Chapter 15: Greenhouse Gas Emissions

A. INTRODUCTION

This chapter evaluates the greenhouse gas (GHG) emissions that would be generated by the Proposed Project and its consistency with the citywide GHG reduction. Per the 2021 *City Environmental Quality Review (CEQR) Technical Manual*, evaluation of GHG emissions serves as a proxy for evaluating the Proposed Project's impact on climate change.

As discussed in the *CEQR Technical Manual*, 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 felt at the local level. New York State and New York City have each established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change.

Per the *CEQR Technical Manual,* the citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. Among the project types identified in the *CEQR Technical Manual* for which a GHG consistency assessment is appropriate are those preparing an environmental impact statement and expected to result in 350,000 square feet or more of development. As described in Chapter 1, "Project Description," the Proposed Project would result in approximately 1,230,300 gross square feet (gsf) of developed floor area, with up to approximately 735,800 gsf at the Armory Site, including a mix of community facility and cultural space, light manufacturing space, commercial office space, a 17,000-person capacity live event venue, and other entertainment uses, along with parking and loading docks. The National Guard Site would be redeveloped with a new, 16-story residential building (up to approximately 494,500 gsf) containing 500 new permanently affordable dwelling units (DUs), replacing a one-story garage and a two-story office building. Accordingly, a GHG consistency assessment is provided.

The Proposed Project would be subject to New York City's energy efficiency and carbon intensity regulations and is anticipated to result in more energy efficient buildings. The commitment for buildings to use electric heating, ventilation, and air conditioning (HVAC) would result in estimated GHG emissions and energy consumption being reduced substantially.

PRINCIPAL CONCLUSIONS

The Proposed Project would not result in significant adverse impacts to greenhouse gas emissions or climate change. In order to determine the potential for significant impacts, an individual project's consistency with the City's emission reduction goals is considered. Based on the Proposed Project's focus on implementing a fully electric energy efficient

HVAC design, its location, and the nature of construction in New York City, the Proposed Project would align with the City's emissions reduction goals. Therefore, the Proposed Project would not result in a significant adverse impact on greenhouse gas emissions or climate change.

The building energy use and vehicle use associated with the Proposed Project would result in up to approximately 9,034 metric tons of carbon dioxide equivalent (CO_2e) emissions per year in the 2032 Build Year. Construction of the Proposed Project would result in an additional 27,580 metric tons of CO_2e—equivalent to approximately 3 years of operation. The design of the Proposed Project would target energy efficiency measures, the inclusion of renewable energy, and carbon emission reductions in line with the City's goals. In addition, future emissions associated with the Proposed Project's consumption of grid electricity is expected to decrease as New York State and New York City target 100 percent renewable electricity, and would result in significant reduction of emissions associated with the buildings' electricity consumption.

Specific energy efficiency measures and design elements that may be implemented with the Proposed Project are being evaluated as the project design moves forward. At a minimum, the Proposed Project aims 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 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).

Additional sustainable design features that are being evaluated for the Proposed Project would, among other benefits, result in lower GHG emissions. Most significantly, the Proposed Project is anticipated to utilize HVAC systems designed to be fully electrified, utilizing high efficiency heat pumps to provide space heating and cooling—eliminating the need for on-site fossil fuel consumption for normal operations. In order to ensure energy consumption is minimized, it is anticipated that the Proposed Project would seek LEED Gold certification which would require the use of less energy than if built only to meet the energy code. Consequently, the Proposed Project would be designed to comply with New York City's carbon intensity limits designed to reduce building emissions within the City and achieve its sustainability goal of net zero emissions (carbon neutral) by 2050.

Further, additional energy savings for the Proposed Project would likely be achieved via guidance for tenant build-out, which would control much of the building's energy use and efficiency, but those are unknown at this time. The Proposed Project's goal of building energy efficiency—meeting the City's updated building code energy requirements—endeavors to obtain consistency with the efficient buildings goal defined in the *CEQR Technical Manual* as part of the City's GHG reduction goal.

The Proposed Project would also align with other GHG goals by virtue of its proximity to public transportation, commitment to construction air quality controls and recycling construction materials, and the fact that, as a matter of course, construction in New York City uses recycled steel and includes cement replacements.

