This chapter of the Draft Environmental Impact Statement (DEIS) evaluates the proposed Water for the Future Shutdown System Operations (WSSO) that would occur as part of Upstate Water Supply Resiliency. It provides background on the purpose and need of WSSO, describes the activities and schedule for WSSO, and presents the environmental impact assessments for WSSO for all applicable impact categories.

10.1 PURPOSE AND NEED AND PROJECT DESCRIPTION

10.1.1 PURPOSE AND NEED

The City's water supply system is designed to provide flexibility for managing the system on a day-to-day basis and to support or respond to planned outages and water supply emergencies. To support temporary shutdown of the Rondout-West Branch Tunnel (RWBT), the New York City Department of Environmental Protection (DEP) would rely upon this flexibility to manage the water supply system to prepare for, support, and respond to the Delaware System being unavailable for water supply purposes from October 1, 2022 to May 2023.

Specifically, implementation of WSSO would occur in three phases with distinct operational protocols. The first would be the pre-shutdown phase (beginning June 1 of the shutdown year), which would prepare the water supply system for heavier reliance on the Catskill and Croton systems during the temporary shutdown and would involve relying more on the Delaware System, including the use of the Catskill/Delaware Interconnection at Shaft 4 (Shaft 4 Interconnection). Once it was established that sufficient supply exists in these two systems to support the temporary shutdown, dewatering of the RWBT would begin on October 1, 2022. As described in Chapter 4, "Water for the Future Background and Planning," this date was identified as the optimal start date for the temporary shutdown as it coincides with the time when the system enters a period of lower demand.

On October 1, flow through the RWBT would be stopped. At this time, the second phase of WSSO would begin, and the temporary shutdown phase would commence. During this phase, DEP would rely on the Catskill and Croton systems to meet demand. Increased reliance on the Catskill System would potentially involve the addition of water treatment chemicals (e.g., aluminum sulfate [alum] and sodium hydroxide) to the Catskill System under certain water quality conditions. To support increased usage of the Croton System, DEP would request a variance from New York State Department of Environmental Conservation (NYSDEC) to allow releases at the minimum drought level from West Branch Reservoir for 8 months (October through May) and New Croton Reservoir for 2 months (April and May) during the temporary shutdown. DEP would also request approval from the New York State Department of Health to use Croton Falls and Cross River pump stations to deliver up to 240 million gallons per day (mgd) from the

Croton System to the Delaware Aqueduct via shafts 11 and 13 respectively in order to supply Kensico Reservoir from the Croton System. Concurrently, DEP would take the west of Hudson portion of the Delaware System offline and manage flows within that system that are typically diverted to the City for drinking water. This would require the construction and use of temporary siphons at Rondout Reservoir.

In June 2023, once the bypass tunnel is connected and the RWBT is brought back online, the third shutdown phase would commence. During this third phase, DEP would temporarily rely more heavily on the Delaware System to allow the water supply system to equilibrate to the conditions that existed prior to the temporary shutdown.

Operating the system in this manner before, during, and for a short period of time following the temporary shutdown would provide DEP with the flexibility needed to support connection of the RWBT Bypass in the Roseton area and internal repairs to the leaking portion of the RWBT near Wawarsing.

Maintaining operation of the water supply system in order to protect public health during the RWBT temporary shutdown is of utmost importance. DEP has conducted a robust analysis of the hydrologic conditions necessary for successful completion of the bypass tunnel connection, which included the development of forecast tools to: (1) identify the appropriate hydrologic conditions for starting the temporary shutdown; and (2) identify hydrologic conditions during the temporary shutdown that would trigger demobilization of the tunnel connection in order to bring the RWBT back online prior to completion of the RWBT Bypass connection, as needed.

10.1.2 PROJECT DESCRIPTION

The following sections provide a detailed description of WSSO.

10.1.2.1 Description of the Surface Water Supply System

As noted above, the City's surface water supply system is comprised of three separate systems: the Catskill, Delaware, and Croton systems.[1] The Catskill and Delaware systems operate under a Filtration Avoidance Determination (FAD). These three systems serve City residents and a number of communities in upstate New York.

In addition to providing drinking water, the City's water supply system is an important regional resource for recreation, wildlife habitat, fisheries, and agriculture, among others. To protect the water supply system and these various uses, operations are governed by a complex regulatory framework comprised of numerous federal and State agreements and permits, including: NYSDEC-regulated minimum conservation releases from most reservoirs; the 1954 U.S. Supreme Court Decree on operations of the Delaware System reservoirs and commitments made by the parties to that Decree and accepted by the Delaware River Basin Commission; the Interim Ashokan Release Protocol at Ashokan Reservoir; and State Pollution Discharge Elimination System (SPDES) permits, as well as other regulations.

[1] The Croton System was generally not used for the City between 2004 and 2015. The activation of the newly constructed Croton Water Filtration Plant in late 2015 allows for the treatment of the Croton System water supply prior to its distribution to the City. As such, the Croton System is now available to supplement the Catskill/Delaware System.

The first objective of the City's system is to provide a clean and reliable source of drinking water. The City is able to achieve this while meeting other operational objectives, in part, because its robust infrastructure enables flexible operations. The system's flexibility allows DEP to anticipate and respond to changes in hydrologic and environmental conditions through dynamic management of the reservoirs within the City's system.[2] For example, in order to manage the water supply to achieve optimum water quality or reliability, DEP has the ability to rely more heavily on one system than another.

The flexibility in the system is derived from connections among the system components, which allows DEP to manage three separate systems as one to provide a constant supply of water. The City's reservoirs are connected either through man-made infrastructure (i.e., tunnels and aqueducts) or natural waterbodies (i.e., rivers, streams, and creeks). These interconnections allow DEP to move water through the system to address water supply needs and regulatory requirements using a combination of diversions, transfers, and releases. Diversions are movements of water between reservoirs or systems through tunnels or aqueducts that would not otherwise be connected. Transfers refer to moving water between connected reservoirs primarily via natural flow paths for the purpose of supplying drinking water. Releases move water to waterbodies that are connected to the system and can be used to meet regulatory flow requirements, and, in some cases, redirect water out of the system. In the Catskill and Delaware systems and at the terminal point of the Croton System, for example, rivers, streams, and creeks transport water outside the system. In addition, water that exceeds the storage capacity of the City's reservoirs flows over reservoir spillways (spills). Similar to releases, spills move water to waterbodies that are connected to the system, and, in some cases, redirect water out of the system. The interconnected nature of the system, which allows DEP to meet multiple operational objectives each day, also requires that operations applied at any single reservoir be coordinated with those at other reservoirs.

To provide additional context to understand WSSO and the specific constraints that guide operation of the City's water supply system, this section, and the descriptions of each of the three systems found in Sections 10.3, "Delaware Water Supply System Assessment and Impact Analysis," 10.4, "Catskill Water Supply System Assessment and Impact Analysis," and 10.5, "Croton Water Supply System Assessment and Impact Analysis," present the following information:

- Each system's location and size;
- Interconnections between the various reservoirs; and
- The quantities of water supplied to the City's distribution system.

Catskill and Delaware Water Supply Systems

Specifically to meet DEP's customers' supply needs, the City draws between 70 percent and 100 percent of its potable water supply from the Catskill and Delaware systems, which are diverted from reservoirs primarily via underground tunnels and aqueducts (see **Figure 10.1-1**).

[2] For more information on how DEP maintains and forecasts reservoir levels, see: http://www.nyc.gov/html/dep/html/drinking_water/forecasting_reservoir_levels_index.shtml.

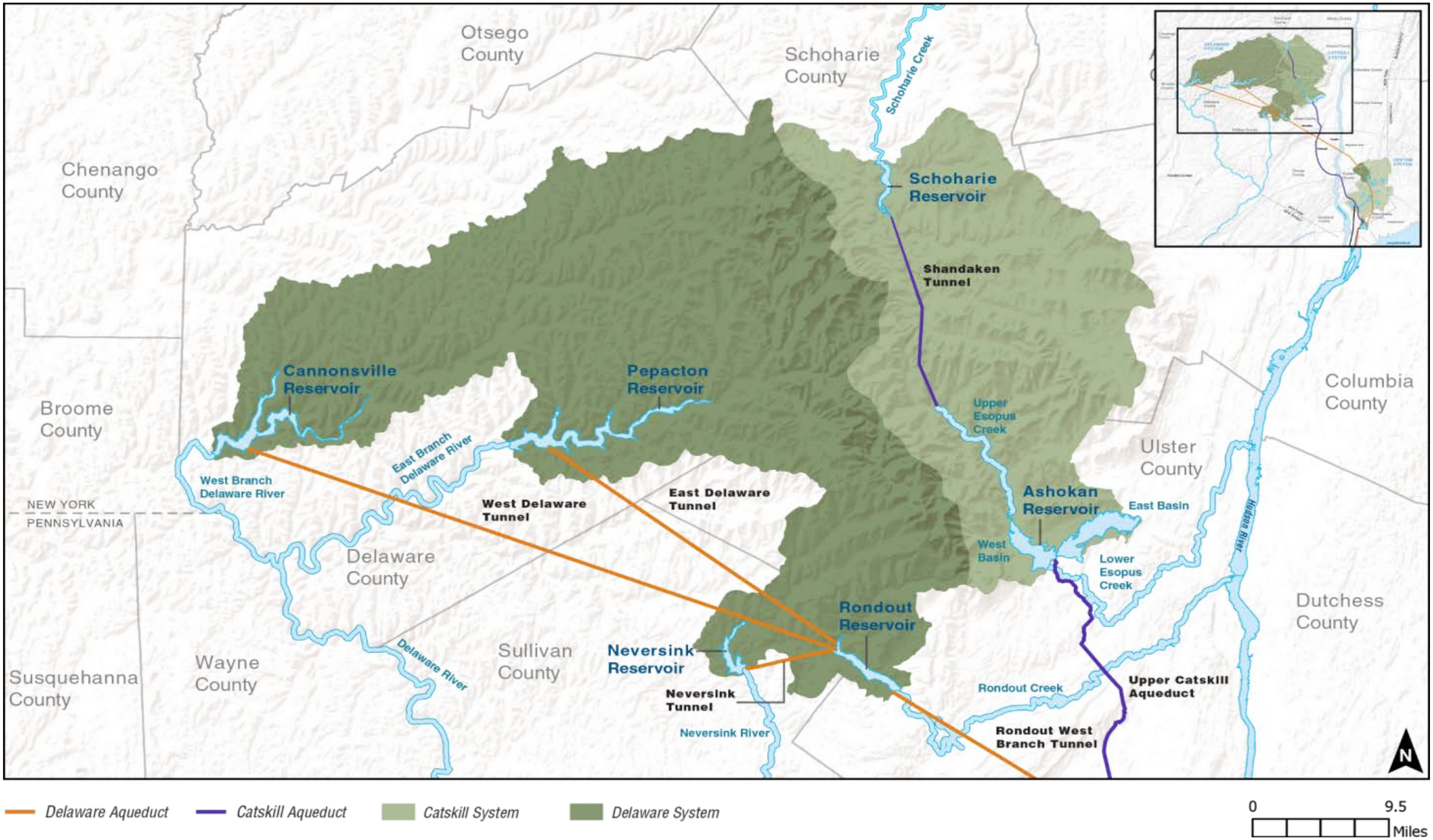

Figure 10.1-1: Catskill and Delaware Water Supply Systems

The Catskill System, located primarily in the Hudson River Basin, includes Schoharie and Ashokan reservoirs. Ashokan Reservoir is divided into a west and an east basin. Water is diverted from Schoharie Reservoir to the West Basin of Ashokan Reservoir via the Shandaken Tunnel that leads to upper Esopus Creek. Water supply for the City is drawn primarily from Ashokan Reservoir's East Basin, where water is diverted by the upper Catskill Aqueduct into Kensico Reservoir. In addition to supplying water to Kensico Reservoir, approximately 20 municipalities and districts in upstate New York receive water supply from the Catskill System via the upper Catskill Aqueduct.

While the primary purpose of diversions from Schoharie Reservoir is to transfer drinking water supply to Ashokan Reservoir, diversions are also required from Schoharie Reservoir to protect and enhance the upper Esopus Creek's recreational use, as codified in Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 670.[3] Water from Schoharie Reservoir that overtops the spillway at its dam is spilled to Schoharie Creek, a tributary of the Mohawk River.

Water released from Ashokan Reservoir enters the Ashokan Release Channel and flows to lower Esopus Creek. Water that spills over the reservoir's East Basin spillway also enters lower Esopus Creek. Ashokan Reservoir was designed as a two-basin system, which assists with the management of episodic turbidity events that sometimes occur within the Catskill System. However, at times large storm events can overwhelm the natural settling process of Ashokan Reservoir, and turbid water can enter the upper Catskill Aqueduct. DEP manages these turbidity events by: (1) reducing diversions of water to Kensico Reservoir; (2) providing alum treatment at the Pleasantville Alum Plant to promote settling of solids in Kensico Reservoir; and/or (3) releasing water from Ashokan Reservoir to lower Esopus Creek. These response actions can be used separately or in combination as necessary. In accordance with the Order on Consent dated October 4, 2013, DEP operates the Ashokan Release Channel pursuant to an Interim Ashokan Release Protocol that governs releases from Ashokan Reservoir to lower Esopus Creek. This protocol is currently being analyzed as part of a separate environmental review related to Modification of the Catalum SPDES Permit (see Section 10.4, "Catskill Water Supply System Assessment and Impact Analysis," for further details on the Interim Ashokan Release Protocol).[4]

On average, the Delaware System supplies slightly more than half of the City's daily demand, which is sourced from four reservoirs. Three of these reservoirs – Pepacton, Cannonsville, and Neversink, are located in the Delaware River Basin. Water is diverted from these reservoirs to the fourth, Rondout Reservoir, which is part of the Hudson River Basin. Water is then diverted from Rondout Reservoir to West Branch Reservoir via the RWBT before continuing through the Delaware Aqueduct to Kensico Reservoir.[5] In addition to supplying water to West Branch Reservoir for the City's system, two municipalities, the Town of Newburgh and the Town of Marlborough, receive water supply from the Delaware System via a connection to the RWBT.

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3 NYSDEC 6 NYCRR Part 670 is available here: http://www.dec.ny.gov/regs/2485.html.

4 The Catskill Influent Chamber State Pollutant Discharge Elimination System Permit ("Catalum SPDES Permit") applies to DEP's operation of the Ashokan Release Channel and application of alum in the Catskill Aqueduct, which accumulates in Kensico Reservoir.

