Chapter 16: Global Climate Change

A. INTRODUCTION

Potential impacts of global climate change on the Proposed Project and potential impact of the project on greenhouse gas (GHG) emissions are analyzed in this chapter. The potential for impacts on the Proposed Project's facilities or operation through changes to the Hudson River water quality or flow and other relevant potential changes due to climate change are discussed first, followed by an assessment of potential GHG emissions resulting from the Proposed Project's construction and operation. Existing scientific studies and information were reviewed and relevant information is presented.

The assessment included impacts in the near future, in the early years of the operation of the facilities, impacts in the 20- to 35-year horizon, and impacts near the end of the century.

This chapter also presents specific actions that United Water New York Inc. (United Water) is committed to undertaking to reduce GHG emissions and reduce the Proposed Project's "carbon footprint." In addition, this chapter discusses a number of actions that United Water is evaluating to further enhance the Proposed Project's environmental sustainability.

This chapter of the DEIS includes the following sections:

Section B: Background.
Section C: Pollutants of Concern.
Section D: Policy, Regulations, Standards, and Benchmarks.
Section E: Methodology.
Section F: Potential Impacts of Global Climate Change on the Proposed Project.
Section G: Potential Impact of the Proposed Project on Greenhouse Gas Emissions.
Section H: References.

B. BACKGROUND

There is general consensus in the scientific community that global climate change is occurring, and will continue to occur as a result of increased concentrations of GHGs in the atmosphere. This increase is associated with emissions of GHGs primarily from combustion of fossil fuels, as well as various other processes. Atmospheric concentrations of GHGs are increasing because these gases have very little chemical removal processes, and the rate of emission exceeds the rate of the various natural processes that remove these gases from the atmosphere. The increase in GHG concentrations, since the beginning of the industrial age, has led to a noticeable warming of the Earth's atmosphere, surface, and oceans, which, in turn, has and will result in myriad climatic changes that will vary by geographic location, including changes in precipitation levels and patterns, changes in oceanic circulation patterns, and the more frequent occurrence of extreme weather events.

Warming of the oceans leads directly to sea level rise due to thermal expansion—a process which is accelerated by the melting of glaciers, ice caps, and sea ice. Sea level rise is predicted to profoundly affect coastal land use and natural environments.

Changes in local climate patterns affect many natural systems and human environments, including drinking water availability and quality, species distribution and extinction, disease patterns and propagation, and many more impacts. Some of these effects could also interact with each other in unexpected ways and accelerate adverse impacts.

Some of the impacts of global climate change may also accelerate global climate change ("positive feedback"). For example, shrinking ice coverage increases surface warming, since the reflectivity (albedo) of land and water are lower than those of ice and snow. Changing of ocean circulation from surface to deep waters could also affect atmospheric temperature.

While the contribution of any single project to climate change is infinitesimal, the combined GHG emissions from all human activity have a severe adverse impact on global climate. The nature of the impact dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. Therefore, this chapter does not identify specific contributions of the Proposed Project to climate impacts, but rather addresses the changes in GHG emission associated with the Proposed Project. Potential impacts of future local climate change and of the associated changes in the surrounding environment on the Proposed Project are examined as well.

C. POLLUTANTS OF CONCERN

GHGs are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the general warming of the Earth's atmosphere, or the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide, methane, and ozone are the primary greenhouse gases in the Earth's atmosphere.

Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, which are also responsible for damaging of the stratospheric ozone layer (creating the "ozone hole"). Since these compounds are being replaced and phased out from use due to the 1987 Montreal Protocol, there is generally no need to address these chemicals in project-related GHG assessments. Although ozone itself is also a substantial greenhouse gas, long-term project-level impacts on ozone emissions as a greenhouse gas do not need to be analyzed, since ozone is a rapidly reacting chemical, and since efforts are ongoing to reduce the production of ozone as a criteria pollutant (ozone is addressed in Chapter 14, "Air Quality" as a "criteria pollutant," or pollutant for which National Ambient Air Quality Standards (NAAQS) have been established).

Although water vapor is of great importance to global climate change, it is not directly of concern as an emitted pollutant since the miniscule quantities emitted from anthropogenic sources are of no consequence. Global climate change can, however, increase evaporation and thereby, indirectly impact global climate change.