Together, these factors demonstrate that the Proposed Project is consistent with the City's sustainability policies designed to meet the GHG reduction goals. Consequently, consistent with the City's sustainability policies and commitment to utilize fully electrified HVAC systems, the Proposed Project demonstrates that it would not interfere with the attainment of the statewide GHG limits for 2030 or 2050. Since the Project Site is located within a disadvantaged community, these measures would also ensure against disproportionate burdens by avoiding additional emissions within the disadvantaged community.

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. 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 (an international agreement), 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 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.

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 Project.

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 are therefore included in GHG emissions analyses when the potential for substantial emission of these gases exists.

To present a complete inventory of all GHGs, component emissions are added together and presented as carbon dioxide equivalent (CO_2e) emissions—a unit representing the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing[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). Consistent with the *CEQR Technical Manual,* CO_2e emissions are estimated using the effect GWP over a 100-year horizon (GWP-100). While New York State GHG emission reduction goals use a 20-year horizon (GWP-20), the emissions of GHGs other than CO_2 represent a very minor component of the emissions associated with the Proposed Actions and the difference between the two GWPs would be negligible. The GWPs for the main GHGs discussed here are presented in **Table 15-1**.

Table 15-1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	100-year Horizon GWP(1)	20-year Horizon GWP (2)
Carbon Dioxide (CO_2)	1	1
Methane (CH_4)	21	84
Nitrous Oxide (N_2O)	310	264
Hydrofluorocarbons (HFCs)	140 to 11,700	427 to 10,800
Perfluorocarbons (PFCs)	6,500 to 9,200	4,880 to 8,210
Sulfur Hexafluoride (SF_6)	23,900	17,500

Notes:
(1) The 100-year 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.
(2) The 20-year GWPs presented above are consistent with New York State's approach to GHG emission estimates as described in the Climate Leadership and Community Protection Act (CLCPA).
Source: 2021 *CEQR Technical Manual; 2023 Statewide GHG Emissions Report*

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

FEDERAL 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

[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.

undertaken efforts to reduce emissions by implementing both global and local measures addressing energy consumption and production, land use, and other sectors. Although the United States has not ratified the international agreements that set emissions targets for GHGs, in December 2015 the United States 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] The United States has since withdrawn as of January 20, 2025.

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

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.

The New York State Energy Plan (last amended in April 2020) outlines the state's energy goals and provides strategies and recommendations for meeting those goals. 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.

In 2019, New York State enacted the CLCPA to achieve the GHG reductions goals established in the New York State Energy Plan and expand on them by: 1) establishing state-wide GHG emission limits to achieve new long-term goals to reduce state-wide GHG by 100 percent (compared with 1990 levels) by 2050; and 2) providing 100 percent of electricity generation in the state from renewable sources by 2040. Among other requirements to meet the state's emission reduction goals, the CLCPA requires state agencies to determine if their decisions are consistent with the statewide GHG emission limits established by the CLCPA in the Environmental Conservation Law (ECL) Article

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[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.

75[4] and ensure that decisions shall not disproportionately burden disadvantaged communities.[5]

The legislation also charges the New York State Climate Action Council with recommending agency regulations to reduce emissions, increasing investments in renewable energy sources, and ensuring 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 on December 19, 2022.

As part of this effort, New York 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. On December 29, 2022, New York State also announced the adoption of California's GHG vehicle standards, the Advanced Clean Cars II Rule, which are at least as strict as the federal standards and would require all new passenger cars and trucks sold in New York State to be zero-emissions by 2035.

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 (decreasing by 2.5 percent each year) and reducing an additional 26 percent from 2020 to 2030. 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 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 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").[6] 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

[4] CLCPA Section 7(2). 01/2020

[5] CLCPA Section 7(3). 01/2020

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

aggressive goal for reducing emissions from building 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 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), targeting 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 complies 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 (DOB) adopted maximum carbon intensity factors for buildings through 2050 by Energy Star Portfolio Manager (ESPM) property type.[7] 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, when 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

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

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 British thermal units (Btu) of energy.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the LEED (Leadership in Energy and Environmental Design) 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.

D. 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.

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

Estimates of potential GHG emissions associated with the Proposed Project are based on the methodology presented in the *CEQR Technical Manual*. Estimates of emissions of GHGs 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 project-generated vehicle use.