5 During typical operations, DEP can operate West Branch Reservoir in various configurations depending on the level of mixing desired for Delaware System water with water in West Branch Reservoir.

In addition to these diversions, water is also released from Pepacton, Cannonsville, and Neversink Reservoirs to the East Branch of the Delaware River, West Branch of the Delaware River, and the Neversink River, respectively, in accordance with a 1954 U.S. Supreme Court Decree and commitments made by the parties to that Decree and accepted by the Delaware River Basin Commission. Water that spills from these reservoirs also enters the waterbodies downstream. The Delaware River Basin Commission is comprised of representatives of the federal government and representatives from the states through which the Delaware River flows, including Delaware, New York, New Jersey, and Pennsylvania. The current management framework that governs the Delaware System reservoirs is referred to as the Flexible Flow Management Program (FFMP) and is intended to balance water supply needs of New York City and the Delaware River Basin states' environmental goals and directives.

Rondout Reservoir is not part of the Delaware River Basin. Water from Rondout Reservoir is released to Rondout Creek in accordance with State requirements for this system aimed at protecting recreational uses as codified in 6 NYCRR Part 671 and Section 672-2.[6] Given the City's reliance on the Delaware System, water within Rondout Reservoir is often diverted to the City in sufficient quantity such that the water surface elevation in Rondout Reservoir remains below the reservoir's spillway. As a result, spills at Rondout Reservoir are uncommon. When they do occur, water spills into Rondout Creek.

Both the Catskill and Delaware water supply systems extend from their respective, rural watersheds northeast of the City through the upper Catskill Aqueduct and RWBT/Delaware Aqueduct to converge at Kensico Reservoir, the terminal reservoir for the two systems. As a result of the extensive watershed protection efforts of DEP and numerous stakeholders, as well as the inherent high quality of the water in these watersheds, the combined Catskill and Delaware System is able to maintain compliance with the requirements for unfiltered surface water systems established by the United States Environmental Protection Agency (EPA) in the Surface Water Treatment Rule and its amendments.[7] To enhance flexibility in the Catskill and Delaware Systems, the City has completed construction of an interconnection between the two systems at Shaft 4 of the RWBT in Gardiner, New York.[8] The Shaft 4 Interconnection would allow water from the Delaware System to be diverted to the Catskill Aqueduct, and would allow delivery of a variable flow range of 50 mgd to 365 mgd from the Delaware Aqueduct to the Catskill Aqueduct prior to water reaching Kensico Reservoir. The interconnection would reduce or avoid use of Catskill water during episodic turbidity events, improve the quality of the water being delivered to communities along the Catskill Aqueduct, and would help to reduce the need for alum treatment of Catskill System water upstream of Kensico Reservoir. Finally, to further increase general system flexibility, the City is enhancing connections between the Croton, Catskill, and Delaware systems in the form of pump stations that can pump water from the Cross River and

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6 NYSDEC 6 NYCRR Part 671, Section 672-2 is available here: http://www.dec.ny.gov/regs/2485.html.

7 EPA's Surface Water Treatment Rule and its amendments are available here: https://www.epa.gov/dwreginfo/surface-water-treatment-rules.

8 The Delaware Aqueduct is at a higher elevation than the Catskill Aqueduct so water can only flow from the RWBT to the Catskill Aqueduct at the Shaft 4 Interconnection site.

Croton Falls reservoirs in the Croton System to Kensico Reservoir via the Delaware Aqueduct. These pump stations are further discussed in the "Croton Water Supply System" section.

While Kensico Reservoir captures inflows from its surrounding watershed in addition to all water diverted from the Catskill and Delaware systems, the reservoir is a drinking water supply source. As such, elevations within the reservoir are closely managed and monitored. As a result, Kensico Reservoir does not spill; however, if elevations ever exceeded those of the reservoir's spillway, water could spill to the Bronx River.

Croton Water Supply System

The Croton System, which can provide up to 30 percent of the City's demand, lies almost entirely within New York State (State) with a small portion to the east located in Fairfield County, Connecticut (see **Figure 10.1-2**). The Croton System consists of a series of interconnected reservoirs and lakes along the main stem of the Croton River and its tributaries extending into Westchester, Putnam, and Dutchess counties, New York. The Croton River begins as three branches – the West Branch, Middle Branch, and East Branch Croton rivers. Boyd's Corners and West Branch reservoirs are located on the West Branch Croton River. Middle Branch Reservoir is located on the Middle Branch Croton River. Water from these reservoirs converges in Croton Falls Reservoir and flows to the continuation of the West Branch Croton River. Just downstream, the West Branch Croton River joins the East Branch Croton River, which delivers water transferred from Bog Brook, East Branch, and Croton Falls Diverting reservoirs, forming the Croton River. The Croton River then flows to Muscoot and New Croton reservoirs and ultimately leads to the Hudson River. The Titicus River (and Titicus Reservoir), the Cross River (and Cross River Reservoir), and the Muscoot River (and Amawalk Reservoir) all flow into Muscoot Reservoir. Water from Muscoot Reservoir flows via a weir and/or gates to the New Croton Reservoir, where water from the Croton System is then diverted through the New Croton Aqueduct to Jerome Park Reservoir. Water from Jerome Park Reservoir is treated at the Croton Water Filtration Plant prior to entering the City's distribution system. While the primary purpose of the reservoir system is drinking water supply, releases are required from most Croton System reservoirs to protect and enhance downstream waterbodies, as codified in 6 NYCRR Part 672-3.[9]

Originally constructed as part of the Croton System, Boyd's Corners and West Branch reservoirs now predominately serve as components of the Delaware System. Other than providing additional storage, the primary function of Boyd's Corners Reservoir is to help maintain the water surface elevation in West Branch Reservoir, which is the receiving reservoir for flows through the RWBT. Water from West Branch Reservoir is then diverted to Kensico Reservoir where it continues to travel south to Hillview Reservoir before entering the City's distribution system.

[9] NYSDEC 6 NYCRR Part 672-3 is available here: http://www.dec.ny.gov/regs/2485.html.

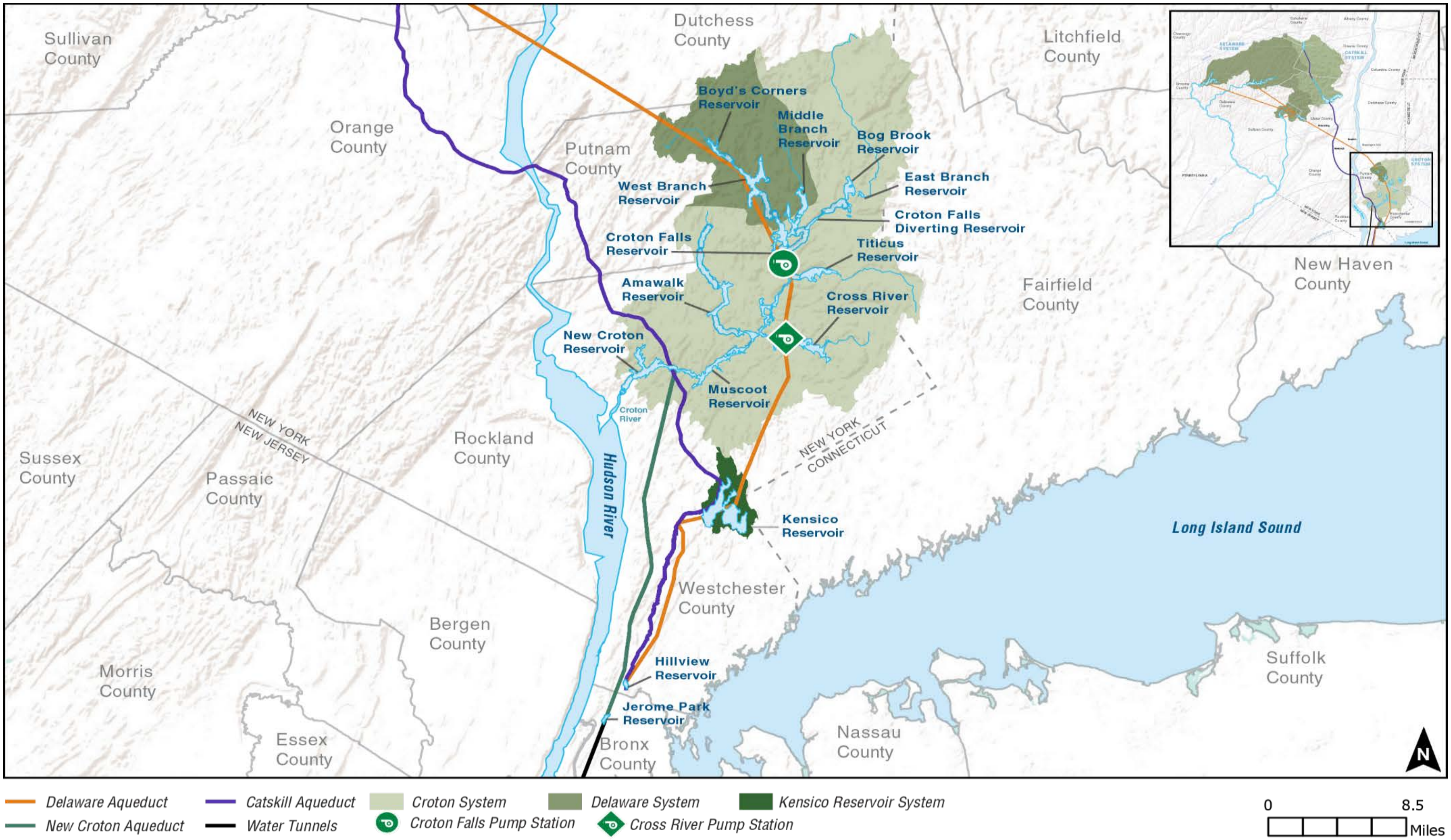

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Figure 10.1-2: Croton Water Supply System

Water travels from Boyd's Corners Reservoir to West Branch Reservoir via transfers, regulated releases, or spills to West Branch Croton River. West Branch Reservoir also receives water from its own small watershed. At West Branch Reservoir, DEP releases regulated minimum flows and the reservoir does not typically spill. However, when they occur, spills (and releases) continue south along the West Branch Croton River to Croton Falls Reservoir, located south of West Branch Reservoir. In addition to regulated releases and occasional spills from West Branch Reservoir, Croton Falls Reservoir receives water from Middle Branch Reservoir. There are no regulatory requirements for releases from Middle Branch Reservoir to Croton Falls Reservoir, so transfers and spills are the only flows from Middle Branch Reservoir to Middle Branch Croton River. Croton Falls Reservoir is connected to Croton Falls Diverting Reservoir via a channel and dividing weir, and the reservoirs can be managed so that water flows from Croton Falls Diverting Reservoir to Croton Falls Reservoir. Spills, regulatory releases, and transfers from Croton Falls Reservoir flow into the continuation of the West Branch Croton River, which joins the East Branch Croton River, and flows into Muscoot Reservoir. Additional water from Croton Falls Reservoir can be made available to the City's water supply system via the Croton Falls Pump Station, which is under construction and would be online prior to commencement of the temporary shutdown. Water can be pumped from Croton Falls Reservoir into the Delaware Aqueduct at Shaft 11 between West Branch and Kensico reservoirs. This blend of Croton System and Delaware System water is ultimately discharged into Kensico Reservoir where it is combined with flows received from the Catskill System.

Croton Falls Diverting Reservoir receives water via the East Branch Croton River in the form of spills and releases from East Branch Reservoir and releases from Bog Brook Reservoir. Releases from East Branch and Bog Brook reservoirs are regulated. There is an underground tunnel connecting East Branch Reservoir to Bog Brook Reservoir. Bog Brook Reservoir has regulated releases that flow first through Bog Brook and then into the East Branch Croton River. East Branch Reservoir spills to the East Brach Croton River, which flows naturally to Croton Falls Diverting Reservoir. Croton Falls Diverting Reservoir passes regulated releases into the continuation of the East Branch Croton River and ultimately Muscoot Reservoir. Additionally there is a rock-lined connecting channel between Croton Falls Diverting Reservoir and Croton Falls Reservoir to divert water from the East Branch Croton River to the Croton Falls Reservoir when it is drawn down.

In addition to receiving flow from Croton Falls Reservoir and Croton Falls Diverting Reservoir, Muscoot Reservoir receives water from Amawalk, Titicus, and Cross River reservoirs. Regulatory releases and water supply transfers from Cross River Reservoir flow via Cross River to Muscoot Reservoir. Amawalk Reservoir is located on the Muscoot River. Spills, transfers, and releases from the reservoir continue along the Muscoot River into Muscoot Reservoir. Flows through the Titicus Reservoir are either released, transferred, or spilled, flowing along the Titicus River before entering Muscoot Reservoir. Finally, as with Croton Falls Reservoir, additional water from Cross River Reservoir can be supplied to the City's water supply system via the Cross River Pump Station. Water can be pumped from Cross River Reservoir into the Delaware Aqueduct at Shaft 13 between West Branch and Kensico reservoirs. This blend of Croton System and Delaware System water is ultimately discharged into Kensico Reservoir where it is combined with flows received from the Catskill System.

Muscoot Reservoir is the final receiving reservoir for all flows within the Croton System before water flows into New Croton Reservoir. Spills and transfers from Muscoot Reservoir flow directly to the New Croton Reservoir and are solely for water supply purposes. There are no regulatory release requirements for Muscoot Reservoir. New Croton Reservoir is the terminal reservoir of the Croton System. Up to 290 mgd can be diverted from New Croton Reservoir to Jerome Park Reservoir and then the Croton Water Filtration Plant via the New Croton Aqueduct. The Croton Water Filtration Plant has a maximum design treatment capacity of 290 mgd and enables the City to meet its water supply needs and comply with State and federal drinking water standards and regulations. After treatment, water from the Croton Water Filtration Plant is sent directly to the City. New Croton Reservoir also has regulatory release requirements, and all releases and spills from the reservoir continue down the Croton River to the Hudson River.

Similar to the Delaware and Catskill systems, the Croton System provides water not only to City customers but also to numerous municipalities and water districts in Westchester and Putnam counties. A number of communities draw water directly from both the New and Old Croton aqueducts, but, unlike the Delaware and Catskill systems, upstate communities served by the Croton System also withdraw water directly from Croton System reservoirs.[10]

Figure 10.1-3 presents a schematic of flow within the City's overall Water Supply System.

