FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE CROTON WATER TREATMENT PLANT
METHODOLOGIES

4.15. WATER RESOURCES

4.15.1. Introduction

This chapter describes the methods used to evaluate existing surface and groundwater resources at the Eastview Site, Mosholu Site, Harlem River Site, and off-site facilities. The surface water, stormwater, and groundwater analyses provided an assessment of the potential impacts to hydrology, natural resources, and local stormwater conveyances resulting from the construction and operation of the water treatment plant at the Eastview, Mosholu, or Harlem River Sites. The objective of the stormwater analysis was to assess the potential impacts of the proposed project on stormwater runoff (peak flow and volume), and also to propose short-term and long-term control measures to mitigate these impacts. In addition, each site being considered for construction of the water treatment plant has certain additional unique concerns related to stormwater and/or groundwater. At the Eastview Site, a key project concern was the maintenance of existing runoff rates and total runoff volume to Mine Brook and its associated forested wetlands. At the Mosholu Site, mitigation measures were developed to alleviate concerns that dewatering during excavation and operation of the proposed facility could lower the groundwater table and adversely affect the forested wetland. At the Harlem River Site, where the proposed plan is to discharge stormwater runoff directly to the river through the existing site outfall, stormwater quality was the central issue.

The proposed step-wise approach to assessing stormwater impacts at both sites included: (1) a description of the general data collection requirements; (2) a discussion of the Future Without the Project; (3) the methodology used to predict stormwater flows and volumes, under existing conditions, the main phases of construction, and long-term operation of the proposed facility; (4) the short-term and long-term impacts to surface water, wetlands, natural resources, and groundwater; and (5) mitigation measures.

4.15.2. Baseline Conditions

4.15.2.1. Existing Conditions

The following section presents methods used to describe the existing stormwater flows and water quality conditions on site. One of the keys to a successful modeling effort is the accurate representation of existing conditions in the study area. The first task conducted in the stormwater and groundwater assessment was data collection, which included site visits and a review of available data such as the existing geotechnical survey and previous groundwater modeling results, plans of the existing storm drainage in the vicinity of each site, and adjacent surface water and wetland hydraulic conditions.

4.15.2.1.1. Surface Water

The surface waters were examined by considering the changes in water quality resulting from the increase in impervious surfaces associated with the layout and design of the project site. Developmental conditions could increase both stormwater flow rates (i.e., velocity) and stormwater pollutant concentrations during rain events, which could potentially degrade on- and off-site surface waters.

The source of these pollutants is primarily atmospheric deposition, but also includes litter, animal droppings, and other debris. Deposited on impervious surfaces, these pollutants make their way, or "run off", into surface waters during rainfall events. Studies have shown that increases in the concentrations of these pollutants are directly related to the percent of impervious surface within developed areas. Using empirical data from national studies, pollutant loadings, in pounds per acre per year, can be estimated for any location depending on the land use cover type (pervious versus impervious condition), the annual rainfall, and drainage area size.

In order to assess the potential impacts associated with increases in stormwater pollutant concentrations, the NYSDEC's *Stormwater Management Design Manual (October 2001*) was used to estimate the pollutant loads produced by the project site under existing conditions. In addition, surface water sampling was undertaken in October 2000 at the Eastview Site and from 1998 to 2001 by the New York City Department of Environmental Protection along the Harlem River Site to assess the current condition of the project sites' surface water quality.

4.15.2.1.2. Stormwater

Stormwater runoff at the Eastview, Mosholu, and Harlem River Sites was simulated using HydroCAD® Version 5 stormwater modeling software. HydroCAD® is distributed by Applied Microcomputer Systems (AMS) of Chocorua, New Hampshire. The model provides hydrograph generation and routing based on the Soil Conservation Service (SCS, now known as Natural Resources Conservation Service) TR-20 procedures.

The watersheds that drain the project sites under existing conditions were delineated based on the most recent topographic survey data identifying 2-foot contour intervals, and subsequently subdivided into a number of basins based on hydrologic divisions. Based on these delineations, conceptual diagrams were developed depicting the flows from the sites under existing conditions. For each sub basin, the following input parameters were determined: area; slope; soil type and infiltration rate; and hydraulic length. The model output provided peak runoff rates and total runoff volumes for each sub basin within the study areas.