Carbon dioxide (CO_2) is the primary pollutant of concern from anthropogenic sources. Although not the GHG with the strongest impact on global climate change for an equal quantity of gas, it 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 in the lower atmosphere by natural processes such as photosynthesis and uptake by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and nitrous oxide also play an important role since they have limited removal processes and a relatively high impact on global climate change as compared to an equal quantity of CO_2. Methane is emitted from agriculture, natural gas distribution, and landfills. Methane is also released from natural processes that include the decay of organic matter lacking sufficient oxygen, for example, in wetlands. Nitrous oxide is emitted from fertilizer use and fossil fuel burning. Natural processes in soils and the oceans also release nitrous oxide. Emissions of these compounds, therefore, are included in GHG emissions analyses as appropriate.

Some other GHGs may also be of importance for certain processes, including certain Hydrofluorocarbons (HFCs), used as refrigerants, foam blowers, and released as byproducts from the production of other HFCs; some perfluorocarbons (PFCs), produced as byproducts of traditional aluminum production, among other activities; and sulfur hexafluoride (SF_6), used as an electrical insulating fluid in power distribution equipment. These compounds are included in GHG emissions analyses only where relevant, and are not included in the analysis of the Proposed Project, since the Proposed Project would not result in the use of, or processes that emit a significant amount of these GHGs.

In order to present a complete inventory of all GHGs, the various emissions are added together and presented as carbon dioxide equivalent (CO_2e) emissions—a sum which includes the quantity of each GHG weighted by a factor of its effectiveness as a GHG using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). GWPs account for the lifetime and the radiative forcing of each chemical over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed here are presented in Table 16-1.

Table 16-1
Global Warming Potential (GWP) for Major GHGs

Greenhouse Gas	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous Oxide (N_2O)	298
Hydrofluorocarbons (HFCs)	124 to 14,800
Perfluorocarbons (PFCs)	7,390 to 12,200
Sulfur Hexafluoride (SF_6)	22,800

Sources: IPCC, Climate Change 2007—The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report, Table 2-14, 2007.

D. POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS

As a result of the growing consensus that human activity resulting in GHG emissions has the potential to profoundly impact the Earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both global and local measures addressing energy consumption and production, land use, and other measures. Although the U.S. has not ratified international agreements setting emissions targets for GHGs, the federal government has announced its goal to reduce the national GHG emissions per economic output by 18 percent over the 10-year period from 2002 to 2012. Achieving this goal would result in a smaller increase in GHG emissions in the U.S. than would otherwise occur by 2012. The U.S. Environmental Protection Agency (EPA) has pursued this goal with various voluntary programs to reduce emissions and increase energy efficiency, by financial incentives for the development and deployment of innovative technologies that would result in reduced GHG emissions, and by investing in scientific and technological research. In addition, the Energy Independence and Security Act of 2007 includes provisions for increasing the production of clean renewable fuels, increasing the efficiency of products, buildings, and vehicles, and for promoting research on carbon capture and storage options.

EPA has recently embarked on a few regulatory initiatives related to GHG emissions, including promulgating fuel economy standards for newly manufactured vehicles, regulation of geological sequestration of CO_2 to ensure protection of water sources and the long-term integrity of CO_2 sequestration, and a GHG reporting rule to collect information on GHG emissions as pollutants under the Clean Air Act.

In addition, there are regional, State, and local efforts to reduce GHG emissions. In 2001, New York State Governor Pataki issued Executive Order 111, Green and Clean State Buildings and Vehicles, a directive that set goals for energy-efficient State buildings, the use of energy from renewable sources, and the procurement of energy-efficient products and alternative fuel vehicles. The 2002 New York State Energy Plan included goals to increase the State's use of renewable energy and called for increased energy efficiency with the aim of cutting the State's GHG emissions. The Energy Plan was designed to provide Statewide policy guidance for energy-related decisions by government and private market participants. In 2004, the New York State Public Service Commission voted to adopt a Renewable Portfolio Standard with a goal of increasing the proportion of renewable electricity used by New York consumers from the 2004 baseline of 19.3 percent to at least 25 percent by 2013. In 2005, Executive Order 142 directed State agencies and authorities to diversify transportation, fuel and heating oil supplies through the use of bio-fuels in State vehicles and buildings.