10.1.2.2 Operation of the Surface Water Supply System

Overall operation of the City's water supply system is based on balancing natural variations in hydrologic drivers (i.e., precipitation) with customer water demands. At present, total system demand for all customers equals approximately 1.1 billion gallons per day. To meet this demand, the water supply system must be managed to respond to changing conditions on a continuous basis, and operational scenarios must be developed to better understand and characterize potential strategies for system operation during planned and unplanned events.

The water supply system receives approximately 50 to 60 inches of rainfall on average each year. In general, precipitation is highest in the winter and spring when demand is lowest. Precipitation can consist largely of snowfall in the winter, resulting in very large inflows in the spring from the combination of rainfall and snowmelt. Conversely, summer and fall are the driest seasons and correspond to the periods of highest demand. Therefore, to optimize available water supplies, the water supply system is typically operated in the spring to fill the reservoirs by approximately June 1 each year to ensure sufficient water supply during the drier summer months when demand is higher. Reservoirs are then drawn down (i.e., there is a drop in water surface elevation and corresponding water supply storage) through the summer and into the fall due to high demand and low inflows to the system. In the winter, the reservoirs gradually begin refilling as demand drops and precipitation increases. Drought conditions, which can occur in any season, reduce the amount of inflow into the reservoirs, resulting in reservoirs being drawn down more than typical and for a longer duration.

[10] Only one municipality, Ossining, is backfed from the Old Croton Aqueduct.

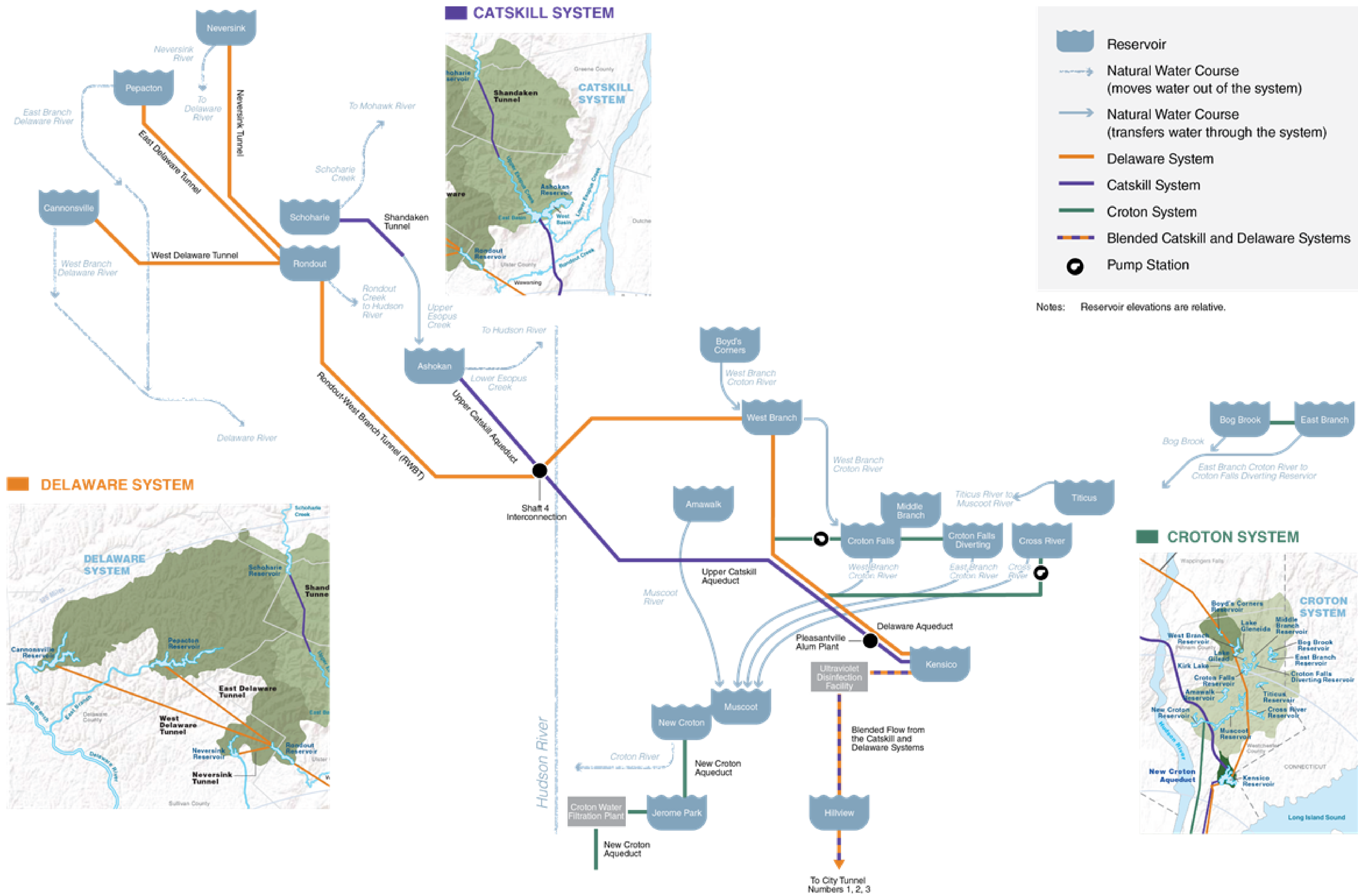

Figure 10.1-3: The New York City Surface Water Supply System Flow Diagram

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DEP's operating procedures are designed to balance storage and inflows across the three systems, diverting more from reservoirs where inflows from upstream waterbodies are highest, while preserving storage in those reservoirs where inflows are lowest. For example, water surface elevations and corresponding storage at Rondout Reservoir where the Delaware Aqueduct begins are managed and balanced through controlled diversions from the Neversink, Pepacton, and Cannonsville reservoirs. Diversions and transfers are also used to meet water supply objectives at reservoirs within the Catskill and Croton systems. Similarly, water quality is managed by maximizing diversions from reservoirs in either system with the highest water quality, and minimizing or curtailing diversions and transfers from reservoirs during water quality events that are often related to storms. This type of preferential diversion or transfer of higher quality water to meet demand occurs both within and between systems. For example, during storm events in the Catskill watershed, the City can reduce diversions from Schoharie Reservoir to Ashokan Reservoir or rely more heavily on water from the Delaware System. Releases are the primary means of meeting other objectives of the system (e.g., watershed agreements, recreational requirements, and regulated minimum releases). While diversions and releases are carefully managed, DEP does not have control over spill events that occur when reservoir levels are high and a storm occurs within the watershed. However, to manage large inflows to the City's reservoirs during storm events, DEP does provide seasonal storage voids in the Delaware and Catskill System reservoirs to increase the natural flood attenuation already provided by the reservoirs and to limit spills.

It is in this context that DEP manages the water system to maximize overall system reliability, maintain high quality drinking water, address environmental objectives, and meet regulatory and other legal obligations. While the system is fundamentally and foremost a drinking water supply system essential to the City and surrounding communities, the assets of the system are also used to support other important environmental and recreational needs.

10.1.3 OST MODELING

Given the size and complexity of the water supply system, operating scenarios used to manage the system must be well coordinated, tested, and updated regularly. DEP evaluates operating scenarios using their Operations Support Tool (OST).[11] The City's OST is a computer-based model that provides computational and predictive support for water supply operations and planning to facilitate DEP's management of the system, response to changing hydrologic conditions and understanding of the potential system response to planned and unplanned events, such as planned infrastructure improvements or storms and droughts, respectively. OST simulates the amount of water available in the City's reservoir system at any given time by accounting for dozens of variables such as weather forecasts, current demand for water, and daily changes to the operation of the water supply system.[12] OST has been in use since 2012 and has been instrumental in managing the complex interplay between multiple, often competing objectives for the water supply system, including water supply reliability, drinking water quality,

[11] *New York City's Operations Support Tool White Paper* that further describes OST is available here at: http://www.nyc.gov/html/dep/html/drinking_water/forecasting_reservoir_levels_ost.shtml.

[12] Daily changes to system operations include those necessary to meet regulatory release requirements, support infrastructure repair, ensure system balance, and manage water quality, among others.

environmental and recreational releases, hydropower generation, and peak flow attenuation for downstream communities. OST incorporates the following data sources into the decision-making process:

- ***Weather and environmental data***: OST uses near real-time data from a number of sources, including multiple gauges that measure reservoir water levels and stream flow, devices that measure the water content of snowpack throughout the watersheds, and rain gauges, as well as weather forecasts from the National Oceanic and Atmospheric Administration's National Weather Service. These data help DEP forecast the amount of water expected to enter the reservoir system, also known as runoff or "inflow" to the reservoirs, over a given period of time.

- ***Historical inflows:*** Historical hydrologic data (inflows) are used in OST as a predictive tool. Natural inflows to the reservoirs were developed from the historical hydrologic record from 1928 to 2012. These inflows represent the flow of water into and throughout the system from associated historical weather conditions. Historical stream flows were developed using United States Geological Survey (USGS) gauge data and historical DEP operations data. Given that the data represent an 80-plus year period of record, the historical data includes inflow characteristics for a range of conditions from extreme storms to the drought of record. Therefore, the historical inflows to the water supply system included within OST, and used to model system response to certain events, represent the potential range of likely inflow conditions that the water supply system could experience, and their likelihood of occurrence over a given timeframe (i.e., 10 years, 30 years). This is critical for modeling various operating scenarios.

- ***Reservoir operating rules****:* Physical infrastructure constraints of the water supply system, such as tunnel hydraulic capacities and available reservoir storage, are included within OST. OST also includes rules for diversions of water to system tunnels and aqueducts necessary to meet drinking water demand and rules for stream releases (in addition to spills, these are collectively referred to as outflows). Outflows include those identified in the FFMP for: Delaware System reservoirs; the Interim Ashokan Release Protocol for Ashokan Reservoir; required releases from Croton System reservoirs; SPDES permit requirements; and other regulations for established system operating rules. This collection of operating rules serves as a foundation for OST. These constraints ensure that OST does not suggest operational scenarios that are outside the scope of existing regulations or the capacity of the City's water supply system.

- ***In-City and upstate demand****:* OST also incorporates the seasonal drinking water demand patterns for the City and more than 70 communities upstate that draw water from the City's water supply system.

OST combines this information (weather and environmental data; historical inflows; operating rules, including outflows; and drinking water supply demand) to model reservoir water quality and elevations as well as outflows to downstream waterbodies under a given operating scenario. This advanced modeling allows DEP to test a range of potential operational changes in a virtual setting – and understand their outcomes – so that operating decisions are made with the best available information. OST also takes into account how ongoing construction projects might affect the water supply, which allows DEP to make operational changes in advance of extreme weather events to "balance" the system while meeting applicable regulatory requirements.

10.1.4 PROPOSED ACTIVITIES

WSSO is a specific and highly unusual operating procedure to support the temporary shutdown that departs substantially from the operating scenarios typically used to manage the City's surface water supply systems. WSSO would involve DEP greatly modifying its typical water supply system operations prior to, during, and immediately following the temporary shutdown. DEP would meet all applicable regulations for its water supply system, unless specifically discussed and assessed in this DEIS as temporary changes to support WSSO. DEP would seek applicable approvals from agencies for any deviations from regulatory requirements that would require approval.

WSSO would commence 4 months prior to the start of the temporary shutdown to prepare the water supply system for heavier reliance on the Catskill and Croton systems while the Delaware System is temporarily unavailable. Beginning June 1, 2022, diversions from the Delaware System would increase as compared to typical operations and the water surface elevation in the Delaware System reservoirs would potentially be drawn down, allowing the City to rely less heavily on the Croton and Catskill Systems, thereby increasing the amount of water stored in those systems. In addition to managing the reservoirs to support initiation of the temporary shutdown, sufficient inflows to DEP reservoirs are critical for the successful implementation of WSSO and to minimize the potential for impacts during the temporary shutdown. Because hydrology (i.e., precipitation and stream flows) can vary widely from year to year, WSSO would include pre-shutdown criteria based on hydrologic forecasts during the summer prior to the shutdown in 2022 that would help identify the onset of drought conditions. If conditions are trending too dry in 2022, the temporary shutdown would not be initiated. Hydrologic conditions would be re-evaluated the following year, and the temporary shutdown would occur only when the hydrologic forecasts indicate there would be sufficiently wet conditions (i.e., non-drought conditions).

Once it is established that sufficient supply exists to support the temporary shutdown, dewatering of the RWBT would begin on October 1, 2022. At this time, the second temporary shutdown phase would commence. All flow through the RWBT would be stopped. DEP would be required to maintain water supply with only the Catskill and Croton systems online for the duration of the temporary shutdown from October 1, 2022 through May 2023. WSSO for the Delaware System during the temporary shutdown would focus on management of surface water in Pepacton, Cannonsville, and Neversink reservoirs that would normally be used for drinking water purposes. An increase in releases from these reservoirs to receiving waterbodies would be required during the temporary shutdown to maintain reservoir elevations at their typical levels, and reduce the likelihood of spills. Rondout Reservoir has limited release capacity compared to other Delaware System reservoirs, because water is typically diverted to the City through the RWBT. In order to increase releases during the temporary shutdown, three temporary siphons would be constructed over Merriman Dam at Rondout Reservoir to transfer water to Rondout Creek. This would provide additional capacity to release water from this reservoir, beyond the approximately

15 mgd maximum that can be released through existing infrastructure at Merriman Dam, for a combined total release capacity of up to 260 mgd. The three temporary siphons at Rondout Reservoir would be the only infrastructure improvements associated with WSSO.

