Chapter 15: Greenhouse Gas Emissions and Climate Change

A. INTRODUCTION

This chapter evaluates the potential greenhouse gas (GHG) emissions from the Proposed Development and properties in the Additional Affected Area that would also be rezoned with the Proposed Actions (see Chapter 1, "Project Description"), as well and their consistency with citywide GHG reduction goals. The ~~2020~~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* and continued and enhanced in *OneNYC*, established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change in the City.

In accordance with CEQR guidance, 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 that 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 Actions would result in approximately 3.7 million sf of developed floor area under the With Action condition (the Proposed Development would include approximately 2.9 million sf of space, and the redevelopment of several projected development sites in the Additional Affected Area that are not controlled by the Applicant would include approximately 800,000 sf of residential and commercial space). Accordingly, a GHG consistency assessment was performed for the Proposed Actions.

PRINCIPAL CONCLUSIONS

The Proposed Actions would not result in significant adverse GHG emission or climate change impacts. The assessment of GHG emissions estimates that the building energy and vehicle use associated with the Proposed Actions would result in up to approximately 41 thousand metric tons of carbon dioxide equivalent (CO_2e) emissions per year. Of that amount, approximately 33 thousand metric tons of CO_2e would be generated by the Applicant's Projected Development Sites (Projected Development Sites A through E). Other projected sites in the Additional Affected Area (Projected Development Sites F through K) would result in approximately 8 thousand metric tons of CO_2e. It was determined that the Proposed Actions are consistent with the applicable citywide GHG emissions reduction and climate change goals, and that there would be no significant adverse GHG emission or climate change impacts.

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.

Overall, the Proposed Actions would support other GHG goals by virtue of its density and location in an area well-served by public transportation, and through requirements to utilize natural gas in new developments (i.e., natural gas would be required to address the air quality [E] Designations). As compared to the No Action condition, the Proposed Actions would provide opportunities for increased residential density, including affordable housing, and space for new jobs in an area with very good transit access. These changes could potentially result in less GHG emissions associated with auto use and suburban sprawl, and can also serve to lessen the pressure of rising rents in the area by increasing the supply of housing, including affordable housing. Therefore, the Proposed Actions would align with the City's emissions reduction goals, as defined in the *CEQR Technical Manual*.

Furthermore, for the Proposed Development, the Applicant is evaluating a number of certification programs and sustainable design features to be incorporated into the design and construction of each new development on the Development Sites (Projected Development Sites A through E) in order to improve energy efficiency and reduce GHG emissions, consistent with the City's emission reduction goals. In particular, the Applicant is considering the incorporation of sustainability measures in certain buildings and components of the Proposed Development that are consistent with the design principles among several building-level and community-level certifications such as LEED, WELL, Living Community Challenge, EcoDistricts, and Passive House principles. The design measures under consideration would ensure that the Proposed Development would achieve the substantially increased stringency of the building energy efficiency requirements under the 2020 Energy Conservation Code of New York State (2020 ECCNYS) Code, and would likely exceed them.

B. GREENHOUSE GAS EMISSIONS

POLLUTANTS OF CONCERN

GHGs are the 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 phenomenon causes the general warming of the Earth's atmosphere, or 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, 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 14, "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 in a variety of ways: 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 N_2O also play an important role 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 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 mostly on CO_2, N_2O, and methane. There are no significant direct or indirect sources of HFCs, PFCs, NF_3, or SF_6 associated with the Proposed Actions.

To present a complete inventory of all GHGs, component emissions are added together and presented as 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[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 15-1**.

Table 15-1
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: ~~2020~~2021 *CEQR Technical Manual*

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

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 undertaken efforts to reduce emissions by implementing both local and global 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 pledges deep cuts in emissions, with a stated goal of

[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.

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

reducing emissions to between 26 and 28 percent lower than 2005 levels by 2025[3] to be implemented via existing laws and regulations with executive authority of the President of the United States. On January 20, 2021, the President of the United States signed an executive order to bring the United States back into the Paris Agreement. Regardless of the Paris Agreement, the U.S. 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 program, which will phase in a requirement for the inclusion of renewable fuels increasing annually up to 36.0 billion gallons in 2022. In 2015, EPA also finalized rules to address GHG emissions from both new and existing power plants that would, for the first time, set national limits on the amount of carbon pollution that power plants can emit. The Clean Power Plan sets carbon pollution emission guidelines and performance standards for existing, new, and modified and reconstructed electric utility generating units. On February 9, 2016, the Supreme Court stayed implementation of the Clean Power Plan pending judicial review. In October 2017, EPA proposed to repeal the Clean Power Plan and issued the Affordable Clean Energy rule June 19, 2019, replacing the Clean Power Plan. The Affordable Clean Energy rule establishes revised emissions reduction measures accepted as best technology and focusing on energy efficiency improvements in place of direct emissions reduction measures.