Emissions from transportation conservatively applies the emission factors for the 2032 analysis year of the Proposed Project. Since vehicular emission factors will 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. However, the *CEQR Technical Manual* methodology does not account for future years or explicitly address potential changes in future consumption associated with climate change, such as increased electricity for cooling. Therefore, this analysis results in overall conservatively high estimates of potential GHG emissions.

As described above, 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 (see "Pollutants of Concern," above). GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as metric tons of carbon dioxide equivalent (CO_2e) emissions per year.

BUILDING OPERATIONAL EMISSIONS

GHG emissions from the Proposed Project are assumed to be designed to meet the City's carbon intensity limits at the time that construction is completed as specified in the Rules of the City of New York.[8] While the carbon intensity limits do not preclude the use of fossil fuels, the Proposed Project will utilize electric-powered equipment (air source heat pumps) to provide heating and cooling to the Project Site buildings (with the potential for fossil fuel-fired emergency generators to provide reliable power in the event of a utility power outage) and comply with LL154. The Proposed Project may also include the use of natural gas for cooking at commercial restaurants and/or food vendors. Therefore, GHG emissions were estimated using the carbon intensity limits for the 2030–2034 time period, and represent the maximum allowed emissions for the Proposed Project including grid electricity consumption, fuel use for maintenance and testing of emergency generators, and cooking services.

As discussed in Chapter 12, "Energy," the Proposed Project is conservatively estimated to consume up to 259,404 million British thermal units (MMBtu) of energy per year—approximately 76,023,814 kilowatt-hours (kWh) per year. However, these estimates are based on citywide average energy consumption estimates for existing buildings. Therefore, actual annual energy consumption from the Proposed Project's building HVAC operations are anticipated to be well below these estimates. Consequently, the Proposed Project's GHG will fall below the City's carbon intensity limits and future emissions are expected to be lower than these projections as the City and State achieve a zero-emission electrical grid by 2040 as well as the City's stricter carbon intensity limits for buildings beyond the 2032 build year.

MOBILE SOURCE EMISSIONS

The numbers of annual weekday and Saturday vehicle trips by mode (cars, taxis, and trucks) that would be generated by the Proposed Project were 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 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 *CEQR Technical Manual* was used to estimate GHG emissions from all trips attributable to the Proposed Project. Since the mobile GHG emissions calculator does not assume an increased percentage of

[8] Rules of the City of New York. 1 RCNY §103-14.

electric vehicles in the regional vehicle fleet, the GHG vehicle emissions 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,[9] emissions from producing and delivering fuel ("well-to-pump") are estimated to add an additional 26 percent to the GHG emissions from gasoline and 27 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 Project, 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 total annual vehicle miles traveled by roadway 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

Roadway Type	Passenger Vehicle	Taxi	Truck
Local	641,502	206,582	427,737
Arterial	1,399,641	450,724	933,245
Interstate/Expressway	874,776	281,703	583,278
Total	**2,915,919**	**939,009**	**1,944,260**

CONSTRUCTION EMISSIONS

A project's impact on climate change comes from the GHG emissions over the full lifecycle of a project—from both construction and operation of the Proposed Project. Since the Proposed Project is anticipated to have a construction schedule duration of more than five years and would be considered long-term, GHG emissions associated with construction were assessed quantitatively. Estimates of emissions of GHGs from the construction activity and materials were quantified, including on-site emissions from engines, emissions from vehicle use, and emissions associated with materials extraction, production, and transport. 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 the Proposed Project's construction 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 miles traveled (VMT) associated with commuting workers. An average round-trip commute distance for

[9] Based on GREET_1_2024 model from Argonne National Laboratory.

construction workers in the NYC Region of 25.3 miles (based on the average trip to work distance for the New York Metropolitan Area area)[10] 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 Project. Table 18-7 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 Project.

The Proposed Project would result in construction worker travel of 1,130,749 VMT over the five years of construction, with a maximum annual distance traveled of 345,386 VMT in 2031. Similarly, construction truck trips would result in a total of 2,609,531 VMT over the construction duration, with a maximum annual distance traveled of 580,958 VMT in 2028. 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 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, were 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 were estimated to require approximately 101,779 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.[11]

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 would also 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 Project.