As described, the Catskill and Croton systems would be relied upon more heavily during the temporary shutdown. As a result, all Catskill and Croton System reservoirs would be drawn down as needed to meet demand, potentially resulting in lower water surface elevations than typical operations for some reservoirs in these systems. In addition, because of the need to rely more heavily on the Catskill System during the temporary shutdown, DEP would likely be precluded from reducing flows from Ashokan Reservoir in response to episodic turbidity events. Further, without dilution with water from the Delaware System, DEP may need to apply alum at lower turbidity levels than under typical conditions. As a result, alum treatment of Catskill System water at the Pleasantville Alum Plant just upstream of Kensico Reservoir would likely be required at a frequency higher than typical during the RWBT temporary shutdown. Construction of chemical system upgrades to support increased alum treatment would be conducted as part of other upgrades to the Pleasantville Alum Plant required under the Catskill Aqueduct Repair and Rehabilitation, described in Chapter 9 of this DEIS. However, more frequent alum treatment during the temporary shutdown is part of WSSO and would likely result in higher than typical deliveries of alum. Increased alum treatment under WSSO could also result in increased deposition of alum floc within Kensico Reservoir near the discharge point for the upper Catskill Aqueduct at the Catskill Influent Chamber in the Town of Mount Pleasant.[13]

While unlikely, once the temporary shutdown has commenced, drought conditions could occur suddenly and with an intensity that would require DEP to demobilize the temporary shutdown construction activities focused on repairing the RWBT and connecting the bypass tunnel, and return the RWBT back to service prior to the completion of the bypass tunnel connection. If necessary, water would flow through the existing RWBT until conditions allow for construction activities to be reinitiated. Therefore, WSSO also includes forecast tools to account for this condition. If the temporary shutdown were demobilized because of drought conditions, the RWBT temporary shutdown would recommence the following October, if hydrologic conditions are favorable based on the pre-shutdown hydrologic forecasts.

Following the end of the temporary shutdown, the third post-shutdown phase of WSSO would commence with the restarting of the RWBT. Operational changes would continue for a short time period to allow the water supply system to equilibrate to typical reservoir conditions. This would include increased reliance on the Delaware System to provide time for the Catskill and Croton systems to recover from reservoir drawdown or changed flow conditions precipitated by operations during the temporary shutdown. Once the RWBT temporary shutdown is complete, the majority of reservoir water surface elevations and downstream flows (releases and spills) would return to typical ranges under typical hydrologic conditions.

In general, as a result of the modified system operations for WSSO, certain downstream waterbodies within and connected to the Delaware, Catskill, and Croton Systems would receive

[13] Alum floc is the term used to describe the mixture of suspended sediment and alum that settles out of the water column and deposits on the reservoir bed.

higher than typical volumes of water, and certain reservoirs would be drawn down more than they typically experience.

10.1.5 Study Areas

The boundaries of each study area evaluated as part of WSSO are defined by a 0.25-mile buffer around each waterbody within the surface water supply system. The buffer is based on either the stream centerline obtained from the USGS National Hydrography Dataset (for waterbodies downstream of DEP reservoirs) or the water surface elevation of the reservoir as set by the reservoir's spillway elevation. For waterbodies downstream of DEP reservoirs (receiving waterbodies), the upstream boundary of the waterbody is defined as the location of the point of spillway or release/transfer input to the waterbody from a City reservoir. The downstream boundary is defined by the next downstream reservoir, or, in the absence of a downstream reservoir, the point along the receiving waterbody where the flows contributed by WSSO would be minor compared to overall flow. For all waterbody study areas, the study area does not include upstream tributaries outside of the 0.25-mile buffer area.

In addition to the waterbody study areas, WSSO includes construction and operation of siphons at Merriman Dam using a 0.25-mile study area around Merriman Dam, truck deliveries associated with the potential need for increased alum treatment within a 0.25-mile study area around the Pleasantville Alum Plant, and alum floc deposition at Kensico Reservoir. Additionally, the three Delaware System tunnels (East Branch, West Branch, and Neversink), which would not receive flow during the temporary shutdown, are evaluated as their own study area. There is no buffer around the tunnel study area because the tunnels are located entirely underground. Maps for each study area can be found within the impact assessment chapters, Section 10.3, "Delaware Water Supply System Assessment and Impact Analysis," through Section 10.5, "Croton Water Supply System Assessment and Impact Analysis."

10.1.6 Schedule

Starting in 2017, DEP would make facility upgrades to the Pleasantville Alum Plant to support the potential need for increased alum treatment during the temporary shutdown. As discussed, construction activities associated with the Pleasantville Alum Plant upgrades are evaluated under the Catskill Aqueduct Repair and Rehabilitation (see Chapter 9.0, "Catskill Aqueduct Repair and Rehabilitation), as they are primarily needed to support activities associated with that component of Upstate Water Supply Resiliency. From April through October 2021, DEP would construct three temporary siphons at Rondout Reservoir to prepare for WSSO.

DEP would initiate WSSO on June 1, 2022, 4 months prior to the temporary shutdown, by increasing diversions from Delaware System reservoirs. Concurrently, over the summer of 2022, DEP would monitor inflows to the reservoirs and evaluate whether conditions indicated the system was entering a potential drought. If identified, the temporary shutdown would be postponed to the following year and hydrologic conditions would be re-evaluated at that time. If conditions are favorable, the temporary shutdown of WSSO would begin on October 1, 2022 and continue for approximately 8 months. At this time, the reservoirs would be operated according to the WSSO temporary shutdown procedure and would include the use of siphons at Rondout Reservoir and potential additional alum treatment at the Pleasantville Alum Plant.

Once the RWBT Bypass is connected and construction is complete, the temporary shutdown would end, and water would flow through the RWBT and newly connected bypass. Water from the Delaware System would be diverted through the RWBT at higher than typical rates to provide time for the Catskill and Delaware Systems to recover. Use of the Rondout Reservoir siphons would stop and they would be removed. In the event of elevated Catskill turbidity levels, alum treatment at the Pleasantville Alum Plant would be unlikely during the post-shutdown phase due to the Delaware System coming back online. Catskill Aqueduct flows could be curtailed and would be diluted with substantial flow from the Delaware System in Kensico Reservoir and via the Shaft 4 Interconnection, similar to typical operations. The post-shutdown phase would continue until the system equilibrates, which for most waterbodies would occur within the first few months following the temporary shutdown.

10.2 HYDROLOGIC EVALUATION AND IMPACT ANALYSIS METHODOLOGY

This section analyzes how modified operation of the water supply system under WSSO (Future With WSSO) would have the potential to alter reservoir water surface elevations (elevations) and spills and releases (flows) compared to typical operations (Future Without WSSO). The section also presents the methodologies, including the modeling and analysis tools, used to simulate the range of elevations and flows predicted to occur under WSSO for comparison to typical operations and quantify any differences. A comparison of the two scenarios was then used to identify whether the changes identified have the potential to result in temporary or permanent environmental impacts within each study area, where applicable, as described in the following sections.

10.2.1 HYDROLOGIC EVALUATION

Unlike projects that include development, construction, or other activities that result in tangible changes to communities or the landscape, WSSO predominantly consists of changes to elevations and flows within the water supply system as a result of modified operations to support temporary shutdown of the RWBT. However, the overarching rules and practices that guide the operations of the water supply system reservoirs would remain consistent with typical operations during WSSO. For example, reservoir elevations fluctuate throughout the year, filling or being drawn down based on hydrology, demands, and other conditions within the water supply system. The operating ranges for most reservoirs during WSSO would be similar to typical operations. For example, reservoirs with narrow operating ranges would continue to have little fluctuation in water surface elevations, while reservoirs that have wide operating ranges would have the potential to be drawn down substantially during the shutdown. Further, except for a few reservoirs, for which DEP would seek a variance in release operations, applicable regulations that govern releases would remain in effect for the duration of WSSO.

Reservoirs are operated in response to hydrology in the water supply watersheds, which is dynamic and fluctuates widely from season to season and from year to year. Because water supply system operations must be continually adjusted in response to hydrologic conditions, a range of elevations and flows are observed across the water supply system over the course of a year, and from year to year. While DEP would use hydrologic forecasting to ensure the system would not be entering a potential drought prior to commencement of the temporary shutdown, the exact hydrologic conditions that would occur at the time of the temporary shutdown are unknown. Therefore, OST was used to characterize and identify the range of conditions (e.g., reservoir elevations and flows) the water supply system could experience once the temporary shutdown is initiated as compared to typical operations. The historical inflow record from 1928 to 2012 was used for this purpose. As previously described, the historical inflow data capture a large range of system conditions that are representative of the natural hydrologic variation of the water supply system and the recurrence of certain types of hydrologic years (i.e., wet or dry).

The historical inflow data in OST were divided into a collection of 3-year blocks to account for the pre-shutdown, temporary shutdown, and post-shutdown phases (collectively referred to as WSSO).[14] The modeling accounted for additional flexibility in water supply system management that would be available based on infrastructure improvements currently underway and slated for completion by 2022. Improvements include the Shaft 4 Interconnection, planned capacity improvements for the Catskill Aqueduct being implemented under the Catskill Aqueduct Repair and Rehabilitation, and upgrades to the Croton Falls and Cross River pump stations. The modeling also accounted for estimated future drinking water demands with implementation of DEP's Demand Management Program.

Two different operating scenarios were evaluated within OST for each 3-year block of historical inflow data: (1) WSSO, and (2) the typical operations that would be in place without the temporary shutdown. These two scenarios effectively represent the future with WSSO, and the future without WSSO, respectively. The OST model output for each scenario was a dataset of reservoir water surface elevations, releases, and spills for each day within each 3-year block. The two datasets – future with WSSO and future without WSSO – represent the range of possible elevations and flows that the water supply system could experience under the two scenarios.

It was necessary to identify a robust method to determine when the changes under WSSO would result in potentially notable changes to the reservoirs and receiving waterbodies in the water supply system. After reviewing several methods for comparing and analyzing the data from OST, multiple metrics were selected to evaluate key hydrologic conditions that, if substantially changed, could result in the potential for environmental impacts. Given the large range of conditions, multiple hydrologic parameters (i.e., metrics) were considered and reviewed to select those that, when compared between future with WSSO and typical future without WSSO, provided the best representation of how conditions under future with WSSO would vary from those under typical future without WSSO. For flows from reservoirs, metrics were selected to compare average, high flow, and low flow conditions. Because the reservoir water surface elevations are constrained by the spillway and intake structures, which would not change with under future with WSSO, the elevation comparison was limited to the average conditions. Further, reservoir elevations generally change more gradually than flows. If the modeling and analysis tools identified study areas that would experience changes substantially outside of the typical range, the study areas were assessed further. No further analyses were conducted for study areas that would experience limited changes when compared to the range of typical operations.

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[14] There are 80+ years of historical hydrological inflows and 79 overlapping 3-year blocks based on these historical inflows (e.g. 1928 to 1930, 1929 to 1931, 1930 to 1932, etc.).

Average Flow Conditions – Downstream of Reservoirs

Average daily flow conditions in the future with WSSO and future without WSSO (typical operations) were compared on a monthly basis (i.e., monthly average daily flows) to identify potential changes in flow under future with WSSO.[15] The average flow conditions under typical operations and WSSO were selected for comparison because they represent the central tendency of flows across the collection of 3-year blocks modeled within OST. The monthly average daily flow condition was calculated by averaging daily flows for spills and releases over each month of the 3-year blocks for typical operations and WSSO. In other words, the projected average spill and release flow for the month of October 2022 (the first month of the temporary shutdown) was calculated by averaging all of the daily values for October 2022 from all of the 3-year blocks modeled for typical operation or WSSO. The range of flows anticipated under typical operations was determined by identifying the highest and lowest values modeled for a particular month for each 3-year block within the typical operations dataset. In **Figure 10.2-1**, each dot represents the monthly average daily release flow for October 2022 from the 79 3-year blocks. The typical range is the highest October 2022 and lowest October 2022 modeled for the full collection of 3-year blocks. This process was repeated for all months of the year across the full collection of 3-year blocks (see **Figure 10.2-2**).[16] If the average (or dataset mean) during WSSO fell outside the typical dataset range, an environmental impact analysis was warranted for that study area as further described in Section 10.2.3, “Impact Analysis Methodology.” If the WSSO dataset mean fell within the typical dataset range, no further analysis was warranted for average flow conditions.

For each study area for both spills and releases, a plot and table are provided that present the dataset mean for monthly average daily flow conditions for typical operations and WSSO, along with the range for typical operations. Refer to **Figure 10.2-2** and **Table 10.2-1** for examples.

High Flow Conditions – Downstream of Reservoirs

The high flow analysis was conducted using OST output for daily flows (i.e., combined release and spill flow value) downstream of all reservoirs to estimate the probability of occurrence of high flow events under both typical operations and WSSO. The method is based on standard calculations of flood probability intervals (Chow, Maidment, and Mays 1988). The probabilities of a high flow occurring were compared for receiving waterbodies downstream of each reservoir to identify the change in probability under the first two phases of WSSO (pre-shutdown and shutdown phases). High flows during the post-shutdown phase were determined to return to typical operations and were not included. **Figure 10.2-3** presents an example of the plots presented for the high flow analysis for each receiving waterbody study area.

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[15] The average flow metric is based on a parameter from The Nature Conservancy’s Indicators of Hydrologic Alteration (IHA) method. IHA was developed to assess ecologically-relevant statistics derived from daily hydrologic data. IHA was designed for assessing impacts from long-term or permanent hydrologic changes such as watershed development and dam construction.

[16] For most study areas, only the first year of the 3-year block is presented because conditions return to typical by the end of the first year. If deviations from typical conditions persist beyond the first year, the data are presented for that period.