Recently, New York State announced that it would update the plan with goals to reduce electricity use by 15 percent from forecasted levels by the year 2015 through new energy efficiency programs in industry and government, create new appliance efficiency standards and set more rigorous energy building codes, invest in renewable energy projects throughout the state, and propose power plant siting legislation that creates an expedited review process for wind and other energy projects that result in fewer GHG emissions.

New York State has also developed regulations (6 NYCRR Part 242 and amendments to Part 200, and 21 NYCRR Part 507) to cap and reduce CO_2 emissions from power plants, to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of 10 Northeastern and Mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit. The regional emissions from power plants will be held constant through 2014, and then gradually reduced to 10 percent below the initial cap by 2019. Each power source with a generating capacity of 25 megawatts or more would need to purchase a tradable CO_2 emission allowance for each ton of CO_2 it emits.

Many local governments are participating in the Cities for Climate Protection™ (CCP) campaign and have committed to adopting policies and implementing quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability. The program is run by ICLEI—Local Governments for Sustainability, an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development.

A number of benchmarks for energy efficiency and green building design have also been developed. Leadership in Energy and Environmental Design (LEED) system is a benchmark for the design, construction, and operation of high performance green buildings that can include energy efficiency components. EPA's ENERGY STAR is a voluntary labeling program for major appliances, office equipment, lighting, home electronics, homes, and commercial and industrial buildings designed to identify and promote energy-efficiency and reduce GHG emissions.

To date, there are no specific benchmarks or regulations applicable to GHG emissions levels or impacts from proposed projects which are applicable to environmental impact analysis. The general approach beginning to emerge is that since GHG emissions impact global climate collectively, from all sources, there is no impact threshold for GHGs, and therefore projects should estimate and disclose potential emissions, and assess the various practicable options available for reducing such emissions.

E. METHODOLOGY

The New York State Department of Environmental Conservation (NYSDEC) and other State, federal, and local agencies are actively developing methodologies to assess the impact of climate change on proposed actions, and the impact of proposed actions on GHG emissions. Currently, however, with the exception of those developed for projects undertaken by the New York State Department of Transportation, there are no mandated federal or New York State methodologies or criteria for assessing the significance of GHGs generated due to the construction and operation of a proposed project.

The methodology set forth here incorporates various existing methodologies best suited for analysis of the Proposed Project based on guidance from NYSDEC.

POTENTIAL IMPACTS OF GLOBAL CLIMATE CHANGE

The analysis of impacts of global climate change on the Proposed Project focuses on the potential for impacts on the Proposed Project facilities or operations through changes to the Hudson River quality or flow. Existing scientific studies and information were reviewed and relevant information is presented.

Due to the uncertain nature of the existing predictions for future climate change impacts in the area of the Project Sites and on the Hudson River, a range of possible impacts is presented where information is available, and a qualitative assessment is presented.

The assessment included impacts in the near future, in the early years of the operation of the facilities, impacts in the 20- to 35-year horizon, and impacts near the end of the century. Exact years may vary by study.

POTENTIAL IMPACT ON GREENHOUSE GAS EMISSIONS

EXTENT OF ANALYSIS

Since the impact of GHGs emitted in the troposphere is the same regardless of where they are emitted, the analysis of GHGs addresses emissions resulting from the Proposed Project, regardless of their location. Direct emissions are emissions from sources located on-site, such as construction equipment during the construction period. Indirect emissions are emissions caused indirectly by the Proposed Project, such as vehicle trips associated with the project or emissions associated with electricity consumption. In addition, there are emissions preceding and following the Proposed Project, referred to as upstream and downstream emissions, such as emissions associated with the transport and production of fuels and construction materials, and emissions associated with disposal of materials after their use. The GHG analysis addresses both direct and indirect emissions, and, where practicable and significant, upstream and downstream emissions as well.