A Geographical Information System (GIS) was used to delineate drainage areas, and determine slopes and hydraulic lengths (i.e., the longest distance stormwater runoff travels in each basin). In addition to the overall area of each basin, the area of various cover types in each basin was determined with GIS in order to facilitate an assessment of infiltration and runoff rates for each cover type.

For the existing conditions model, the acreages of wetland, wooded, and paved areas were approximated using the GIS database. Infiltration and runoff rates were calculated using runoff curve numbers for each soil type and cover type, as provided in the Soil Conservation Service Technical Release 55 (SCS TR-55). Runoff curve numbers are factors that predict the rate which water passes through and over specific cover types.

Based on published topographic information and preliminary field inspections, the modeled study area at the Eastview Site extends from the Grasslands Road (100C) north, to include the portion of the Valhalla Campus that contributes runoff directly and indirectly to Mine Brook. Walker Road and Westchester County's Correctional Complex delineate the western and eastern boundary of this study area, respectively. The Mosholu Site is located within the southeast corner of Van Cortlandt Park and covers the existing driving range and clubhouse area. The modeled study area is bounded by the Major Deegan Expressway, Mosholu Parkway, West Gun Hill Road, Jerome Avenue, and 233rd Street. The Harlem River study area is relatively narrow, extending from the Major Deegan Expressway to the river in the east-west direction and extending from the rail tracks to the University Heights Bridge in the north-south direction.

Stormwater conditions under the various project stages, for the 3-month, 1-year, 2-year, 5-year, 10-year, and 100-year storms, were simulated using the HydroCAD® model. A Type III storm was used to model these storm events. This is the most common type of storm in New York City and is typical of eastern coastal areas of the United States, where large 24-hour rain events are typically associated with tropical storms. The 24-hour rainfall associated with each design storm was determined using the U.S. Weather Bureau Technical Paper 40 and the National Weather Bureau at John F. Kennedy Airport. For Eastview Site, the Westchester County's *Best Management Practices Manual for Stormwater Management*, *1984* was also used for guidelines and regulations.

The 3-month, 1-year, and 5-year storms were selected because they reflect a variety of conditions that may affect natural resources in the vicinity of the water treatment plant sites. The 3-month return period represents a storm event that would provide water at frequent enough intervals to support a stormwater-dependent wetland. Storms occurring at greater return intervals would generally not be frequent enough to sustain wetlands. The 1-year and 5-year storms were simulated to determine the existing peak flows and 24-hour runoff volumes under these conditions, which are parameters relevant to both wetlands and upland resource areas. An assessment of peak flow rates is important because increase in peak flows could result in erosion along drainage paths in both upland and wetland areas. The 5-year design storm is the standard design storm used by the NYCDEP to size infrastructure needed to dissipate peak flows and maintain existing 24-hour runoff volumes. In order to comply with the New York State General Permit for Storm Water Discharges associated with industrial activity from construction activities (NYSDEC GP 02-01), the modeling effort also included the 2-year, 10-year, and 100-year 24-hour storms. A 100-year storm was also modeled to assist the impacts analysis in accordance with the Code of the Town of Mt. Pleasant. Although, the proposed plant at the Eastview Site would utilize the 100-year 24-hour design storm (7.2 inches) for the stormwater infrastructure design, a more frequent 10-year design storm was analyzed for potential water resource impacts because this more common storm is anticipated to have a greater influence on the natural resources. However, the sizing of the proposed stormwater infrastructure, at either the Mosholu or Harlem River Site, would be designed for the 10-year 24-hour design storm (in accordance with NYCDEP requirements) as well as to evaluate potential water resources impacts.

4.15.2.1.3. Groundwater

The groundwater assessment effort began with the development of a conceptual model of the direct impact area that includes the water treatment plant site and the immediate surroundings. The conceptual model consisted of on-site/off-site mapping of topographic and hydrologic features, cross sections of geologic layering and bedrock elevations, estimates of groundwater-wetland and stream-groundwater interaction, characterization of rainfall-recharge and groundwater discharge rates, and analysis of long-term precipitation for identifying high water table conditions.