There are also local and regional efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, which established a goal of reducing GHG emissions in New York State by 80 percent, compared with 1990 levels, by 2050, and created 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 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. The state has also adopted California's GHG vehicle standards (which are at least as strict as the federal standards).

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. The new 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 2015 plan also establishes new 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 to achieve the GHG reductions goals established in the New York State Energy Plan as well as establishing a new long-term goal to reduce statewide GHG by 100 percent, compared with 1990 levels by 2050. The legislation charges New York State Climate Action Council with establishing statewide GHG emission limits and agency regulations to reduce emissions, increase investments

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

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

in renewable energy sources, and ensure that significant portions of investments are made in disadvantaged communities. Pursuant to these requirements, the Climate Action Council will prepare and approve a scoping plan outlining recommendations for attaining the GHG emission limits and reduction goals. A final scoping plan is anticipated to be approved by 2022.

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. 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.

Many local governments worldwide, including New York City's, 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 comprehensive plan for a sustainable and resilient New York City (which began as *PlaNYC* 2030 in 2007, and continues to evolve today as *OneNYC*) includes GHG emissions reduction goals, many specific initiatives that can result in emission reductions, and initiatives aimed at adapting to future climate change impacts. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 ("30 by 30") was codified by Local Law 22 of 2008 and is 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, as part of *OneNYC*, the City has announced a more aggressive goal for reducing emissions from building energy down to 30 percent below 2005 levels by 2025 and achieving net-zero citywide 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 sf 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 sf will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Conservation Code, 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 is convening 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. The members of the Technical Working Groups will develop and recommend the data analysis, interim metrics and indicators, voluntary actions, and potential mandates to effectively achieve the City's emissions reduction goal. In 2016, the City published the building sector Technical Working Group report, which included commitments by the City to change to building energy code and take other measures aimed at substantially reducing GHG emissions.

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

In May 2019, the New York City Council enacted Local Law 97 of 2019—the Climate Mobilization Act. For most buildings that exceed 25,000 gross square feet (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.

For certain projects subject to CEQR (e.g., projects with 350,000 gsf or more of development or other energy intense projects), an analysis of the projects' contributions to GHG emissions is required to determine consistency with the City's reduction goal, which is currently the most appropriate standard by which to analyze a project under CEQR, and is therefore applied in this chapter.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the Leadership in Energy and Environmental Design (LEED) system is a benchmark for the design, construction, and operation of high-performance green buildings that includes energy efficiency components. Similarly, the Enterprise Green Communities (EGC) Program, a voluntary program for sustainable development of affordable housing, may be applied for some sites under the Proposed Actions. 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 are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter assesses 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 the increment between the condition with and without the Proposed Actions. The reason for this different approach is that to account for the incremental emissions only would require speculation regarding where people may live in the future without the Proposed Actions if residential units are not built at this location, what energy use and efficiency might be like for those alternatives and other related considerations, and similar assumptions regarding commercial and other uses. The focus is therefore on the total emissions associated with the uses, and on the effect of measures to reduce those emissions.

The potential GHG emissions associated with the Development Site as well as the Additional Affected Area have been estimated, including off-site emissions associated with electricity use, on-site emissions from heat and hot water systems, and emissions from vehicle use associated with the projected development. GHG emissions that would result from construction and solid-waste-related emissions are discussed qualitatively.

As per CEQR guidance, analysis of building energy is based on the average citywide carbon intensity of buildings by use type in 2008. The carbon intensity of electricity is currently substantially lower than it was in 2008, and will likely be even lower in the 2032 analysis year and lower still in future years, as the fraction of electricity generated from renewable sources continues to increase as part of the City's goal for 100 percent renewable electricity. In addition, the City has introduced carbon intensity limits for most buildings over 25,000 sf that would reduce GHG emissions over time and result in much lower carbon intensities than in 2008.