TIME SCALES FOR ANALYSIS

Emissions are presented on an average per-year basis and as total lifetime emissions. The lifetime of the Proposed Project is estimated as 50 years. Emissions related to materials and construction would actually occur over a shorter period prior to and during construction. As described above in section C, “Pollutants for Analysis,” the time scale of the impact of GHGs is addressed by calculating the GWP of GHGs for 100 years and presenting total estimated CO_2e emissions.

EMISSIONS CALCULATIONS

Emissions related to construction materials and to building heating, ventilation and cooling (HVAC) were calculated based on the methodology used by the King County, Washington, Department of Development and Environmental Services. Since precise building design does not yet exist, this estimate is based on the facilities’ size and generic construction emissions. The administration building would be the only space requiring HVAC, with 8,860 square feet (sf) of space requiring heating and cooling.

Emissions from delivery, concrete, and dump truck trips were estimated based on the total number of construction truck trips (see Chapter 15, “Construction Impacts”), an assumed round-trip distance of 70 miles for concrete and dump trucks and 304 miles for all other deliveries, and an emission factor of 1,400 grams of CO_2e per mile. A round trip of 70 miles was assumed for concrete and dump trucks since those would need to be local; the round trip could be less, but this distance was assumed as a conservative estimate. An assumption of 304 miles for other deliveries is the average round-trip distance for all commodities with a destination of New York, assuming trucks return empty, calculated for the 2002 *Commodity Flow Survey* (Bureau of Transportation Statistics). The emission factor was obtained from EPA’s MOVES model, for heavy duty single-unit diesel trucks at 40 mph.

Upstream emissions related to the installation of all the treatment systems, pumps, and water transmission lines were estimated based on the expected expenditure related to all systems and water transmission lines and the associated emissions from producing the materials and products. A simplifying assumption was made that all materials are iron or steel. This results in a somewhat high estimate, since the expenditure would include other materials that are likely to have less embodied energy than iron or steel, but the estimate also does not include the upstream transport of the materials, which would add some emissions.

The expected expenditure on systems and pipes is $10.3M. The embodied emissions were estimated by dividing the emissions from the Steel Products from Purchased Steel sector (NAICS 3312) and the fraction of emissions from the Iron and Steel Mills sector (NAICS 331111) associated with steel products (as estimated by dividing the value of purchased materials for 3312 by the value of shipped product for all 331111) by the total shipped product value of steel products. This ton/$ factor was then multiplied by $10.3M to estimate the total associated CO_2e emissions. Details of this methodology can be found in Appendix 16.1.

Indirect emissions associated with employee trips and deliveries are not included since the number of regular employees and annual deliveries is small enough to render this component negligible. Up to 85 deliveries per year, 3 visitors per month, and 10 employees per day would be expected on average at the Project Sites.

Indirect emissions related to the use of electric power for treatment and pumping systems were calculated by multiplying the estimated average power use by the average emission factor related to power production in New York State in 2013. This was estimated by adjusting the 2006 New York State average emissions, 0.358 metric ton (Mg) of CO_2 per megawatt-hour (MWh), reported by the U.S. Department of Energy's Energy Information Administration, to account for the current commitment by the State to achieve a level of 25 percent of power produced from renewable sources by 2013. The adjustment was approximated by assuming that the ratio of all other sources would remain the same and that the emissions associated with renewable and nuclear energy is negligible. The resulting emission factor for 2013 was 0.349 metric tons CO_2 per MWh.

F. POTENTIAL IMPACTS OF GLOBAL CLIMATE CHANGE ON THE PROPOSED PROJECT

POTENTIAL LOCAL CLIMATE-RELATED IMPACTS—STATE OF CURRENT KNOWLEDGE

The Climate Change Task Force established by the New York City Department of Environmental Protection estimated that there is a high probability (on the order of 60 percent) that annual precipitation in the New York City watersheds will increase between 2.5 and 7.5 percent by the 2050s, and a low probability that it will increase up to 12.5 percent or decrease up to 2.5 percent, relative to the 1980s.