Construction is estimated to require 430 metric tons of cement based on the number of concrete truck deliveries, carrying an assumed capacity of 10 cubic yards of concrete, the composition of which is 10 percent cement. 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.[12] The precise origin of cement for this project is unknown at this time.

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[10] 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.

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

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

Construction is estimated to require 17,775 metric tons of steel based on the number of trucks projected to deliver steel to the Project Site, carrying an assumed capacity of 25 tons. An emission factor of 0.6 metric tons of CO_2e per metric ton of steel product produced was applied to estimate emissions associated with production energy consumption,[13] 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.[14]

~~Total GHG emissions associated with construction are considered as part of the total emissions generated by the Proposed Project. Because detailed architectural drawings of the Proposed Project have not yet been prepared, emissions associated with construction of the Proposed Project have not been estimated explicitly. However, analyses of similar projects have shown that construction emissions are typically equivalent to the total operational emissions up to approximately 5 to 10 years.~~

EMISSIONS FROM SOLID WASTE MANAGEMENT

As detailed in Chapter 11, "Solid Waste and Sanitation Services," the Proposed Project would not fundamentally change the City's solid waste management system. Therefore, as per the *CEQR Technical Manual*, the GHG emissions from the Proposed Project's solid waste generation, transportation, treatment, and disposal are not quantified and no further assessment is warranted.

E. PROJECTED GHG EMISSIONS

BUILDING OPERATIONAL EMISSIONS

The building floor area, emission intensity, and resulting GHG emissions from each of the uses for the Proposed Project are presented in detail in **Tables 15-3**. The analysis presents the total emissions after construction.

MOBILE SOURCE EMISSIONS

The mobile-source-related GHG emissions from the Proposed Project are presented in detail in **Tables 15-4**.

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

[14] 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

Building	Source Use	Building Area (gsf)	Carbon Intensity Limit[1] (kg CO_2e / gsf - year)	Annual GHG Emissions (metric tons CO_2e)
Armory	Museum	30,200	5.396	163
	Community-Based Organization Space	54,200	2.957	160
	Office	73,000	2.691	196
	Light Manufacturing/Incubator Space	87,800	1.417	124
	Event Venue	99,800	2.957	295
	Flex Space/Sport Fields	87,200	4.480	391
	Recreation/Entertainment	65,500	2.957	194
	Parking and Loading	79,300	0.214	17
	Back of House (circulation, mechanical etc.)	158,800	0.214	34
	Armory Total	**735,800**	**2.140**	**1,574**
National Guard Site	Residential	438,500	3.347	1,468
	Local Retail	14,400	2.104	30
	Parking	41,600	0.214	9
	National Guard Site Total	**494,500**	**3.047**	**1,507**
			TOTAL:	**3,081**

Notes: Totals may not sum due to rounding.

Table 15-4
Annual Mobile Source Emissions
(metric tons CO_2e)

Source Use	Passenger Vehicle	Taxi	Truck	Total
Office	335	5	484	823
Residential	523	12	1,429	1,964
Local Retail	144	0	108	252
Museum	58	17	31	106
Recreation/ Community Facility	45	70	49	164
Light Manufacturing/Incubator Space	192	5	1,683	1,880
Event Venue / Recreational	209	327	227	763
Total	**1,506**	**435**	**4,012**	**5,953**

Notes:
Totals may not sum due to rounding.

In addition to the direct emissions included in the analysis, an additional approximately 25 percent of direct emissions would be emitted upstream (associated with fuel extraction, production, and delivery).

CONSTRUCTION EMISSIONS

Total GHG emissions associated with the construction of the Proposed Project, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 27,580 metric tons of CO_2e emissions—which is equivalent to approximately 3 years of operational emissions. GHG emissions would be generated by on-site fuel consumption from equipment and truck idling (of ready-mix concrete truck and other necessary idling), truck and car fuel consumption while traveling on regional roadways, and the embodied carbon emissions associated with construction

materials (including concrete and steel). An overall summary of construction GHG emissions by source type for the Proposed Project are presented in **Table 15-35**.