The evaluation of hydrogeologic conditions in the vicinity of the water treatment plant at the Harlem River, Mosholu, and Eastview Sites was based primarily on data from the current geotechnical design investigation. Published geologic information, describing features at a regional scale, was also consulted. Published sources of information included:

- Previous studies on aqueduct and reservoir construction from NYCDEP's Bureau of Water Supply;
- Data from well construction in the area collected by the U.S. Geological Survey (USGS) and the New York State Department of Health;
- Geological and hydrogeological reports prepared by USGS and the New York State Geological Survey for Westchester County;
- Meteorological data from the National Oceanic and Atmospheric Administration (NOAA); and
- Westchester County‘s Best Management Practices Manual for Stormwater Management, 1984.

The subsurface information from the recent geotechnical investigations that were pertinent to the hydrogeologic evaluation included: (1) descriptions of samples of soil and bedrock from the borings drilled at each site; (2) elevations of the top of the bedrock surface, determined at the borings and at probes made with an Air-Track drill at additional locations among the borings; (3) results of field permeability tests that were conducted in soils and bedrock; (4) groundwater elevation data from several sets of water-level measurements made in the piezometers that were installed at the boring locations; and (5) groundwater elevation data from water-level measurements that were made in open boreholes after the borings were completed (at those locations where no piezometers were installed). The water-level data from the open boreholes are not as reliable as those measured in wells or piezometers; however, they are generally representative of water table elevations.

The data on subsurface conditions were used to create contour maps of the water table elevation and the bedrock surface elevation. A geologic cross-section of the water treatment plant sites during construction was developed. The descriptions of the subsurface materials and field permeability testing results were used to estimate hydraulic conductivities and porosities for the different strata.

Since groundwater systems are typically complex and the anticipated changes are subtle, a mathematical model or computer simulation is the best available method to predict potential impacts to the system and to develop engineering controls or measures to minimize any potential adverse effects. Once the model is developed for the site, estimates of future groundwater flows and elevations can be determined under a variety of scenarios. Detailed groundwater modeling was only completed for the water treatment plant sites. Due to the smaller degree of potential impacts, lack of data on existing groundwater status, and the shorter durations of construction, the off-site facilities were assessed qualitatively.

The model selected for this preliminary analysis was the MODFLOW, a three-dimensional model approved by USGS, NYSDEC and the U.S. Environmental Protection Agency (USEPA) for use on water supply and contaminated groundwater projects in New York State. The model uses a finite-difference approximation to solve the basic equations governing the flow of groundwater for a given system. The model utilizes a grid system (in plan view) that can be varied, and the model layers can also have varying thickness. This allows the model to focus on a specific area of concern after the initial broader analysis is completed.

4.15.2.2. Future Without the Project

The three proposed water treatment plant sites were evaluated for their stormwater runoff, surface water quality and groundwater flows for both the peak construction and operation years assuming the water treatment plant would not be built. This evaluation forms the future without the project baselines against which the proposed project was evaluated. For the Eastview Site, the evaluation included both the peak construction and operation years of the proposed Croton project for the two scenarios (with and without the Cat/Del UV Facility). Future conditions at each site were projected based on known proposals for development. The actual assessment of future conditions under these scenarios was determined using the same methodology as applied to the existing conditions described above.

4.15.3. Potential Impacts

4.15.3.1. Potential Project Impacts

The potential impacts resulting from the operation of the water treatment plant on surface water, stormwater, and groundwater in the basins draining from the Eastview, Mosholu, and Harlem River Sites were predicted by modifying the HydroCAD® model to reflect long-term drainage basin changes. The existing stormwater runoff model and GIS maps were also modified to reflect the final site drainage plans. Peak flows and total runoff volumes were estimated based on the various design storms described previously. An assessment of pre- and post-construction stormwater runoff was conducted, and long-term mitigation measures incorporated. The goal of the long-term stormwater mitigation plan is to provide long-term control and treatment of stormwater runoff from the site, to the maximum extent practicable. This includes landscaping to ensure proper stabilization of the site, providing treatment of stormwater runoff from all impervious services, and maintaining flows to adjacent natural resource areas at pre-construction rates and volumes.