The changes are not expected to be uniform across all seasons. Winter precipitation could increase by 10 to 20 percent by the end of the century. Summer precipitation may remain the same, although current predictions are variable. More precipitation may be expected in the form of rain rather than snow, increasing flows in the Hudson River in winter and decreasing them in spring. Rising winter temperatures may also melt snow faster and earlier, resulting in increased soil moisture and runoff in winter and early spring. Peak river flow may occur up to approximately a week earlier by mid century and up to two weeks earlier by the end of the century.

Severe rainfall events may occur more frequently and be more intense. The number of heavy-precipitation events, when more than 2 inches of rain fall in a period of 48 hours, is projected to increase by 8 percent by mid-century, and 12 to 13 percent by the end of the century. The highest rainfall during any five-day period of each year is predicted to increase by 10 percent by mid-century, and by 20 percent by the end of the century.

Although average precipitation is expected to increase, drought periods may also increase in duration and frequency. Increased drought would change the flow levels in the Hudson River and may affect the location of the saline wedge and the salinity in the Hudson in general. Although low-flow periods in the summer may not change significantly, under a high global emissions scenario it is possible that the lowest flow may decrease by 10 percent and the duration of the summer low-flow period would be extended by several weeks. Eutrophication (excess inputs of organic matter) and primary production (production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis) in the Hudson River estuary can increase dramatically in response to lowered freshwater during drought events.

The Hudson River in the area of the Project Sites is an estuary, directly affected by tidal changes. Future increase in sea level would affect both the level of the water in the estuary and its salinity, and is likely to result in saline water reaching farther up the river, resulting in overall increased salinity near the proposed location of the raw water intake in the river. Normally, the location of the salt front (defined as 100 milligrams of chloride per liter) ranges from about River Mile 35, near the Proposed Project, and as far as upper Newburgh Bay, at about River Mile 60, but extreme high freshwater stream flows can push the salt front all the way out of the river and extreme drought conditions can send the salt front past the water intake and as far north as Poughkeepsie. It is unclear at this time, precisely how and to what degree the above mentioned changes in precipitation would impact salinity in the vicinity of the proposed location of the raw water intake in the river, but clearly a wider range of salinity is possible, as is an overall higher level of salinity.

Changes in flow may also lead to changes in sediment deposition and erosion, changing the river bottom of the Hudson River and its banks, but no specific local information is available at this time.

Observed sea level rise in the New York City area in the 20th century ranges from 2 to 4 millimeters (mm) per year, averaging 2.7 mm/year since the 1850s, and a 10 percent higher mean rate for the 20th century alone. This includes coastal subsidence due to geological activity. The Intergovernmental Panel on Climate Change (IPCC)[1] estimates that by the end of this century (2090-2099) global sea levels could rise by 0.18 to 0.59 meters (roughly 7 to 23 inches) above late 20th century levels (1980-1999) An additional 0.14 meters (5.5 inches) of sea level rise is estimated to result by the end of the century due to coastal subsidence (based on the current trend). Therefore, the conservatively low estimate for end of century mean sea level rise

[1] The IPCC is the internationally recognized organization tasked with providing decision-makers and others interested in climate change with an objective source of information about climate change. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical, and socioeconomic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. IPCC reports are neutral with respect to policy, are of high scientific and technical standards, and aim to reflect a range of views, expertise, and wide geographical coverage.

in the New York area is on the order of 0.32 to 0.73 meters (12.5 to 28.5 inches). More importantly, the frequency of flooding is expected to increase due to the higher frequency of severe storms. The 100-year flood level is the level commonly used for planning purposes. This level indicates the level that waters would reach with a probability of 1 percent in any given year, based on historical data. If severe storms occur more frequently in the future, the actual 100-year flood level would be higher, requiring higher design elevations. The stillwater level of the Hudson River would increase with the increase in sea levels, and higher flooding elevations would be added to the above mentioned predicted sea level increase. Although precise flooding predictions for the Hudson River are not available, studies of the frequency of 100-year coastal storms in New York City have shown that such storms could occur with a frequency ranging from 4 to 60 years, depending on the prediction model scenario and the exact location analyzed.