~~Table 15-3~~
~~Total Construction Emissions (metric ton CO_2e)~~

~~Source~~	~~Emissions~~
~~On-Site~~	~~148~~
~~Transportation~~	~~4,890~~
~~Material~~	~~22,542~~
~~**Total**~~	~~27,580~~

Table 15-35
Total Construction GHG Emissions (metric tons CO_2e)

Use	2027	2028	2029	2030	2031	2032	*Total*
Nonroad	25	37	27	41	16	2	*148*
Transportation	582	1,144	1,074	1,015	860	215	*4,890*
Materials[1]							*22,542*
Total							***27,580***

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 for the Proposed Project is presented in **Table 15-~~5~~6**. 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 Project, depending on location, access to transit, building type, and energy efficiency measures.

In addition, total GHG emissions associated with construction, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 27,580 metric tons.

~~In addition, total GHG emissions associated with construction were considered as part of the Proposed Project's total emissions. Because detailed architectural drawings of the proposed buildings have not yet been prepared, emissions associated with construction of the Proposed Project have not been estimated explicitly. However, analyses of similar projects have shown that construction emissions are typically equivalent to the total operational emissions up to approximately 5 to 10 years.~~

Table 15-~~5~~6
Summary of Annual GHG Emissions
(metric tons CO_2e)

Building	Source Use	Building Operations	Mobile	Total
	Museum	163	106	**269**
	Community-Based Organization Space	160	164	**324**
	Office	196	823	**1,020**
	Light Manufacturing/Incubator Space	124	1,880	**2,005**
	Event Venue	295	763	**1,642**
	Flex Space/Sport Fields	391		
	Recreation/Entertainment	194		
	Parking and Loading	17	---	**17**
	Back of House (circulation, mechanical etc.)	34	---	**34**
	Armory Total	**1,574**	**3,737**	**5,311**
National Guard Site	Residential	1,468	1,964	**3,432**
	Local Retail	30	252	**282**
	Parking	9	---	**9**
	National Guard Site Total	**1,507**	**2,216**	**3,723**
Total		**3,081**	**5,953**	**9,034**

Note: Totals may not sum due to rounding.

F. PROJECT ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The Proposed Project would include a number of sustainable design features which would, among other benefits, result in lower GHG emissions. It is anticipated that the Proposed Project would seek LEED Gold certification which would require the use of less energy than if built only to meet the energy code. Furthermore, compliance with the City's carbon intensity limits would also result in energy efficient building designs that would exceed energy code requirements. Moreover, development with access to transit and existing roadways is, in general, consistent with sustainable land use planning and smart growth strategies to reduce the carbon footprint of new development. These features and other measures currently under consideration are discussed in this section, addressing the PlaNYC/OneNYC goals as outlined in the *CEQR Technical Manual* as well as New York State GHG reduction goals stated in the CLCPA. The implementation of the various design measures and features described would result in development that is consistent with the City's emissions reduction goal, as defined in the *CEQR Technical Manual*.

BUILD EFFICIENT BUILDINGS

Several measures have been identified that are under consideration to be implemented in the final design of the Proposed Project that would reduce GHG emissions (directly or indirectly). However, the design specifics will continue to evolve as part of the LEED certification process. These measures are listed below and represent measures currently under consideration that are likely to be implemented, along with other measures may be included once building-specific designs are further advanced:

- HVAC systems would be designed to be fully electrified, utilizing high efficiency heat pumps to provide space heating and cooling;

- Exhaust systems and split air systems would be designed with energy recovery technology;
- Heat pumps would produce domestic hot water and the plumbing systems would use high-efficiency fixtures and appliances;
- Windows would be located such that designs would limit total glazing area, incorporate thermal breaks, and utilize high-performance coatings;
- Incorporation of efficient, directed exterior lighting as well as maximizing interior daylighting;
- Incorporation of motion sensors for lighting control for back-of-house and support spaces;
- Use efficient lighting and elevators, exceeding requirements;
- Sub-metering of electricity and water allowing tenants to track and optimize their use;
- Water conserving fixtures, meeting New York City's stringent building code requirements;
- High performance, continuously insulated envelope assemblies;
- High-albedo roofing materials; and
- Third-party building commissioning would be undertaken upon completion of construction to ensure energy performance.

The estimated GHG emissions associated with building energy use for the Proposed Project would fall below the carbon intensity limits through 2035 due to the use of fully electrified HVAC systems. With implementation of the measures above, the Proposed Project would compliant with the City's energy efficiency measures, renewable energy, and carbon emission reduction goals. Further, the Proposed Project's GHG emissions would be likely to achieve future building emissions limits as the carbon intensity associated with grid electricity is expected to decrease as New York State and New York City target 100 percent renewable electricity by 2040.

