of the New York City Building Code, Flood-Resistant Construction. The proposed buildings at these sites will be required to have design flood elevations (DFEs) of at least +16 feet NAVD88 or +17 feet NAVD88. Residential units would need to be located at or above the DFE. Because the projected BFEs by the end of the century under the "High" scenario of sea level rise would be at +17 feet NAVD88 and +18 feet NAVD88, some of the DFEs could be below the BFE in the future. Other uses and critical infrastructure such as electrical equipment, plumbing, and heating and cooling systems should be located above the DFE, or otherwise dry floodproofed (fully sealed or protected from flood waters). New developments outside of the current 1-in-100 flood zone would not be required to be built in accordance with Appendix G of the New York City Building Code, but the 2021 Zoning for Coastal Flood Resiliency text amendment encourages those sites to plan for future flood risk. ~~However~~ Additionally, some of the sites may be subject to future discretionary city approvals, and would need to account for future sea-level rise projections. ~~Any residential units at these sites should be above 17 feet NAVD88. Other uses and critical infrastructure such as generators, pumps, fuel storage, electrical and communications connections should be above 17 feet NAVD88 or otherwise sealed or protected. If solutions up to this elevation for specific components prove to be impracticable, the City could also consider protection up to 15 feet NAVD88, which would account for the upper end of NPCC's "Middle Range" scenario.~~

~~Any development under the Proposed Actions directly along the East Channel waterfront would require flood-proof construction in accordance with DOB requirements and include elevation of the shoreline to support ongoing neighborhood-wide resiliency efforts.~~ The Proposed Actions would also result in a new resilient waterfront by raising the grade of the waterfront in connection with the construction of mixed-use developments, providing additional flood protections to inland developments within the Project Area consistent with the City's resiliency goals and the local community's Vision Plan for Resiliency. This would include creation of a continuous raised shoreline that would, with a mix of hard infrastructure as well as natural features such as native coastal plantings, provide flood protection and erosion control.

FUTURE PRECIPITATION

New York City Department of Environmental Protection (DEP) has identified that the Project Area experiences nuisance flooding (with flood levels greater than 4 inches) as well as deep and continuous flooding (with flood levels greater than 1 foot). This occurs at the northmost sites (40th Ave between 21st and 22nd St) under a limited flood condition, or rainfall of 1.77 inches per hour (in/hr). Under moderate flood, or 2.13 in/hr, the northernmost sites continue to be affected as well as the sites at the 42nd Road and 23rd Street intersection, 43rd Road and 10th Street intersection, 44th Road and 10th Street intersection, and within Gordon Triangle. Projections of 2050s stormwater flooding show the same locations to be affected. Thirteen sites would experience nuisance flooding and one site would experience deep and continuous flooding. By the 2080s, 34 sites would have nuisance flooding and 32 sites would have deep flooding.

In addition, street ends would incorporate resiliency measures that would be determined in the design process. Stormwater management improvements (e.g., bioswales, Greenstreets, ongoing separation of combined sewer overflows [CSO] and stormwater discharges) implemented irrespective of the Proposed Actions throughout the area would improve street drainage during rain events, further reducing the risks of flood damage associated with local flooding (e.g., inland flooding due to short-term, high-intensity rain events coupled with inadequate drainage). The Proposed Actions would also not adversely affect other resources (including ecological systems, public access, visual quality, water-dependent uses, infrastructure, and adjacent properties) due to climate change.

TEMPERATURE & URBAN HEAT ISLAND

The sites associated with the Proposed Actions are identified as being vulnerable to extreme heat by the New York City Department of Health (DOH), with a Heat Vulnerability Index (HVI) of 2 out of 5—considered a high level of risk. The Project Area is generally bounded by the mid-block between 39th Avenue and 40th Avenue, between 21st Street and 23rd Street, and Queens Plaza South to the north, the East River, Anable Basin and 5th Street to the west, 47th Avenue, 46th Avenue, 46th Road, and the mid-block between 44th Drive and 45th Avenue to the south, and 11th Street, 23rd Street, 24th Street, and the mid-block between 24th Street and Crescent Street to the east. The majority of the area is located in Queens Community District 2, with a portion located north of Queens Plaza North to mid-block between 39th Street and 40th Street, between 21st Street and 23rd Street located in Community District 1. The Project Area is directly west of Long Island City's central business district, often referred to as the core.

The probability that New York City would experience an increase in air temperatures and relative humidity (characterized as the heat index of a given location) is considered by NPCC to be "very likely." NPCC projected that temperatures are likely to increase by up to 7.1 degrees Fahrenheit by the 2050s and that New York City would experience up to 9 heat waves per year with an average duration up to 6 days. By the end of the century, temperatures are likely to increase by up to 13.5 degrees Fahrenheit with up to 10 heat waves per year with an average duration of 10 days.

The Proposed Actions would result in 4.38 acres of new publicly accessible waterfront open space at six RWCDS projected development sites in the Project Area (Projected Development Sites 63, 64, 65, 67, 69, and 71). As a result, within the non-residential study area in the With Action condition, total public open space would increase from 11.78 acres in the No Action condition to 15.29 acres in the With Action condition. In the residential study area, total publicly accessible open space would increase from 72.20 acres in the No Action condition to 76.58 acres in the With Action condition. The Proposed Actions would also incorporate high-albedo roofing materials as required by the City that would reflect incoming solar heat and prevent its absorption and re-emission through the urban heat island effect.

The design elements required to be incorporated within the Proposed Actions, alongside the creation of additional open spaces, would ensure resilience to potential heat increases and limit the impact of the urban heat island effect at proposed and potential buildings within the Project Area. ✷