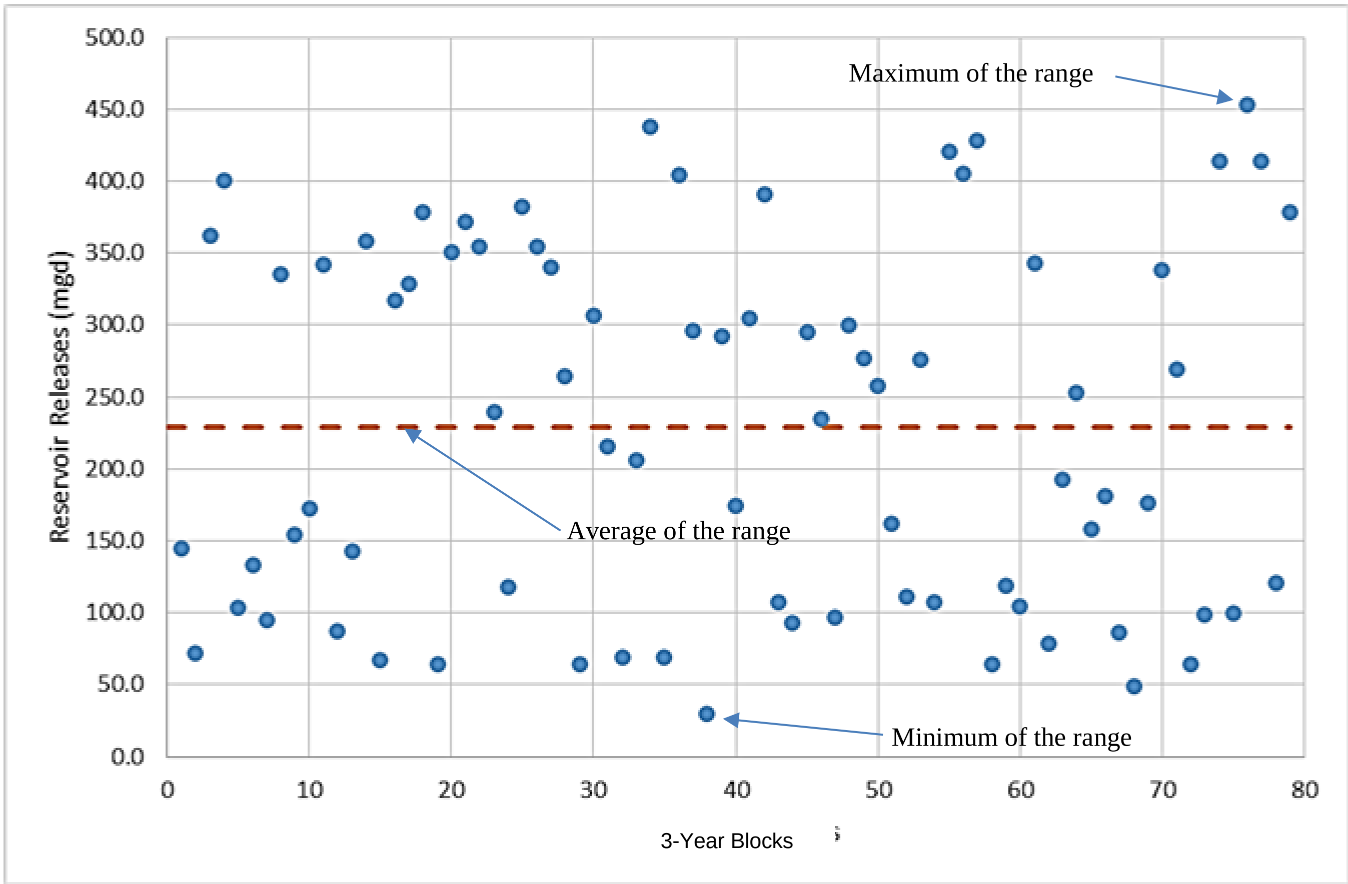


Figure 10.2-1: Illustrative Example of Average of Daily Release Flows across the Collection of 3-Year Blocks for a Single Reservoir for a Single Month (Typical Operations)

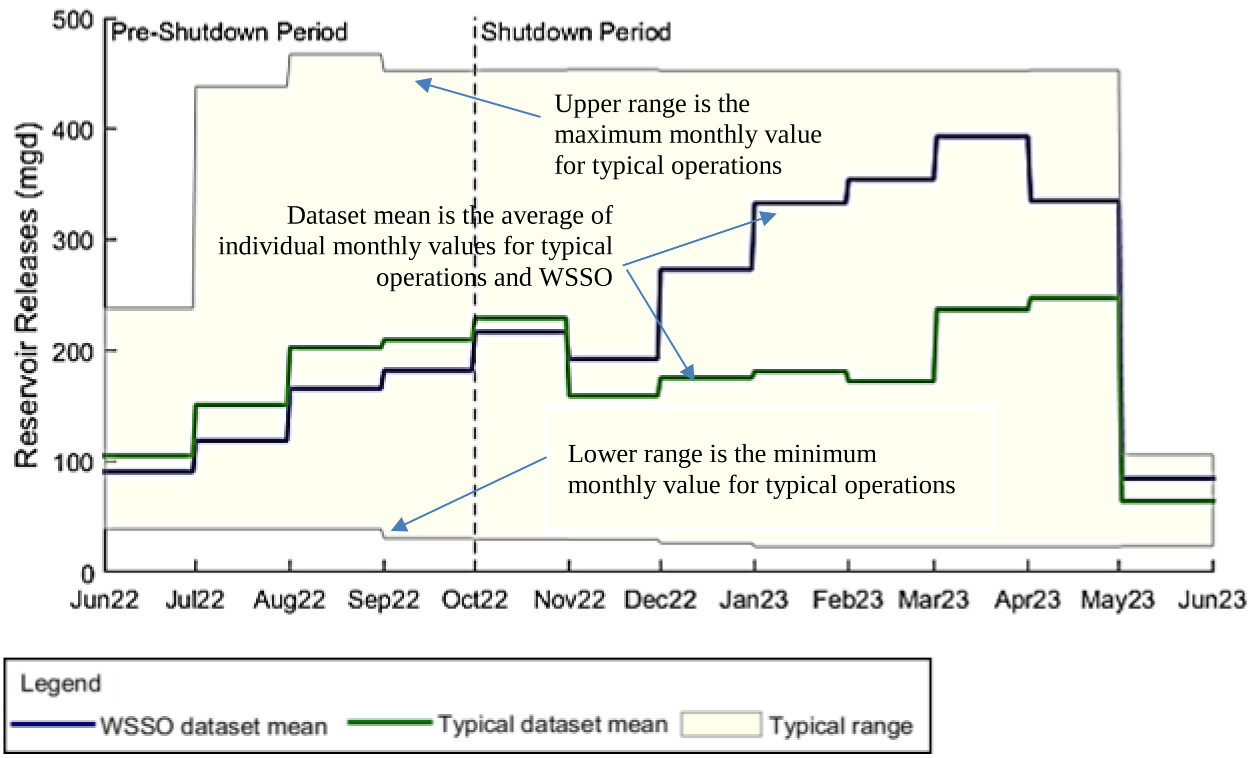
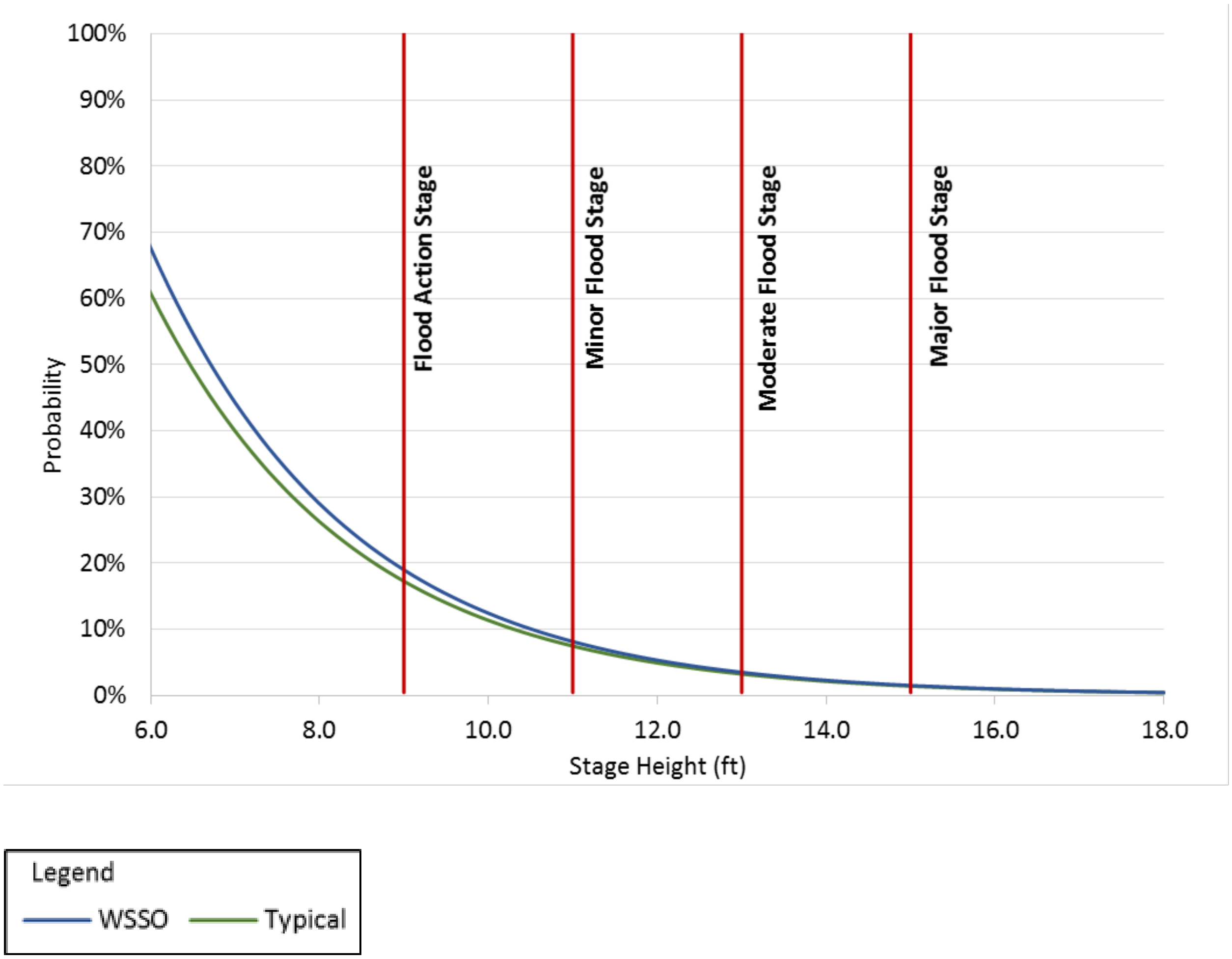


Figure 10.2-2: Illustrative Example of Average of Daily Release Flows across the Collection of 3-Year Blocks for a Single Reservoir for 12 Months

Table 10.2-1: Illustrative Example Tabular Comparison of Monthly Average Daily Release Flows for Each Month for a Single Reservoir

		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	105	39	238	91	-14
	July	151	39	439	119	-32
	August	203	39	468	166	-37
	September	210	30	452	182	-28
Shutdown Period	October	229	30	453	217	-12
	November	159	29	454	193	34
	December	176	26	452	273	97
	January	181	23	452	333	152
	February	172	23	452	353	181
	March	235	23	452	393	158
	April	253	23	452	345	92
	May	64	23	105	84	20



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	17.3%	19.0%	+1.7
Minor Flood Stage	7.4%	8.1%	+0.7
Moderate Flood Stage	3.2%	3.5%	+0.3
Major Flood Stage	1.4%	1.5%	+0.1

Figure 10.2-3: Illustrative Example of the High Flow Probability Plot with National Weather Service Flood Stages

Model flows at locations associated with available USGS gauges were routed through USGS rating curves for gauge height and discharge (the relationship between a given flow within a waterbody and its corresponding water surface elevation). These curves were compared to the National Weather Service (NWS) flood stages specific to the gauge location.

NWS flood stages are based on the level of potential damage that could occur at specific river stage elevations, as follows:

- Flood Action Stage – the stage where the NWS or a partner needs to take some type of action in preparation for possible significant hydrologic activity. No flooding can occur at the flood action stage.

- Flood Stages defined by NWS, which describe or categorize the severity of flood impacts:

  - Minor Flood Stage – minimal or no property damage, but possibly some public threat (e.g., inundation of roads).

  - Moderate Flood Stage – some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations.

  - Major Flood Stage – extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

At some locations, NWS flood stages were based on the stage of the reservoir spillway immediately upstream of the USGS gauge. At these locations, flood stages were estimated based on spillway rating curves for the respective dam.[17] Further, there are locations where no NWS flood stages were available, for example, flood stages have not been determined at any USGS gauges in Westchester or Putnam counties. At these locations, the analysis involved plotting the range of potential high flow events predicted as part of WSSO versus typical operations and visually comparing the plots of the two scenarios in order to identify potentially significant differences.

The purpose of this evaluation was to identify the potentially significant increase in probability of flows reaching flood stage levels during WSSO by using either visual comparison or the flood stage information. Where warranted, this information was used to characterize the corresponding potential environmental impact. For the high flow analysis, if WSSO were to result in a significant increase in the probability of high flows, an environmental impact analysis is warranted for that study area as further described in Section 10.2.3, “Impact Analysis Methodology.” Minor increases in the probability of high flows did not warrant an impact assessment because of the temporary duration of WSSO.

[17] Spillway rating curve is the relationship between height of water flowing above the dam spillway (stage height) and flow.

It should be noted that reservoirs under either typical operations or WSSO would not be the cause of flooding. Reservoirs reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when the reservoir is full and spilling. Therefore, any potential increase in high flows downstream of a reservoir would be indicative of a temporary reduction in the level of attenuation provided by the reservoir. Flows would continue to be lower downstream of the reservoir than if the reservoir were not present, regardless of the operational scenario.

Minimum Flow Conditions – Downstream of Reservoirs

Most reservoirs have minimum release regulations promulgated by state law or interstate agreement. To ensure that low flow conditions for reservoir releases were considered, compliance with minimum release regulations for the City's reservoirs was also evaluated based OST modeling results. The potential for impacts during low flow conditions was specifically evaluated downstream of West Branch and New Croton reservoirs, since release requirements at those two reservoirs could temporarily change to support WSSO, if approved by NYSDEC.

Average Reservoir Elevations

Average reservoir elevations were compared using the dataset mean approach described for average flow conditions. Monthly average daily reservoir elevations were calculated for each month within each 3-year block for typical operations and WSSO.[18] The typical range of elevations was determined based on the minimum and maximum values for each month. The average of the monthly values (referred to as the dataset mean) for WSSO was compared to the typical range, and if it fell outside the typical range, an environmental impact analysis was warranted for that study area as further described in Section 10.2.3, "Impact Analysis Methodology." If the dataset mean fell within the typical range, no further analysis was warranted for water surface elevations. The average of the monthly values was selected for comparison because it represents the central tendency of the 3-year blocks.

For each study area, a plot and table are provided that present the dataset mean for monthly average daily elevations for typical operations and WSSO, along with the range for typical operations. Refer to **Figure 10.2-4** and **Table 10.2-2** for examples.

Hydrologic Evaluation Summary

Table 10.2-3 presents summary results of the hydrologic evaluation for WSSO. Cells shaded green indicate the WSSO dataset mean is within the typical range. Cells shaded orange indicate the dataset mean is outside the typical range. Additional details on the hydrologic evaluations for each location are presented in the "Study Area Evaluation" section for each study area.

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[18] In most cases, the first year of the 3-year block is presented because conditions return to typical by the end of the first year. If deviations from typical persist beyond the first year, the data are presented for that period.