Vehicular emission factors will also continue to decrease in future years as vehicle engine efficiency increases and emissions standards continue to decrease, resulting in lower emissions in future years. Emissions from transportation from development components completed earlier than 2032 would therefore have a higher intensity, but would be lower overall since the full level of activity would not occur until full build-out occurs. Overall, the emissions presented for the 2032 analysis year are conservatively high as compared with earlier years and subsequent operational years. Since the methodology does not account for future years and other changes described above, it also does not explicitly address potential changes in future consumption associated with climate change, such as increased electricity for cooling, or decreased on-site fuel for heating. Furthermore, since detailed design information is not yet available, emissions reduction measures, described later in this chapter, are also not included in the quantified emissions. Overall, this analysis results in conservatively high estimates of potential GHG emissions.

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).

The following sections describe the methodology used for quantifying GHG emissions associated with the development anticipated under the Proposed Actions.

BUILDING OPERATIONAL EMISSIONS

Estimates of emissions from building electricity and fuel use were prepared using building carbon intensity by use type as detailed in the *CEQR Technical Manual*. Per *CEQR Technical Manual* guidance, the building carbon intensity data represents 2008 citywide averages by use type and not projections for the analysis year (2032). The intensity factors were multiplied by the building floor areas (gsf) by use type under the Reasonable Worst Case Development Scenario (RWCDS). Future emissions are expected to be lower as efficiency and renewable energy use continue to increase with the objective of meeting state and City GHG reduction goals.

MOBILE SOURCE EMISSIONS

The number of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by each land use was calculated using the transportation planning assumptions developed for the analysis and presented in Chapter 13, "Transportation." The assumptions used in the calculation include average daily weekday and Saturday person trips and delivery trips per dwelling unit, the percentage of vehicle trips by mode, and the average vehicle occupancy, and were applied to the number of dwelling units and floor areas (gsf) described above. To calculate annual totals, the number of trips on Sundays was assumed to be the same as on Saturday. Travel distances shown in Table 18-6 and 18-7 and associated text of the *CEQR Technical Manual* were used in the calculations of annual vehicle miles traveled by cars, taxis, and trucks. Table 18-8 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 obtain estimate GHG emissions from car, taxi, and truck trips.

Based on the latest fuel lifecycle model from Argonne National Laboratory,[6] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 24 percent to the GHG emissions from gasoline and 22 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 Actions, and as per the *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 annual vehicle miles traveled associated with each use type, forming the basis for the GHG emissions calculations from mobile sources, are summarized in **Table 15-2**.

Table 15-2
Vehicle Miles Traveled per Year—RWCDS

Use Type	Passenger Car	Taxi	Truck
Proposed Development			
Residential	7,030,671	497,019	1,916,523
Local Retail	1,687,499	0	264,518
Office	1,189,319	136,018	803,545
Cinema	2,084,528	1,259,809	694,260
Supermarket	1,530,910	23,024	108,881
Physical Culture Establishment	65,146	284,326	16,644
Community Center	126,245	68,871	284,859
Medical Office	69,559	41,705	20,112
Daycare	43,222	2,468	2,975
Performing Arts Center	368,245	241,815	77,752
Open Space	7,852	0	0
Total – Proposed Development	**14,202,194**	**2,555,056**	**4,19,070**
Additional Affected Area			
Residential	2,000,638	141,431	545,363
Commercial	1,913,947	0	300,014
Total – Additional Affected Area	**3,914,585**	**141,431**	**845,377**
Total – Proposed Actions	**18,116,779**	**2,696,487**	**5,035,447**

CONSTRUCTION EMISSIONS

A description of construction activities is provided in Chapter 19, "Construction." Construction emissions include emissions from on-road trips, on-site non-road engines, and materials extraction, production, and transport.

The number of vehicle trips by mode (worker cars, delivery trucks) that would be generated by construction activities was calculated using the assumptions developed for the analysis and presented in Chapter 19, "Construction." The assumptions used in the calculation include average daily workers, the percentage of auto trips, and the average vehicle occupancy to develop annual vehicle

[6] Based on GREET1_2021 model from Argonne National Laboratory.

miles traveled (VMT) associated with commuting workers. An average round-trip commute distance for construction workers in the New York City Region of 25.3 miles (based on the average trip to work distance for the New York Metropolitan Area area)[7] was used. Similarly, the numbers of trucks (concrete trucks, dump trucks, and tractor trailers) for each phase of construction activity were used to estimate truck VMT. Distances for truck deliveries were developed based on estimates of the origin and destination of materials for the Proposed Development as well as sites in the Additional Affected Area. Table 18-8 of the *CEQR Technical Manual* was used to determine the percentage of vehicle miles traveled by road type, and the most recent version of the EPA MOVES model was used to obtain an estimate of car and truck GHG emission factors used to produce the associated emissions attributable to the Proposed Actions.