POTENTIAL IMPACTS ON THE PROPOSED PROJECT

The potential vulnerability of the Proposed Project to climate related impacts is mainly related to Hudson River water elevation and quality. It should be noted that the Haverstraw Water Supply Project, as either the Proposed Project or the Ambrey Pond Reservoir Alternative, would serve as adaptation to potential climate change impacts since the project is aimed at meeting future increased demand for water. The Proposed Project is also aimed at reducing the dependence on water reservoirs, which are easily impacted by drought conditions—conditions which may be more frequent and severe in the future.

The potential future climate impacts described above could lead to various changes in Hudson River water properties, including temperature, salinity, turbidity, and possibly water quality impacts. However, the levels or likelihood of precise future water conditions are not currently available. Better information may begin to appear in the coming years, and actual significant changes may not begin to be measurable for decades. Nonetheless, the Proposed Project's advanced water treatment facility, which would utilize raw water from the Hudson, is well suited to deal with a wide range of raw water quality and salinity. Higher salinity, or more frequent or longer events of elevated salinity, would require the water treatment processes to use more electric power than would be required with the current conditions. Increased electricity use would result in additional GHG emissions. Other water quality changes would not be expected to present any particular difficulty to producing the desired high quality potable water. The design of the facilities and process include enough flexibility, such that the facility and/or processes could be adapted should any changes be required when changes begin to appear in the future and/or as better predictions of future conditions become available.

Changes in sea level, which would impact the stillwater level in the Hudson River estuary, and changes in flow levels and storm flooding and flooding frequency, could potentially impact the raw water intake structure. The depth or precise location of the intake itself may need to be adjusted in the future. More importantly, the river water intake and all land-side facilities, including the intake pumping station, will be designed so as to elevate all critical systems above potential flood levels such that the facility can continue to operate during periods of high waters, including periodic storm-related flooding events. This total level would comprise a sea level increase component and a storm flood level component which would likely be higher than the current 100-year flood level as defined by FEMA.

New York State and New York City have each convened a task force to address the issue of predicted climate change-related sea levels rise and storm surge. The City recently launched the Climate Change Adaptation Task Force (City Task Force), which is working to secure the City's critical infrastructure against rising seas, higher temperatures, and increasing precipitation projected to result from climate change.[1] The City Task Force is composed of over 35 city and State agencies, public authorities, and companies that operate, regulate, or maintain critical infrastructure in New York City. The City Task Force will be assisted by the New York City Panel on Climate Change (NPCC), which is modeled on the IPCC, and includes leading climatologists, sea-level rise specialists, adaptation experts, and engineers, as well as representatives from the insurance and legal sectors. The NPCC will provide the City and City Task Force members with information about climate risks (including climate change projections), adaptation, and risk assessment. The NPCC is expected to issue preliminary climate change projections in late 2008/early 2009.

New York State formed the Sea Level Rise Task Force (Task Force) in 2007 to assess impacts to the State's coastlines from rising seas and to recommend protective and adaptive measures. The Task Force held its first meeting on June 27, 2008 and its report is due to the Legislature by December 31, 2009. United Water will continue to investigate this issue prior to finalizing the design of the Intake Site facilities in order to finalize the determination of appropriate design levels, and will incorporate any specific information or recommendations made by either task force in this regard that are relevant to the Proposed Project.

G. POTENTIAL IMPACT OF THE PROPOSED PROJECT ON GREENHOUSE GAS EMISSIONS

CONSTRUCTION EMISSIONS

The GHG emissions projected to result from the Proposed Project include those emissions generated through the extraction, fabrication, transport, construction, and disposal of building materials, as well as emissions through landscape disturbance during construction. The CO_2 emissions associated with construction materials vary considerably with the type of facility, but have conservatively been estimated for planning purposes as 38.7 metric tons per 1,000 square feet (sf) of floor area. Based on conceptual designs, it is anticipated that the total floor area of proposed buildings associated with the Proposed Project would be approximately 98,466 sf. The CO_2 emissions embodied in the facility structures are therefore on the order of 3,811 metric tons.

Emissions associated with construction truck trips were estimated to be 4,561 metric tons of CO_2e.

The CO_2e emissions embodied in the systems and pipes, calculated as described above, are estimated at 10,405 metric tons.

OPERATIONAL EMISSIONS

HEATING, VENTILATION, AND COOLING (HVAC)

The CO_2e emissions associated with the water treatment plant administration building's HVAC, calculated as described above, are estimated at 263 metric tons per year. This includes a 30 percent reduction associated with energy efficient building design.