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

USE CLEAN POWER

Under the carbon intensity limits for most buildings in New York City established under the Rules of the City of New York,[15] the Proposed Project would be required to report its GHG emissions each year and compare its emissions to the applicable carbon intensity limits. Stricter GHG emission limits would also be phased into developments in later years with a requirement that buildings show zero emissions beginning in 2050. While the use of fossil fuels would not be specifically prohibited by the City, the Proposed Project would utilize electric-powered systems for the normal operation of the heat and hot water systems, and residential cooking appliances.

In the Future with the Proposed Project, the proposed residential building also would be subject to the requirements to utilize available roofing space for the installation of either

[15] Section 103-14

a green roof or a solar photovoltaic system generating at least 4kW, or a combination of the two. While available rooftop space for photovoltaic systems has not been identified for the National Guard Site, the current design includes consideration of solar installation on the roof of the Armory Site. Therefore, it is also possible that local on-site renewable power production (e.g., geothermal, solar, wind) would be considered while reviewing options for LEED credits, EPA Energy Star, and achieving the above efficient building goal.

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

TRANSIT-ORIENTED DEVELOPMENT AND SUSTAINABLE TRANSPORTATION

The Project Site is located adjacent to the Kingsbridge Road subway station and is also supported by the nearby Bx9, Bx22, Bx28, and Bx32 bus routes. The Proposed Project is anticipated to include newly constructed infrastructure for low-emission mobility options such as bike storage, e-mobility options, and up to 20 percent of parking space to support EV charging. Therefore, the Proposed Project would support the goal identified in the *CEQR Technical Manual* of supporting transit-orient development and sustainable transportation.

REDUCE CONSTRUCTION OPERATION EMISSIONS

As described in detail in Chapter 19, “Construction,” construction specifications would include an extensive diesel emissions reduction program, including diesel particulate filters for large construction engines, use of electric equipment in lieu of fossil-fuel powered where feasible, limiting idle times on site, 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. Therefore, the Proposed Project would support the goal identified in the *CEQR Technical Manual* of reducing construction emissions.

USE BUILDING MATERIALS WITH LOW CARBON INTENSITY

The Proposed Project would limit the need for building materials by utilizing an adaptive reuse of the existing Armory Site. This would reduce the concrete and steel needed to be manufactured to construct the Proposed Project as well as reduce the construction debris and waste associated with demolition of the existing site.

For new materials needed, recycled steel may be used for most structural steel, to the extent feasible, since the steel available in the region is mostly recycled and would result in reduced upstream emissions. Upstream emissions for recycled steel are associated with both the production of steel using scrap metal (compared to iron ore) and with transportation of steel to the construction site. However, the Proposed Project may also consider further reductions by considering procurement using less energy intensive production technologies (such as electric arc furnaces to process scrap metals as opposed to traditional fossil fuel fired blast furnaces used to process raw iron.)

Low-carbon cement replacements (such as fly ash, slag, or other pozzolans) would also be used to the extent feasible. Therefore, the Proposed Actions would support the goal identified in the *CEQR Technical Manual* of using low carbon building materials.

G. CONCLUSIONS

The operation of the Proposed Project would result in the emission of ~~8,912~~9,034 metric tons of CO_2e per year. In addition, total GHG emissions associated with construction, including direct emissions and upstream emissions associated with construction materials (excluding fuel), would be approximately 27,580 metric tons.~~Total GHG emissions are anticipated to be equivalent to the total operational emissions up to approximately 5 to 10 years.~~

The Proposed Project would incorporate several sustainable design factors that demonstrate that the Proposed Actions are consistent with the City's sustainability policies designed to meet the GHG reduction goals. Consequently, the Proposed Actions are consistent with the City's sustainability policies and commitment to utilize fully electrified HVAC systems, and the Proposed Project demonstrates that it would not interfere with the attainment of the statewide GHG limits for 2030 or 2050. Since the Project Site is located within a disadvantaged community, these measures would also ensure against disproportionate burdens by avoiding additional emissions within the disadvantaged community. ✷