The Proposed Actions in total would result in construction worker travel of approximately 15.9 million VMT as a result of the Proposed Development and approximately 2.9 million VMT resulting from the Additional Affected Area. Additionally, the Proposed Development would result in construction truck trips totaling approximately 6.4 million VMT, while the development in the Additional Affected Area would result in construction trup trips totaling approximately 2 million VMT. These data were used as the basis for the GHG emissions calculations from mobile sources, applying emission factors as described above for operational mobile source emissions.

On-site emissions were calculated for non-road construction engines based on specific estimates of construction activity and fuel consumption data from the NONROAD emissions module within model EPA's MOVES model. A detailed schedule for the use of non-road construction engines was developed, as described in Chapter 19, "Construction." The detailed data, including the number, type, power rating, and hours of operation for all construction engines was coupled with fuel consumption rate data from EPA's MOVES model to estimate total fuel consumption throughout the duration of the construction activities. Non-road construction engines are estimated to require approximately 726,901 gallons of diesel equivalent throughout the duration of construction. The quantity of fuel was then multiplied by an emission factor of 10.30 kilograms CO_2e per gallon of diesel fuel.[8]

Upstream emissions related to the production of construction materials were estimated based on the expected quantity of iron or steel and cement. Although other materials will be used, cement and metals have the largest embodied energy and direct GHG emissions associated with their production, and substantial quantities would be used for the Proposed Development as well as other projected sites in the Additional Affected Area.

The construction is estimated to require 29,737 metric tons of cement for the Proposed Actions. An emission factor of 0.928 metric tons of CO_2e per metric ton of cement produced was applied to estimate emissions associated with energy consumption and process emissions for cement production.[9] The precise origin of cement for the Proposed Actions is unknown at this time.

Construction is estimated to require 22,543 metric tons of steel. An emission factor of 0.6 metric tons of CO_2e per metric ton of steel product produced was applied to estimate emissions associated

[7] New York State Department of Transportation (NYSDOT). *2009 NHTS, New York State Add-On*. Key Tables. Table 3: Average Travel Day Person-Trip Length by Mode and Purpose, trip-to work distance for SOV in NYMTC 10-county area. 2011.

[8] EPA. Emission Factors for Greenhouse Gas Inventories. 26 March 2020.

[9] The Portland Cement Association. Life Cycle Inventory of Portland Cement Manufacture. 2006.

with production energy consumption,[10] and 0.65 metric tons of CO_2e per metric ton of steel product produced for process emissions associated with iron and steel production were applied.[11]

EMISSIONS FROM SOLID WASTE MANAGEMENT

The Proposed Development and development in the Additional Affected Area would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from solid waste generation, transportation, treatment, and disposal are not quantified.

PROJECTED GHG EMISSIONS

BUILDING OPERATIONAL EMISSIONS

The building floor area, emission intensity, and resulting GHG emissions from the potential land uses from the Proposed Actions are presented in detail in **Table 15-3**. The mobile-source-related GHG emissions from all potential uses are presented in detail in **Table 15-4**.

MOBILE SOURCE EMISSIONS

In addition to the direct mobile-source emissions included in the analysis, an additional approximately 24 percent of emissions associated with fuel extraction, production, and delivery would be emitted upstream.

CONSTRUCTION EMISSIONS

The estimated GHG emissions from construction of the Proposed Development and sites in the Additional Affected Area are presented in **Table 15-5**. Total construction emissions for the Proposed Actions, 84,902 metric tons CO_2e, would be equivalent to approximately 2 years of operational emissions. Emissions for the Proposed Actions are approximately proportional to the size of their respective development areas.

[10] Arpad Horvath et al. Pavement Life-cycle Assessment Tool for Environmental and Economic Effects, Consortium on Green Design and Manufacturing. UC Berkeley. 2007.