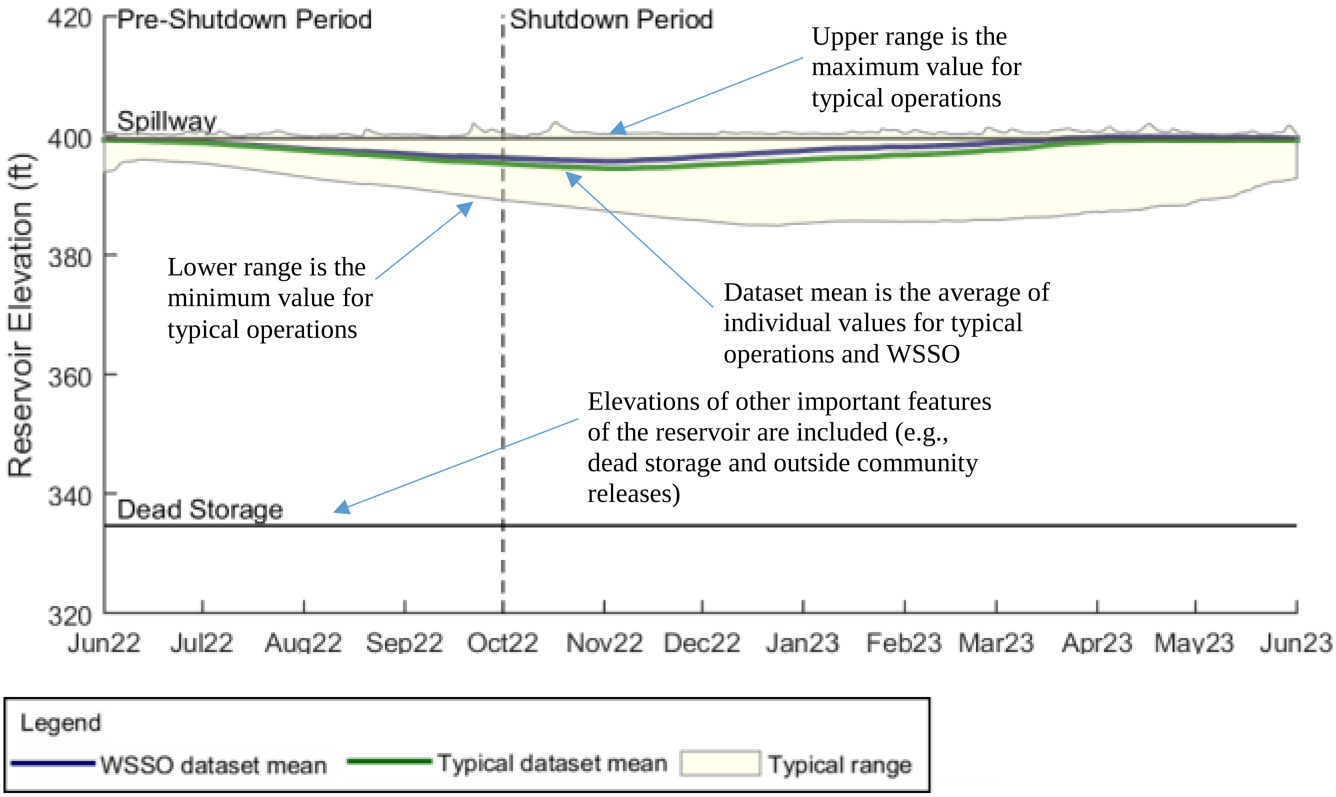

Figure 10.2-4: Illustrative Example Graphical Comparison of Daily Reservoir Water Surface Elevations for a Single Reservoir

Table 10.2-2: Illustrative Example Tabular Comparison of Monthly Reservoir Water Surface Elevations

		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	399	396	400	399	0
	July	398	394	400	398	0
	August	397	392	400	397	0
	September	396	390	400	397	1
Shutdown Period	October	395	388	400	396	1
	November	395	387	400	396	1
	December	396	385	400	397	1
	January	396	386	400	398	2
	February	397	386	400	398	1
	March	398	386	400	399	1
	April	399	388	401	400	1
	May	399	391	400	400	1

Table 10.2-3: Summary Results of the Hydrologic Evaluation for WSSO

System	Waterbody	Projected Change during WSSO
Delaware	Cannonsville Reservoir	No change from typical range
	Pepacton Reservoir	No change from typical range
	Neversink Reservoir	No change from typical range
	Rondout Reservoir	Increased releases due to siphons, reduced reservoir elevation, particularly in fall of temporary shutdown but within range of historical drawdown events
Catskill	Schoharie Reservoir	No change from typical range
	Shandaken Tunnel[1]	No change from typical range
	Ashokan Reservoir	Reduced releases due to exception from Interim Ashokan Release Protocol during RWBT shutdown (community releases would continue), overall flow downstream within typical range
Croton	Boyd's Corners Reservoir	No change from typical range
	West Branch Reservoir[2]	Reduced releases due to minimum release variance in October through May of the temporary shutdown
	Croton Falls Reservoir	No change from typical range
	Cross River Reservoir	No change from typical range
	Bog Brook Reservoir	Increased releases, reduced spills; overall flow downstream within typical range, sustained reservoir drawdown more than typical but within range of historical drawdown events
	East Branch Reservoir	Increased releases, reduced spills; overall flow downstream within typical range, sustained reservoir drawdown more than typical but within range of historical drawdown events
	Middle Branch Reservoir[3]	No change from typical range
	Amawalk Reservoir	No change from typical range
	Titicus Reservoir	No change from typical range
	Croton Falls Diverting Reservoir	No change from typical range
	Muscoot Reservoir[3]	No change from typical range
	New Croton Reservoir	Reduced releases due to minimum release variance in April and May of temporary shutdown, slight reservoir drawdown outside of typical range in spring of the temporary shutdown
	Kensico Reservoir[4]	No change from typical range

Notes:

1 Shandaken Tunnel is a diversion structure between Schoharie Reservoir and Esopus Creek. There are no spills or water surface elevations associated with this structure.

2 The OST models spill from West Branch Reservoir; however, it does not occur during simulations due to operations rules that manage storage to prevent spills

3 Middle Branch and Muscoot reservoirs spill and release directly to their respective downstream reservoirs. Therefore, spills and releases are not evaluated for these reservoirs.

4 Kensico Reservoir elevations are managed such that it does not spill, and releases are not required.

Legend

- (green) WSSO dataset mean is within the typical range
- (orange) WSSO dataset mean is outside the typical range

10.2.2 HYDRAULIC ANALYSIS

Based on results of the hydrologic evaluation described above, waterbodies that were identified as having a high potential for substantially different flows during WSSO as compared to typical operations were modeled to assess potential changes to water surface elevations and velocities from modified stream flows. As warranted to further investigate the potential for impacts along receiving waterbodies from releases and spills from DEP reservoirs during the temporary shutdown, a Hydrologic Engineering Center - River Analysis System (HEC-RAS) model was developed to approximate the hydraulic response to anticipated flows. The model is distributed by the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center and is widely used for hydraulic analyses and flood assessments for conveyances ranging from small swales and creeks to large river systems.

Stream channel information for the HEC-RAS modeling was based on surveyed cross sections collected along the stream length that provided horizontal and vertical information about the stream channel, bed, and banks. Cross section data were supplemented with Light Detecting and Ranging (LiDAR) data, and the changes in stream flows (increases and decreases from typical operations) were modeled using the HEC-RAS program to identify corresponding water surface elevations, extents and velocities that could occur as a result of WSSO.

10.2.3 IMPACT ANALYSIS METHODOLOGY

This section describes the impact analysis methodology for each analysis impact category that was applied to the study areas identified as requiring further assessment. Analyses were conducted to evaluate whether WSSO would have the potential for impacts within each of the assessment categories from changes to reservoir elevations or flows downstream of reservoirs. The potential for impacts was also evaluated from siphon construction at Rondout Reservoir, additional alum deliveries to the Pleasantville Alum Plant, and the associated potential increase in floc accumulation in Kensico Reservoir from alum treatment of Catskill Aqueduct water. For this section, increased deliveries of alum and alum floc accumulation are collectively referred to as increased alum treatment during WSSO.

As part of the impact analyses, baseline conditions applicable to each impact category were established by compiling data obtained from a review of desktop information (e.g., hydrologic data, system modeling, maps, plans, aerial imagery, ArcGIS layers), as well as observations made during field assessments conducted between late 2012 and early 2015. Future conditions of each impact category with and without WSSO were evaluated for the three analysis phases, the pre-shutdown phase of WSSO (starting in June 2022), the temporary shutdown phase (starting in October 2022 and continuing through May 2023) and the post-temporary shutdown or recovery phase, beginning in May 2023, and conservatively extending 2 years after the temporary shutdown phase to ensure rebalancing of the water supply system is adequately captured. Future conditions without WSSO were based on typical operations during the same time periods. The potential for significant adverse impacts for each applicable impact category was determined by comparing future conditions with and without WSSO for each impact category.

Assessments were not required for all impact categories. For all study areas, a shadows analysis was not conducted because WSSO would not result in new structures or additions to existing structures greater than 50 feet tall or be located adjacent to, or across from, a sunlight-sensitive resource. Similarly, a solid waste and sanitation services assessment is not applicable because WSSO would not result in the generation of 50 tons per week or more of solid waste. In addition, a greenhouse gas emissions and climate change analysis is not applicable because WSSO would not result in any significant generation of greenhouse gases and, therefore, would not warrant a climate change related analysis. The remaining impact categories for each study area are evaluated in the respective impact analysis sections.

In addition to the impact analyses for WSSO provided below, the potential for WSSO to result in significant adverse impacts is included as part of a cumulative assessment for Upstate Water Supply Resiliency. The cumulative assessment addresses socioeconomic conditions, energy, greenhouse gas emissions and climate change, and public health for Upstate Water Supply Resiliency and is provided in Chapter 12 of this DEIS.

The impact analysis is organized to present the Delaware System first, because it would be taken offline at the start of WSSO, followed by the Catskill and then Croton Systems.

The following sections describe the impact analysis methodologies for each impact category.

10.2.3.1 Land Use, Zoning, and Public Policy

The land use, zoning, and public policy assessment consisted of evaluating the potential for WSSO to result in direct effects to and indirect effects resulting from non-compatible conditions with existing land use and zoning, or conflict with public policies within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and from increased alum treatment at the Pleasantville Alum Plant.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing land uses, zoning districts and relevant public policies, including adopted State, county, neighborhood, and community plans; (2) establishing future conditions without WSSO by identifying anticipated updates to land use, zoning, and public policies planned and programmed for implementation within the study area by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO by evaluating whether the proposed project would result in direct or indirect displacement or alteration of land uses or zoning districts or if the proposed project would potentially be non-compatible with applicable public policies.

10.2.3.2 Socioeconomic Conditions

The socioeconomic assessment consisted of evaluating the potential for WSSO to result in direct or indirect effects to factors that influence the socioeconomic conditions or character of the study areas, including land use, population, housing, and economic activity, from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing socioeconomic conditions and trends in the study areas; (2) establishing future conditions without WSSO by identifying anticipated changes to socioeconomic conditions planned and programmed for implementation within the study area by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO by evaluating whether WSSO would result in significant impacts due to: (a) direct residential displacement; (b) direct business displacement; (c) indirect residential displacement; (d) indirect business displacement; and (e) adverse effects on a specific industry.

10.2.3.3 Community Facilities and Services

The community facilities and services assessment consisted of evaluating the potential for WSSO to result in changes to community facilities and services within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could physically displace or alter community facilities and services within the study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying the local community facilities and services; (2) establishing future conditions without WSSO by identifying anticipated changes to community facilities and services planned and programmed for implementation within the study area that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to those community facilities and services due to the physical displacement or alteration of land occupied by a community facility or service, increase demands on community facilities and services, or disruption of operations of the community facility or services.

10.2.3.4 Open Space and Recreation

The open space and recreation assessment consisted of evaluating the potential for WSSO to result in changes to open space and recreation within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter the quality or availability of open spaces for continued public and private recreational uses within the study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by mapping existing uses of open space and recreational resources adjacent to each waterbody, including those identified in local open space plans; (2) establishing future conditions without WSSO by identifying plans to expand or create new open space or recreational resources within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential impacts from WSSO to open space and recreational resources by evaluating if the proposed project would potentially restrict public access to or displace open spaces and recreational resources.

10.2.3.5 Historic and Cultural Resources

The historic and cultural resources assessment consisted of evaluating the potential for WSSO to result in changes to historic and cultural resources within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter the integrity of historic and cultural resources.

The historic and cultural resources assessments were conducted in accordance with the New York State Historic Preservation Act (SHPA) of 1980, as set forth in Section 14.09 of the New York State Parks, Recreation, and Historic Preservation Law. The assessments have also been prepared in accordance with Section 106 of the National Historic Preservation Act of 1966 (NHPA). These laws require that state and federal agencies, respectively, consider the effects of their actions on any properties listed on or determined eligible for listing on the National and State Registers of Historic Places (N/SR).

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) describing existing historic and cultural resources; (2) establishing and describing the baseline conditions within the applicable study area by identifying previous disturbance areas and activities; (3) establishing future conditions without WSSO by identifying whether any changes to existing historic or potential archeological resources are likely to occur by the analysis year; (4) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (5) analyzing the potential impacts from WSSO to historic and cultural resources by evaluating if the potential changes from construction or operation activities, or reservoir elevations and flows downstream of reservoirs would potentially disturb or alter the integrity of historic and cultural resources.

10.2.3.6 Critical Environmental Areas

The critical environmental area assessment consisted of identifying the potential for WSSO to result in changes to Critical Environmental Areas (CEAs) within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could affect the exceptional or unique character of CEAs within the surrounding study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by mapping existing CEAs; (2) establishing future conditions without WSSO by identifying anticipated changes to CEAs planned and programmed for implementation within the study area by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to CEAs by evaluating if the potential changes from construction or operation activities, or reservoir elevations and flows downstream of reservoirs would affect the exceptional or unique character of CEAs within the surrounding study areas.

10.2.3.7 Visual Resources

The visual resources assessment consisted of identifying the potential for WSSO to result in changes to views to or from visual resources or within view corridors with aesthetic value within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could would alter views of the waterbodies within the surrounding study areas. The potential effects to nearby sensitive resources due to nighttime lighting were also assessed.