[1] This is in addition to the NYCDEP Climate Change Task Force mentioned above, which focuses on DEP infrastructure.

ELECTRICITY FOR PUMPING AND TREATMENT

Plant operations would have an associated ongoing energy demand. The estimated power consumption for the Proposed Project and the associated GHG emissions are presented in Table 16-2. Of the total estimated annual power consumption and ensuing GHG emissions, 62 percent would be associated with the desalination process due to the high-pressure pumping required to pass the water through the reverse osmosis membranes. The salinity levels of the Hudson River waters at the raw water intake site in the river are known to vary throughout the year based on precipitation and snowmelt patterns. During the months of February through May, the salinity levels are the lowest, and the energy consumption of the reverse osmosis treatment would be reduced, and at times of maximum snowmelt, would be zero.

Table 16-2
Power Consumption and Associated GHG Emissions

	Phase 1 (2.5 mgd)	Phase 2 (5.0 mgd)	Phase 3 (7.5 mgd)
Average Electricity Use (kWh per day)	16,300	24,900	33,200
Normalized Electricity Use (kWh per million gallons)	6,520	4,980	4,427
GHG Emissions (metric tons CO_2e per year)	2,079	3,176	4,235

Sources: Power consumption from Black and Veatch. GHG emissions AKRF based on EIA data (see text for full description).

It should be noted that these represent the estimates for emission levels from electricity generation in New York State in 2013, and future year emissions may be lower. As more renewable electricity production capacity comes on line as a consequence of RGGI and of state renewable energy profiles, the average state-wide emission factor will decrease. Since the precise impact of those actions is not currently known, future estimates are not presented here.

The Proposed Project is expected to use between 4,427 and 6,520 kilowatt hours (kWh) of electricity per million gallons (Mgal) of potable water produced. This is a higher electricity use rate as compared with water treatments other than desalination. For comparison, a study of 137 water utilities across the U.S., sponsored by the New York State Energy Research and Development Authority (NYSERDA), ranked the utilities by their energy efficiency. The 10 highest scoring utilities had much lower normalized electricity use, averaging 324 kWh/Mgal versus 2,360 kWh/Mgal for the 10 lowest scoring utilities. It should be noted that the energy ranking included other factors, such as service utility area, pumping elevations, and length of distribution. Although most of the highest ranking utilities had a very low electricity usage factor, they also did not require much pumping and many were implementing very little treatment (using pre-treated water). It is not known if any desalination facilities were included, but none were presented exclusively. Clearly desalination requires more power, but this comparison alone cannot be used to evaluate the efficiency of the Proposed Project. Since most desalination is from sea water, with higher salinity, most desalination facilities would use more energy per gallon of potable water produced. Since the systems will be designed for maximum efficiency, the Proposed Project would use only the energy required for this type of process, and will seek to reduce energy consumption via energy efficiency measures for the Project as a whole and produce renewable energy where practicable.

SEQUESTRATION

Generally, the elimination of vegetation on a site would accelerate the release of CO_2 sequestered in any vegetation found on the site back to the atmosphere. However, the Water Treatment Plant Site is only partially vegetated. Similarly, the Intake Site is an industrial site with no substantial surface vegetation. As a result, the use of these Sites for the Proposed Project would not constitute a significant change in sequestered carbon.

TOTAL NET PREDICTED EMISSIONS

Since sequestration is not expected to change significantly due to the Proposed Project, net GHG emissions would be the sum of all direct and indirect, upstream and on-site emissions. The emissions from each component, and the total lifetime and annual average emissions are presented in Table 16-3. Note that annual emissions are average for the duration of each component; the facilities are assumed to operate for 50 years; although construction is expected to occur for a total of five years, most activity and associated emissions would be over a three-year period. Upstream emissions associated with embodied energy for materials are assumed to occur over a five year period since they would be spread out throughout the extraction of raw material and production of fabricated products.