[11] Based on 42.3 teragrams of CO_2e emitted and approximately 65,460,000 tons produced; Source: EPA. *Inventory of U.S. Climate Change and Sinks: 1990–2009*. April 15, 2011.

Table 15-3
Annual Building Operational Emissions—RWCDS

Source Use	Building Area (gsf)	GHG Intensity (kg CO_2e/gsf/yr)	Annual GHG Emissions (metric tons CO_2e)
Proposed Development			
Residential	2,416,447	6.59	15,924
Local Retail	74,930	9.43	707
Office	250,070	9.43	2,358
Cinema	73,000	9.43	688
Supermarket	30,000	9.43	283
Physical Culture Establishment	30,000	9.43	283
Community Center	70,820	11.42	809
Medical Office	5,000	9.43	47
Daycare	10,000	5.25	52
Performing Arts Center	21,900	11.42	250
Parking	212,950	1.24	264
		Total – Proposed Development	**21,666**
Additional Affected Area			
Residential	687,861	6.59	4,533
Commercial	84,985	9.43	801
Parking	48,555	1.24	60
		Total – Additional Affected Area	**5,395**
		Total – Proposed Actions	**27,061**

Notes: Totals may not sum due to rounding.
Per *CEQR Technical Manual* guidance, electricity emissions are representative of existing conditions in 2012 and not the analysis year (2032). Future emissions are expected to be lower.
Representative emission intensity for existing buildings are higher than new and future construction, and do not include the specific energy efficiency measures.
Sources: ~~2020~~2021 *CEQR Technical Manual*

Table 15-4
Annual Mobile Source Emissions—RWCDS
(metric tons CO_2e, 2032)

Use	Passenger Vehicle	Taxi	Truck	Total
Proposed Development				
Residential	2,279	144	2,788	5,211
Local Retail	547	0	385	932
Office	385	39	1,169	1,594
Cinema	676	364	1,010	2,049
Supermarket	496	7	158	661
Physical Culture Establishment	21	82	24	127
Community Center	41	20	414	475
Medical Office	23	12	29	64
Daycare	14	1	4	19
Performing Arts Center	119	70	113	302
Open Space	3	0	0	3
Total – Proposed Development	**4,603**	**738**	**6,096**	**11,437**
Additional Affected Area				
Residential	648	41	798	1,483
Commercial	620	0	437	1,057
Total – Additional Affected Area	**1,269**	**41**	**1,230**	**2,540**
Total – Proposed Actions	**5,871**	**779**	**7,326**	**13,977**

Table 15-5
Total Construction GHG Emissions
(metric tons CO_2e)

Use	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	*Total*
Proposed Development											
Nonroad	1,106	1,095	244	1,197	891	45	751	195	4	-	5,529
Transportation	1,081	3,421	2,072	1,820	3,561	1,702	902	1,275	1,013	-	16,846
Materials[1]											43,089
Total											**65,465**
Additional Affected Area											
Nonroad	1,063	540	136	478	151	-	288	-	-	-	2,180
Transportation	1,517	1,697	540	393	0	0	521	0	0	-	4,668
Materials[1]											12,590
Total											**19,938**
Proposed Action Total											**84,902**

Notes:
Totals may not sum due to rounding.
[1] Emissions associated with construction materials are not reported annually, as emissions are associated with the production of materials and may not occur within the same year.

SUMMARY

A summary of GHG emissions by source type is presented in **Table 15-6**. Note that if new buildings were to be constructed elsewhere to accommodate the same number of units and space for other uses (e.g., outside of New York City or in areas not as well served by transit or with lower density), 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 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 15-6
Summary of Annual GHG Emissions—RWCDS
(metric tons CO_2e)

Use	Building Operations	Mobile	*Total*
Proposed Development			
Residential	15,924	5,211	27,135
Local Retail	707	932	1,639
Office	2,358	1,594	3,952
Cinema	688	2,049	2,738
Supermarket	283	661	944
Physical Culture Establishment	283	127	410
Community Center	809	475	1,284
Medical Office	47	64	111
Daycare	52	19	72
Performing Arts Center	250	302	552
Parking	264	0	264
Open Space	0	3	3
Total – Proposed Development	**21,665**	**11,437**	**33,103**
Additional Affected Area			
Residential	4,533	1,483	6,016
Commercial	801	1,057	1,858
Parking	60	0	60
Total – Additional Affected Area	**5,395**	**2,540**	**7,934**
Total – Proposed Actions	**27,061**	**13,977**	**41,037**

In addition, total GHG emissions associated with construction, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 85 thousand metric tons.

ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The Applicant seeks to facilitate new mixed-use development in a developed area with excellent access to public transit. As such, the Proposed Development (Applicant-controlled Projected Development Sites A through E) would be consistent with sustainable land-use planning and smart-growth strategies that aim to reduce the carbon footprint of new development. Furthermore, with the Proposed Development, new construction would include a number of design elements and measures which would, among other benefits, result in lower GHG emissions for the proposed buildings. The Applicant is considering the incorporation of sustainability measures in certain buildings and components of the Proposed Development that are consistent with the design principials of several building-level and community-level certifications, such as LEED, WELL, Living Community Challenge, EcoDistricts, and Passive House principles.

This section also discusses the consistency of the Proposed Actions with the Citywide GHG reduction goals as defined in the *CEQR Technical Manual*. Since part of the Proposed Actions would not result in development under ongoing control of the Applicant, specific decisions regarding construction and building design, which would affect energy use and GHG emissions, cannot be made by the Applicant within the scope of the Proposed Actions and would be made by other 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

The Proposed Development would have energy-efficient window glazing and insulation designed to reduce heat loss and facilitate daylight harvesting by admitting more daylight than solar heat. The energy systems would utilize high-efficiency heating, ventilation, and air conditioning (HVAC) systems, with many components designed to reduce energy consumption. Energy recovery ventilation would be included in the building design where applicable. The buildings would also have high-albedo roofs to reduce energy consumption and reduce the buildings' contribution to the urban heat-island effect. Green roofs are also being considered. Additionally, in order to meet New York City requirements, rooftop photovoltaic solar panels may be installed.

High efficacy LED exterior lighting would be included in the building design, and motion sensors for lighting would be incorporated in common areas, resulting in efficient energy consumption.

Large tenants in the Proposed Development would be provided with submeters for electricity allowing tenants to track and optimize their electricity use. Variable Refrigerant Flow (VRF) systems anticipated for the Proposed Development would be selected with the aim to reduce the

impacts from refrigerants in HVAC systems. Building energy systems commissioning would be undertaken upon completion of construction to ensure energy performance. The Applicant would also provide sustainable design guidelines to tenants for build-out.

Water conserving fixtures meeting New York City's stringent building code requirement would be installed, and water-efficient landscaping would be selected to reduce water consumption, indirectly reducing energy consumption associated with potable water production and delivery. As discussed in the *CEQR Technical Manual*, climate change is projected to have wide-ranging effects on the environment, including changes in intense precipitation levels. The measures the Proposed Development would include would also improve resiliency of the Project Area by reducing peak discharges to the City's sewer system during rain events, requiring greater onsite storage of stormwater runoff, and slower release to the sewer system. Stormwater detention and compliance with a performance standard on release rate during rain events would also be required for new buildings that are connecting to the City's sewer system, as described in Chapter 10, "Water and Sewer Infrastructure."

As part of the Propoed Development's design, the Applicant would also include infrastructure that would capture and reuse rainwater, as well as rainwater gardens that would contribute to the area's rainwater management.

The Applicant is required at a minimum to achieve the energy efficiency requirements of the New York City Building Code. In 2020, as part of the City's implementation of strategies aimed at achieving the OneNYC GHG reduction goals, the City brought the New York City Energy Conservation Code (NYCECC) up to date with the 2020 Energy Conservation Code of New York State (2020 ECCNYS), which substantially increased the stringency of the building energy efficiency requirements and adopted the ASHRAE 90.1-2016 standard as a benchmark and aligns with NYStretch Energy Code 2020 developed by New York State Energy Research and Development Authority (NYSERDA). The Proposed Development would implement any measures required under such programs, as legally applicable.

The estimated GHG emissions associated with the building energy use, which were conservatively estimated for the Proposed Actions using the 2008 citywide average emission intensities, would generally fall below the immediate building emissions intensity limits set forth in Local Law 97, and with the implementation of the above measures, the Proposed Actions would be in line with the City's energy efficiency, renewable energy, and carbon emission reduction goals. GHG emissions associated with electricity consumption at the new buildings would continue to decrease in future years as the carbon intensity associated with grid electricity is expected to decrease, with New York State and New York City targeting 100 percent renewable electricity by 2040. Therefore, the Proposed Development would support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

For the Additional Affected Area, 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 the additional Projected Development Sites that would be developed as a result of the Proposed Actions would not otherwise be controlled by the Applicant. However, in general, pursuing denser development, one of the objectives of the proposed rezoning, would result in overall increased energy efficiency.