NYSDEC provides a list of 15 categories of State aesthetic and visual resources that should be included in an evaluation of the potential for impacts to visual resources. Local resources are also considered in this analysis, such as parks, historic structures, and landmarks, and the Hudson River as an American Heritage River. American Heritage Rivers are designated by federal Executive Order 13061 to protect natural resources and the environment, support economic revitalization, and to preserve historic and cultural resources.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by determining existing visual conditions of the waterbodies within the study areas, including turbidity and exposed shoreline during typical conditions; (2) establishing future conditions without WSSO by identifying proposed projects that would alter views within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential impacts from WSSO to visual resources through a qualitative determination of the effect to the aesthetic views of the waterbodies within the study area due to construction or operation activities, or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations based on the potential for increased exposed shoreline.

10.2.3.8 Natural Resources

The natural resources assessment consisted of identifying the potential for WSSO to result in changes to natural resources from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter a variety of natural resource types within the surrounding study areas.

The sections below provide details on impact analysis methodologies for each natural resources subcategory that were evaluated, as applicable, based on predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area.

Geology and Soils

This section presents the methodology for the analysis of the potential for WSSO to result in a disturbance to geology and soils within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, or construction and operation of siphons at Rondout Reservoir that could cause erosion of, instability of, or composition changes to geology and soils within the study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by performing a review of soils data from the USGS Mineral Resources Program's online spatial data of New York Soils, United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS) Web Soil Survey, and published soil surveys for the counties in which the study areas are located; (2) establishing future conditions without WSSO by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential from WSSO for impacts to geology and soils.

For those waterbodies that would experience substantially higher than typical flows with WSSO that could possibly result in erosion, additional geomorphic analyses were conducted. The geomorphic assessment was completed using a combination of hydrologic analysis, field reconnaissance surveys, geomorphic surveys, and HEC-RAS hydraulic modeling to compare existing geomorphic and historical hydrologic conditions to anticipated hydrologic conditions during the RWBT temporary shutdown. The assessment assumed that geomorphic conditions in 2015 would be representative of conditions at the waterbody during the temporary shutdown planned for 2022 through 2023. The assessment approach was as follows:

(a) Review the historical reservoir spill frequency and duration data to estimate the return interval of the effective discharge;[19]

[19] The effective discharge is often considered an index that describes the streamflow responsible for carrying the most sediment over time and forming the geometry of the channel.

(b) Identify and conduct a field survey of representative reaches of the receiving waterbody that would be expected to receive sustained flows greater than the mean daily flow;

(c) Use the field survey data to estimate the shear stress and largest moveable particle size resulting from the historical effective discharge; and

(d) Compare results from (c) to the shear stress and largest moveable particle size predicted by the HEC-RAS model for the anticipated reservoir release flow to the receiving waterbody during the RWBT temporary shutdown.

Field surveys of streams consisted of reach identification, Bank Assessment for Non-point Source Consequences of Sediment (BANCS) and Pfankuch assessments, identification of low-lying vegetated areas for vegetation monitoring, recorded observable vegetation species in low-lying areas, photograph documentation of depositional areas and structures potentially impacted by future release flows (e.g., beaver dams), pebble counts of active riffles, collection of bar/pavement/sub pavement samples, and completion of reach profile and riffle cross section surveys for evaluation reaches along the stream.[20]

For each evaluation reach, a representative riffle was selected for surveying within a minimum 800-foot longitudinal profile. At the selected riffle, the intermediate axis or protrusion height of 100 particles was measured. The evaluation reach was visually assessed for point bars and mid-channel bars, and representative locations were selected where possible. In the absence of bars, pavement/sub-pavement samples were collected near the representative active riffle. The cross section and profile surveys were completed using differential leveling to record the elevations of the channel bottom, water surface, field indicators of effective discharge, and mid-channel bar features. The field procedures for data collection followed the River Stability Field Guide by (Rosgen 2008). Field survey data were entered in RIVERMorph® software in the field, which was used for quality control checks and adjustments in the field.[21] Measurement equipment consisted of hand-held GPS equipment with sub-meter accuracy to record the locations of longitudinal profile start/end points, cross section pins, bar and pebble samples, beaver dams, and photograph locations.

Following completion of the field survey, the pebble and bar sample data were entered into RIVERMorph®, and surveyed indicators of effective discharge were checked for consistency between the riffle cross section and the longitudinal profile. Velocity, discharge, Near Bank Stress, and Bank Erosion Hazard Index estimates were completed for the effective discharge based on the observed indicators. Sediment entrainment calculations were completed using RIVERMorph®, following procedures outlined in the River Stability Field Guide (Rosgen 2008).

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20 BANCS and Pfankuch are two assessments methods to estimate the stability of stream banks and their susceptibility to erosion.

21 RIVERMorph® is a software package designed to support river assessment and restoration, and includes tools for stream classification, survey data reduction, discharge analyses, channel stability analyses, bank erosion prediction, natural channel design, and regime equations, among other capabilities.

The results of the BANCS and Pfankuch assessments were used to perform a qualitative assessment of the potential for impacts from flows that would be anticipated during the temporary shutdown. Bank stability was completed for select banks by comparing study banks with higher Bank Erosion Hazard Index and near bank stress scores to observed stable banks with low scores. In order to estimate the maximum moveable particle size that could occur during the RWBT shutdown release flows, the HEC-RAS model that was developed for Rondout Creek was used to predict shear stress and maximum moveable particle size, following the procedures outlined in the River Stability Field Guide (Rosgen 2008).

Terrestrial Resources

This section presents the methodology for the analysis of the potential for WSSO to disturb terrestrial resources within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, or construction and operation of siphons at Rondout Reservoir that could cause disturbance to ecological communities and wildlife within the surrounding study areas. All assessments with the exception of Rondout Creek Downstream of Rondout Reservoir Study Area were conducted using desktop assessment. Field surveys at the Rondout Creek Downstream of Rondout Reservoir Study Area were conducted as described in the Geology and Soils in Section 10.2.3.8, “Natural Resources.”

Ecological Communities

Ecological and terrestrial communities were identified to the greatest extent practicable using aerial imagery, topographic maps, the Nature Conservancy’s Northeast Terrestrial Habitat Map (Ferree and Anderson 2013), and New York Natural Heritage Program (NYNHP) consultation results. The Nature Conservancy’s Northeast Terrestrial Habitat Map was used in lieu of Edinger et al. 2014 for WSSO study areas due to its ability to identify detailed ecological communities when considering a large landscape scale. Where field studies were conducted, ecological communities were identified in accordance with Edinger et al. 2014. Ecological communities are defined as variable assemblages of interacting plant and animal populations that share a common environment. Terrestrial cultural communities are defined by Edinger as communities that are created or modified and subsequently maintained by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community, is substantially different than before it was modified by humans (Edinger et al. 2014). The Nature Conservancy’s Northeast Terrestrial Habitat Map (Ferree and Anderson 2013) was used to identify ecological communities present in undeveloped portions of the study areas. This tool is a northeast region-wide ecological community mapping and modeling effort based on numerous datasets from State and federal governments as well as State Natural Heritage programs. This tool was utilized due to the large size of the WSSO study areas. The definitions for ecological community types in the Northeast Terrestrial Habitat Map are not the same as Edinger et al. 2014. The ecological community definitions for the Northeast Terrestrial Habitat Map tool are taken from “The Northeastern Terrestrial Habitat Classification System” (Gawler 2008) and were developed by NatureServe and accepted by participating states.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) describing baseline conditions of ecological communities based on ArcGIS data, topographic maps, the Nature Conservancy's Northeast Terrestrial Habitat Map (Ferree and Anderson 2013), and NYNHP database consultation and observations of ecological habitat during site surveys (field surveys were conducted for those areas where the hydrologic analysis and desktop assessment of ecological communities indicated a reasonable potential for impacts, specifically the Rondout Creek Downstream of Rondout Reservoir Study Area); (2) establishing future conditions without WSSO due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to significant natural communities.

Potential effects to ecological systems present in each study area are discussed in the impact analysis for the relevant study area.

Wildlife

The wildlife assessment for each study area consisted of identifying the terrestrial wildlife that has the potential to occur in each study area and estimating any changes that could occur directly to wildlife or terrestrial habitat used by wildlife as a result of the anticipated WSSO conditions in each reservoir and watercourse.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) describing baseline conditions of wildlife based on ArcGIS data, topographic maps, the 2000-2005 New York State Breeding Bird Atlas, the New York State Amphibian and Reptile Atlas Project, and the NYSDEC Nature Explorer (field surveys were conducted for those areas where the hydrologic analysis and desktop assessment of ecological communities indicated a reasonable potential for impacts); (2) establishing future conditions without WSSO due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO by evaluating whether the proposed project would potentially cause a disturbance to wildlife within the surrounding areas.

Databases mentioned above were consulted to identify common and protected wildlife that has the potential to occur within the study areas.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare and Vulnerable Species

This section presents the methodology for the analysis of the potential for WSSO to disturb federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species or their habitat within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, or increased alum treatment during WSSO. Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species within the study areas were identified in consultation with U.S. Fish and Wildlife Service (USFWS), NYNHP, and NYSDEC. In addition, the Westchester County Endangered Species List (updated 2005), maintained by the Westchester County Department of Parks and Conservation was reviewed. DEP coordinated with these agencies as well as county and local offices, as applicable, to determine whether further on-site analyses would be necessary for the study areas. ArcGIS data was also used to identify broad habitat characteristics of the study areas.

Based on consultations with the above-noted agencies, federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species were reported as occurring within or adjacent to the study areas. Specifically, NYNHP provided results from their consultation that identified the species and/or habitats with State, heritage and global rankings based on species rarity, population trends, and threats, along with other information related to the species. NYSDEC Central and Regional offices provided additional information on species, locations, and habitat occurrences in accordance with USFWS protocol.

USFWS was consulted, in accordance with the Endangered Species Act of 1973 and Fish and Wildlife Coordination Act of 1934, and provided an online report of any federally listed Threatened, Endangered, and Candidate Species, or species proposed for listing known to exist within the study area counties. In addition to data provided by these sources, local and county legislation related to endangered, threatened, and species of special concern was reviewed and species lists compared with federal and State species information to ensure relevant flora and fauna were identified. Species provided protection under the Migratory Bird Treaty Act of 1918 (MBTA), and other protective legislation such as the Bald and Golden Eagle Protection Act (BGPA), were evaluated, if documented to occur within the study area. The assessments for federal threatened and endangered species determines whether the proposed project activities have the potential to affect or result in a take of a species. Where there is a federal nexus with the project, species are assessed under Section 7 of the Endangered Species Act. Under Section 7, a project's impacts to protected species are designated as one of the following: "no effect," "may affect, but is not likely to adversely affect," and "may affect, and is likely to adversely affect." A finding of "no effect" means there will be no impacts, positive or negative, to protected resources. A finding of "may affect, but is not likely to adversely affect" means that project impacts will either be beneficial, not measurable or undetectable, or otherwise unable to be evaluated. A finding of "may affect, and is likely to adversely affect" means protective resources are likely to be exposed to the project action or environmental consequences and will respond negatively. Under Section 10 of the Endangered Species Act, projects are evaluated on their potential to result in "take" to a protected resource. Take is defined in the Endangered Species Act as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" and "harm" includes actions that result in impacts to habitat.

The assessment of the federal and State listed species identified as potentially occurring in the WSSO study areas consisted of estimating any temporary, indirect, or direct effects to the habitat or natural history of the species based on anticipated WSSO conditions in each reservoir and watercourse. Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) mapping and describing baseline conditions of potential habitat for significant natural communities based on ArcGIS data, consultations with the above-noted agencies, and observations of species habitat during site surveys (field surveys were conducted for those areas where the hydrologic analysis and desktop assessment of threatened and endangered species indicated a reasonable potential for impacts, specifically the Rondout Creek Downstream of Rondout Reservoir Study Area); (2) establishing future conditions without WSSO due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to identified species by evaluating if construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs would potentially cause a disturbance to those species within the surrounding areas. Overall, no take to any federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, or unlisted rare and vulnerable species is anticipated.

Aquatic and Benthic Resources

This section presents the methodology for the analysis of the potential for WSSO to result in a disturbance to aquatic and benthic resources within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could cause direct or indirect effects to aquatic and benthic resources that would potentially be present within water resources, specifically surface water and/or wetlands, identified within the study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) mapping and describing baseline conditions of potential habitat for significant natural communities based on identifying existing aquatic communities in the reservoirs and streams from desktop assessment and NYSDEC reports; (2) establishing future conditions without WSSO due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to species identified to have the potential to be affected by WSSO by estimating changes in the physical habitats in the reservoirs and streams based on modeling data and basic information on the ecology of fishes in fluctuating reservoirs and tailwater streams.

The assessment also includes the evaluation of the potential for impacts to aquatic resources from construction and operation of siphons at Merriman Dam, and the potential for impacts from the additional alum treatment during WSSO and subsequent accumulation of alum floc that would occur in the northwest corner of Kensico Reservoir.

To assess the potential for impacts to benthic organisms from increased deposition of alum in Kensico Reservoir, sediment grab and vibracore samples were obtained at 36 sampling stations in the area of the Catskill Aqueduct at the Catskill Influent Chamber cove during November 2014. At each station, sediment samples were collected from three distinct strata: (1) the top 0.5 foot of sediment or the potential alum floc layer; (2) the compacted alum floc/sediment layer; and (3) the pre-flocculant or native sediment layer. Each of the sampled strata were analyzed for total aluminum, dissolved aluminum in the sediment pore water, percent moisture, percent organic carbon, percent solids, and grain size analysis.

A hydrographic survey of the bathymetry in the area of historical alum deposition was conducted. The hydrographic survey was designed to meet or exceed survey standards promulgated by the U.S. Army Corps of Engineers (USACE 2013). Background imagery, including georeferenced orthophotographs and polygons representing survey boundaries, were evaluated to guide the survey design. The single beam bathymetric survey-transect spacing was 25 feet on-center and survey lines were oriented parallel to the longitudinal axis of the Catskill Aqueduct at the Catskill Influent Chamber CATIC cove; and, in the reservoir, survey lines were oriented roughly parallel to the shoreline. Additional perpendicular “cross-tie” lines spaced 250 feet apart were provided for overlapping data points that allowed for statistical assessment of the bathymetric data quality.