Table 16-3
Total GHG Emissions (metric tons CO_2e)

Component	Total Lifetime[1]	Average Per Year
HVAC	13,148	263
Process Electricity[2]	190,580	4,448
Embodied Buildings[3]	3,811	762
Embodied Systems[3]	10,405	2,081
Construction Trips[4]	4,561	1,520
Total	*222,504*	*9,074*

Notes:
1. Lifetime is assumed to be 50 years.
2. Assumes Phase 2 electricity use levels for 20 years and Phase 3 levels for 30 years.
3. Embodied emissions would occur over a period prior to and during construction, assumed to be 5 years.
4. Construction emissions would occur during the construction period only, estimated as 3 years.

Clearly the largest component of the net GHG emissions would be the process electricity, representing 89 percent of the total lifetime emissions associated with the Proposed Project. Although delivery of products was included in the estimate, upstream delivery of products from the country of origin, if outside of the U.S., or from the source of material within the U.S. to the distributer is not included since these origins are unknown at this time.

POTENTIAL EMISSIONS MITIGATION MEASURES

As indicated above, the implementation of the Proposed Project, like all human endeavors, would expend energy and generate GHG emissions. There is no direct causal relationship with the Proposed Project's emissions and a specific climatic event.

It should be noted that the development of a dependable long-term water supply through the application of a desalination technique may in itself be considered a response to the potential effects of climate change on freshwater availability. The Proposed Project serves as adaptation to potential climate change impacts since it is aimed at meeting future increased demand for water, and since it would also reduce the dependence on reservoirs, which can be easily impacted by drought conditions—conditions which may be more frequent and severe in the future.

Nonetheless, there are several aspects of the Proposed Project that serve to moderate or mitigate the Proposed Project's energy use and GHG emissions:

- The Proposed Project's facilities, both at the water pumping station and at the water treatment plant, will be designed to a LEED standard, making maximum use of the facility design to reduce energy consumption, including the use of natural light.
- Heating and cooling will be applied only as necessary to maintain water treatment processes.
- Pump and systems efficiency will be a priority when selecting equipment, e.g., premium efficiency motors will be used exclusively.
- United Water is anticipating production of solar energy on-site via photovoltaic systems installed on approximately 100,000 sf of rooftop area, on water tanks, and as a canopy over parking and entry spaces. Since the system design details are not yet known, this has not been included in the analysis in this chapter.
- As described in Chapter 2, "Project Description," development of the Proposed Project would be phased, so that facilities would be brought on line only as needed to meet the demand for water.

There are some additional measures currently under consideration by United Water that may be incorporated in the final design if found to be practicable:

- The Reverse Osmosis system required for desalination of the raw water is the most energy intensive component of the treatment process due to the need for high-pressure pumps. This system could be bypassed when the raw water does not require desalination, saving considerable energy. This option is currently being investigated and will be included if it is found to be practicable.
- As noted in Chapter 2, depending on final designs, water may be withdrawn from the Hudson River continuously throughout the day or it may be withdrawn only approximately 12 hours a day, when salinity is lower. This would result in reduced energy usage for desalination.
- United Water is currently undertaking a study of efficiency and energy use at all of its facilities to identify further potential energy saving opportunities from existing operations.
- The use of process water for cooling building spaces is being investigated, and will be incorporated in the plans if found to be practicable.
- The use of landfill gas from the adjacent landfill and JRSTP is being investigated as an energy source. It is possible that due to the age of the landfill it may not contain sufficient gas for use. If use of gas from either or both is found to be practicable it may be included.
- The option of on-site wind-power generation is currently being studied. If suitable sites for wind turbines are identified, which do not create an unacceptable visual impact within the waterfront area or other unacceptable impacts, this may be included.

- The option of harvesting rainwater on site for use as raw water is being investigated. This water would have lower salinity and therefore require less energy for treatment. Although the quantity is expected to be small compared to the throughput of the plant, if found to be practicable this may be included.
- The use of water turbines for on-site power production is being considered. If solutions are found that enable operating water turbines without causing unacceptable impacts on fish populations or other aspects of the environment, this option may be included.
- In order to reduce the carbon footprint associated with construction of the proposed facilities, the use of recycled materials and locally produced products will be investigated and used where practicable.

H. REFERENCES

Although many sources were consulted, the main documents consulted were the following:

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