Some of the additional Projected Development Sites may require additional measures if developers apply for construction funding through the New York City Department of Housing Preservation and Development (HPD). These sites would be developed under HPD's affordable

housing requirements, including certification under the enterprise green communities (EGC) program per the HPD EGC Overlay. The EGC program certification for new buildings would require the implementation of designs 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.

Therefore, the Proposed Actions overall would also support the goal identified in the *CEQR Technical Manual* of building efficient buildings.

USE CLEAN POWER

To the extent practicable, the Applicant would encourage the development and use of clean power for sites under the Applicant's control (Projected Development Sites A through E). While the use of clean power would not be specifically required, a primarily electric building design is currently being considered. If fossil-fuel equipment is used, the Proposed Development would use natural gas, a lower carbon fuel, for the normal operation of the heat and hot water systems. The Proposed Development would also be designed to utilize available rooftop space for the installation of solar generation, consistent with Local Laws 92 and 94. It is also possible that additional local renewable power production (e.g., geothermal, solar, wind) would be considered while reviewing the principles of LEED, EPA Energy Star, to achieve the above efficient building goals.

While details for sites in the Additional Affected Area are not known at this time, all sites would be required to use natural gas for fossil fuel-fired heating and hot water equipment due to (E) Designations related to air quality (see Chapter 14, "Air Quality"). Natural gas has lower carbon content per unit of energy than other fuels, and thus reduces GHG emissions. Furthermore, buildings within the Additional Affected Area would also be required to consider the inclusion of solar photovoltaics within available rooftop space.

Therefore, the Proposed Actions would support the goal identified in the *CEQR Technical Manual* of using clean power.

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The Applicant would consider the use of pedestrian-oriented public spaces and wayfinding principles as part of the design for the Proposed Development to ease the connection to bicycle networks. Potential for carshare programs and electric scooter sharing would also be explored. Preferential parking for carpooling, as well as charging infrastructure for electric vehicles described above would be included. The Proposed Development would include below-grade parking facilities in every building, with the plan to achieve a minimum of 30 percent reduction in parking footprint. Charging infrastructure for electric vehicles would also be included for at least 20 percent of the parking provided. The Project Area would be supported by transit options that include the E, M, and R subway lines at the Steinway Street and 36th Street Stations, as well as local buses throughout the Project Area. The Project Area also includes several Citi Bike stations.

REDUCE CONSTRUCTION OPERATION EMISSIONS

Construction specifications would include an extensive diesel emissions reduction program, as described in detail in Chapter 19, "Construction," including diesel particle filters for large construction engines and other measures. These measures would reduce particulate matter emissions; while particulate matter is not included in the list of standard GHGs ("Kyoto gases"), recent studies have shown that black carbon—a constituent of particulate matter—may play an important role in climate change. The Applicant is exploring the use of biodiesel engines or electric construction equipment, and would implemement a Construction Waste Management Plan to promote the waste reduction.

For sites in the Additional Affected Area, promotion of the GHG reduction goal through construction specifications cannot be achieved within the scope of the Proposed Actions, since the additional Projected Development Sites that would be developed as a result of the Proposed Actions would not otherwise be controlled by the Applicant.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

For the Proposed Development, recycled steel may be used for most structural steel since the steel available in the region is mostly recycled. Some cement replacements such as fly ash and/or slag may also be used, and concrete content would be optimized to the extent feasible. The use of local, rapidly renewable, or certified sustainable wood, and recycled build-out materials would be considered. Construction waste would be diverted from landfills to the extent practicable by separating out materials for reuse and recycling.

For sites in the Additional Affected Area, promotion of the GHG reduction goal through design specifications cannot be achieved within the scope of the Proposed Actions since the Additional Projected Development Sites that would be developed as a result of the Proposed Actions would not otherwise be controlled by the Applicant. However, as discussed above, 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. CONCLUSION

As described above, the Proposed Actions would include substantial energy efficiency and other design measures and features aimed at reducing GHG emissions. The implementation of the various design measures and features described above would result in development that is consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*. ✷