The long-term impact of the project on adjacent surface water and wetlands would depend on the extent to which groundwater levels are influenced by the proposed structure. Potential impacts were evaluated using both analytical methods and a numerical groundwater flow model. For an initial evaluation, a water budget analysis was developed to estimate the amount of groundwater that flows to the adjacent surface waters and wetlands under existing conditions. Groundwater modeling was then performed to make a more sophisticated evaluation of the impacts of the proposed plant on groundwater and nearby surface waters and wetlands. The model was developed using information available from site investigations such as boring logs, bedrock packer tests, and visual observations. Since the model domain was much larger than the site limits, model characteristics outside the model domain were estimated through interpolation, extrapolation, and professional judgment. The purpose of the model was to simulate long-term impacts on the nearby surface water or wetlands.

Potential long-term impacts to wetlands and upland trees were assessed by reviewing predicted changes to stormwater flows and volumes and groundwater elevations. These analyses are described in the Natural Resources Section 5.14 for the Eastview Site, Section 6.14 for the Mosholu Site, and Section 7.14 for the Harlem River Site. Stormwater management is considered conceptually in the general facility design process. Based on the detailed hydrologic modeling described here, any potentially significant change predicted to occur on stormwater or groundwater that would affect the hydrology, vegetation, or functions of wetlands will result in stormwater management considerations that would be incorporated into the proposed project. Similarly, any significant stormwater changes that would adversely affect water available for infiltration in upland areas would be addressed in the project best management practices (BMPs), because these changes could potentially alter soil moisture regimes. The BMPs were identified and summarized in the impact sections.

4.15.3.2. Potential Construction Impacts

The potential impact of the construction of the water treatment plant on stormwater, groundwater, surface water and natural resources in the basins draining from the Eastview, Mosholu, and Harlem River Sites will be predicted by modifying the HydroCAD® model to reflect basin changes that would occur during the construction period. This information is presented in the stormwater/groundwater management plan in Appendix G, in accordance with the NYSDEC State Pollutant Discharge Elimination System Permit (SPDES). The HydroCAD® model and GIS base maps will be modified based on changes in site conditions and land use changes, to predict runoff during the major phases of construction sequencing. These construction phases include: site preparation (the temporary installation of paved haul roads and gravel parking and storage areas during construction to facilitate equipment movement and storage); excavation and foundation preparation; and building construction (including access roads and parking area).

The 3-month, 1-year, 5-year, 50-year, and 100-year storms will be simulated under construction conditions with HydroCAD®. BMPs will be identified and summarized to ensure that peak flows would be dissipated to avoid erosion impacts, and that total storm volumes would be maintained to avoid alterations in wetland hydrology.

Potential groundwater impacts will be evaluated by comparing model output both with and without the proposed project. Several structures of the facility would be constructed below the existing water table elevation, which could affect groundwater elevations and flow in the study area. During the construction phase of the project, variation in groundwater elevation and the potential overall impact to Mine Brook (at the Eastview Site), and the forested wetland (at the Mosholu Site) were assessed by evaluating results of water elevation measurements obtained from monitoring wells within the study area. In addition, the preliminary groundwater model developed for the proposed project will be used to determine the potential effects of project construction and long-term operation on groundwater flow and elevation.

4.15.4. Mitigation

The proposed BMPs would be designed to avoid potential impacts wherever possible. If potential impacts were impossible to avoid, the potential impact areas were minimized. Where potential impacts are unavoidable, conceptual mitigation plans are described in the subsequent chapters for each site. The BMPs included design of a detention basin to provide the Eastview Site with long-term control of stormwater runoff in accordance with local design criteria, and an infiltration gallery at the Mosholu Site to maintain the hydrology of the forested wetland during both construction and operation of the facility.

In general, mitigation activities have been designed to compensate for unavoidable potential impacts after reasonable attempts have been made to avoid and minimize them. When feasible, the potential effectiveness of mitigation measures was predicted by using computer modeling. Mitigation measures are described in this section based on the specific potential impacts.