Benthos were sampled in the northwest corner of Kensico Reservoir at a total of 23 locations in areas with previous alum deposition and adjacent areas outside of the zone of deposition. Benthos were sampled with a petite ponar grab sampler in accordance with NYSDEC benthic sampling protocol for lakes and reservoirs (NYSDEC 2014). Two benthic macroinvertebrate grab samples were collected and composited for each location. A third grab sample was collected for the analysis of sediment grain size, percent moisture, percent solids, and percent organic matter. Data from the 2014 survey were summarized using the same benthic community metrics per NYSDEC (2014) as prior surveys for comparison. These metrics included Number of Taxa, Abundance, Shannon Diversity, Hilsenhoff’s Biotic Index, Dominance 3, Non-Chironomid and Oligochaete (NCO) Richness, Percent Chironomid, and Number of Diptera Taxa. An underwater video survey of the reservoir bottom was also conducted at each of the 23 sampling locations to provide additional observations of the physical conditions at each benthic sampling location.

Results from the sampling were used with the OST model to estimate the potential areal extent and depth of alum floc deposition from additional alum treatment during the temporary shutdown (see Section 10.4.6, “Kensico Reservoir Study Area Impact Analysis”). The OST includes a trigger for alum addition that uses predicted turbidity in the Catskill Aqueduct to determine when aluminum sulfate would be added to reduce turbidity entering Kensico Reservoir. Deposition is based on model calculations of flow velocity and settling velocity based on three particle size classes for influent turbidity.

Water Resources

This section presents the methodology for the analysis of the potential for WSSO to result in a disturbance to water resources within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could cause disturbance to surface water, floodplains, groundwater, and wetlands within the surrounding study areas.

Surface Water

Where applicable, based on construction, the impact analysis consisted of: (1) conducting a desktop mapping of surface water bodies within the study areas; (2) quantifying temporary and permanent disturbance to surface water from construction; and (3) estimating surface water flows under typical conditions and during WSSO. Because of the unique nature of WSSO, changes to hydrology from RWBT temporary shutdown for individual waterbodies were assessed as part of the hydrologic evaluation described previously (see Section 10.2.1, “Hydrologic Evaluation”).

Floodplains

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) identifying specific work activities that could occur within designated flood zones; (2) identifying changes from WSSO that could impact conveyance capacity; and (3) identifying the need for hydraulic analyses to quantify changes in water surface elevations or flow velocities during WSSO. Because of the unique nature of WSSO, changes to stream hydraulics from the temporary shutdown were assessed for individual waterbodies as part of the hydrologic evaluation previously described.

Wetlands

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) mapping and describing baseline conditions of previously identified wetlands; (2) establishing future conditions without WSSO due to natural processes and by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts on wetlands from WSSO compared to typical operations.

Wetlands potentially occurring within the study areas were identified through a desktop evaluation of NYSDEC freshwater wetlands maps and USFWS National Wetland Inventory (NWI) maps. The NYSDEC maps depict the approximate location of the wetland boundary as well as a wetland buffer area of 100 feet that extends into the upland from the mapped wetland boundary. NYSDEC freshwater wetland maps are based on aerial photography, soil surveys, elevation data, other wetland inventories, and sometimes field verification, while NWI maps are based on aerial photography, supplemented by published soil survey maps and USGS topographic maps. NYSDEC typically does not regulate (or map) wetlands smaller than 12.4 acres, unless it is deemed to be of unusual local importance, whereas all wetlands that USFWS NWI maps are larger than 0.5 acre and some smaller if easily detected with remote sensing. USFWS NWI classifies wetlands as either palustrine, lacustrine, riverine, or estuarine/marine deepwater (Cowardin et al. 1979). Lacustrine, riverine, and estuarine/marine deepwater wetlands were considered surface water for this assessment. USFWS NWI maps are not ground-truthed and therefore some wetlands are more difficult to detect via remote sensing such as forested wetlands and wetlands with typically drier hydrology. Vernal pools have not been analyzed because they are primarily hydrologically fed by surface water runoff and would not be hydrologically connected to the reservoirs or downstream watercourses. Vernal pools are not mapped and there are no desktop assessment tools currently available that would allow for the analysis of vernal pools.

Groundwater

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) mapping and describing baseline and future regional groundwater conditions without WSSO based on a review of published reports by the USGS and local groundwater utilities; (2) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (3) analyzing the potential for impacts on groundwater resources from WSSO due to hydrologic changes compared to typical operations.

10.2.3.9 Hazardous Materials

The hazardous materials assessment consisted of identifying the potential for WSSO to result in changes in exposure to hazardous materials within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could increase pathways to human or environmental exposure.[22] WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals).

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing future conditions with WSSO by determining the potential for WSSO to inundate, erode, or otherwise disturb the existing ground surface; (2) if inundation, erosion, or disturbance was found to exist, establishing and describing baseline conditions and future conditions without WSSO by identifying the presence of legacy contamination located adjacent to each waterbody based on a desktop assessment of State and federal environmental databases listed below; and (3) analyzing the potential for impacts from WSSO to result in changes in exposure to hazardous materials within the surrounding study area.

The potential for hazardous material impacts was assessed using the following environmental databases:

- Federal Databases and Records
    - The National Priority List (NPL) database
    - The Resource Conservation and Recovery Act Information System (RCRIS) database
    - The Resource Conservation and Recovery Act Generator (RCRAGN) database
    - Environmental Justice Screening and Mapping Tool
- New York State Databases and Records

[22] The one construction project, installation of siphons at Rondout Reservoir, would result in minimal land disturbance.

- Environmental Remediation Databases
- The Spill Incident database
- Environmental Site Remediation database
  - State Superfund Sites
  - Brownfield Cleanup
  - Environmental Restoration
  - Voluntary Cleanup
  - Inactive Hazardous Waste Disposal Sites Registry
  - Institutional and Engineering Control
- Bulk Storage Program Database – (Underground Storage Tank [UST] and Aboveground Storage Tank [AST])
  - Petroleum Bulk Storage
  - Chemical Bulk Storage
  - Oil Storage Facility listings
- Landfill - Solid Waste Management Facilities Map

10.2.3.10 Water and Sewer Infrastructure

The water and sewer infrastructure assessment consisted of identifying the potential for WSSO to result in changes to conveyance and demand for water and sewer infrastructure including municipal drinking water intakes, sewer discharges, drinking water wells, and septic systems due to the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying and mapping the existing municipal drinking water intakes or sewer discharges, including wells and septic systems, at each waterbody based on Federal, State, and local databases of these resources within the study areas; (2) establishing future conditions without WSSO by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on construction or operation activities, and the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for WSSO to impact water and sewer infrastructure by determining whether increased flows and corresponding water surface elevations within the waterbody could potentially impact any drinking water wells or septic systems within the study area.

10.2.3.11 Energy

The energy assessment consisted of identifying the potential for WSSO to result in changes to energy generation or demands within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter energy demand or distribution within the surrounding study area.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing hydroelectric facilities in the study area; (2) establishing future conditions without WSSO by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO by estimating the total change in energy generation as a result of construction or operation activities, or the potential changes in reservoir elevations and flows downstream of reservoirs; and (4) analyzing the potential for impacts from WSSO to energy by determining whether these changes would have the potential to impact regional availability of electricity.

10.2.3.12 Transportation

The transportation assessment consisted of identifying the potential for WSSO to result in changes to transportation within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter traffic flow, volume, or parking within the surrounding study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, a transportation impact analysis was conducted. The transportation impact analysis takes into account such factors as location, extent, and intensity of construction activities.

The impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing traffic conditions, public transportation and pedestrian activity in the immediate vicinity of the Merriman Dam and the Pleasantville Alum Plant; (2) establishing future conditions without WSSO by identifying proposed projects that would result in changes in land use or increases in traffic within the study areas that are anticipated to be completed by the analysis year; (3) establishing the future conditions with WSSO based on the temporal distribution of the proposed construction vehicles within the Rondout Reservoir Study Area and the additional alum deliveries to the Pleasantville Alum Plant; (4) determining the peak hour vehicle trips (including transportation passenger car equivalents [PCEs] for inbound and outbound trips) that would temporarily be generated by WSSO within these study areas; (5) for the proposed construction vehicles within the Rondout Reservoir Study Area, analyzing the potential for construction impacts from WSSO based on the estimated number of vehicles that would be temporarily generated and the duration of the activity; (6) for the additional alum deliveries to the Pleasantville Alum Plant Study Area, determining if the operational project-generated traffic within the study area would be above the

CEQR screening threshold of 50 peak hour vehicle trip ends, and would, therefore, require a traffic analysis; and (7) if an operational traffic analysis is warranted, analyzing the potential for impacts from WSSO by performing a traffic analysis using the Synchro Version 8. The analysis considered the extent and duration of increases in vehicle trips from workers and equipment; street, roadway, or sidewalk closures; potential for impacts on the parking supply; and losses in other transportation services during WSSO within the study areas.

10.2.3.13 Air Quality

The air quality assessment consisted of evaluating the potential for WSSO to result in changes to air quality within the study areas from the potential changes in reservoir elevations and flows downstream of reservoirs that could result in objectionable odors within the surrounding study areas. In addition, the air quality assessment included evaluating the potential for changes to air quality within the study areas from construction of the siphons at Rondout Reservoir, or increased alum treatment during WSSO that could generate air quality emissions from stationary and/or mobile sources.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions and future conditions without WSSO within the applicable study area by determining existing exposed shoreline during typical conditions; (2) establishing future conditions with WSSO based on the potential changes in reservoir elevations and flows downstream of reservoirs; and (3) analyzing the potential for impacts from WSSO to air quality through a qualitative determination of the anticipated objectionable odors as a result of decaying organic material resulting from an increase in exposed shoreline based on the predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations.

In addition, the impact analysis for the Rondout Reservoir and Pleasantville Alum Plant Study Areas included: (1) establishing and describing the baseline conditions within each study area by identifying the existing local ambient air quality in the study areas using the monitoring station(s) nearest to the immediate vicinity of the Merriman Dam and the Pleasantville Alum Plant based on the NYSDEC's EPA-approved air monitoring network; and (2) establishing future conditions without WSSO by identifying proposed projects within the study areas that are anticipated to be completed by the analysis year; (3) establishing the future conditions with WSSO based on the proposed activities within the Rondout Reservoir Study Area and the additional alum operations within the Pleasantville Alum Plant Study Area; and (4) analyzing the potential for impacts from WSSO by determining if the project would generate air quality emissions from stationary and/or mobile sources.

10.2.3.14 Noise

The noise assessment consisted of identifying the potential for WSSO to result in impacts to sensitive receptors from noise within the study areas associated with construction or operations of the siphons at Rondout Reservoir, or increased alum treatment during WSSO that could generate noise emissions from stationary and/or mobile sources.

Stationary Noise

A stationary noise screening assessment was conducted to determine if there were noise-sensitive receptors within 1,500 feet of stationary noise sources to be used for the siphon activities over Merriman Dam within the Rondout Reservoir Study Area. The stationary noise construction analysis accounts for such factors as location of the work activities in relation to noise-sensitive receptors and magnitude and intensity of work activities. Therefore, if noise-sensitive receptors were determined to be located within 1,500 feet, a stationary noise impact analysis was conducted using the methodology described below.

A stationary noise screening assessment was also conducted to determine if there were noise-sensitive receptors within 1,500 feet of the Pleasantville Alum Plant Study Area. If noise-sensitive receptors were determined to be located within 1,500 feet, a stationary noise impact analysis was conducted using the methodology described below.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing noise levels and sources in the immediate vicinity of the Merriman Dam and the Pleasantville Alum Plant Study Area; (2) establishing future conditions without WSSO by identifying proposed projects that would result in a change in land use, or new noise-generating sources that would contribute to an increase in ambient noise levels within the study areas that are anticipated to be completed by the analysis year; (3) establishing the future conditions with WSSO based on noise levels that would be received from construction equipment to be used at Merriman Dam, operation of temporary siphons at Merriman Dam, and operational equipment to be used at the Pleasantville Alum Plant Study Area; (4) analyzing the potential for impacts from WSSO by determining if noise levels that would be emitted from construction equipment to be used at Merriman Dam, operation of temporary siphons at Merriman Dam, and operational equipment to be used at the Pleasantville Alum Plant Study Area would comply with local ordinances and *CEQR Technical Manual* guidance.

Existing noise levels within the study areas were developed using typical noise levels for residential land uses obtained from American National Standards Institute/Acoustical Society of America S12.9 Part 3 (2013) and are summarized in **Table 10.2-4**. The existing noise levels selected for the study areas varied by site based on proximity to major transportation corridors, population density of the areas, and other noise-producing elements.

Reference equipment noise levels and usage factors for the impact analyses were obtained from the *CEQR Technical Manual*. Spreadsheet calculations were performed to estimate stationary noise levels at the property line or the nearest noise-sensitive receptors, as applicable. The equipment that would be used during the primary construction phases was included in the calculations for each study area and the usage factor applied was based on peak construction operating condition. The equipment was conservatively assumed to be located in close proximity to each other at the center of the site. The reference noise levels were adjusted to the appropriate distance assuming free field conditions with attenuation from existing dense tree zones, if applicable. The amount of tree zone attenuation was based on methods from the Federal Transit

Table 10.2-4: Typical Daytime and Nighttime Noise Levels (L_{eq}) for Residential Land Use Categories

Residential Land Use Category	Daytime Noise Levels (dBA)	Nighttime Noise Levels (dBA)
Very noisy urban residential	66	58
Noisy urban residential	61	54
Urban and noisy suburban residential	55	49
Quiet urban and normal suburban residential	50	44
Quiet suburban residential	45	39
Very quiet suburban and rural residential	40	34

Notes:
L_{eq} = equivalent noise level
dBA = A-weighted decibels
Source: American National Standards Institute/Acoustical Society of America S12.9 Part 3 (2013).

Administration's *Transit Noise and Vibration Impact Assessment*, dated May 2006. ArcGIS was used to determine the distance between the study area construction sites and the nearest noise receptors.

If the estimated noise levels were predicted to exceed local noise code requirements, or if construction activities would occur during time periods prohibited by local noise codes, DEP would work with the Towns or Villages, as appropriate.

Mobile Noise

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, a mobile noise impact analysis was conducted. The mobile noise construction analysis accounts for such factors as location of the work activities in relation to noise-sensitive receptors and magnitude and intensity of work activities.

The impact analysis consisted of: (1) establishing the temporal distribution of the proposed construction vehicles within the Rondout Reservoir Study Area and the additional alum deliveries to the Pleasantville Alum Plant Study Area for WSSO based on the proposed activities within the study areas; (2) determining the peak hour vehicle trips (inbound and outbound) that would temporarily be generated by WSSO within these study areas; (3) determining the peak hour noise Passenger Car Equivalents (PCEs) that would temporarily be generated by WSSO within these study areas (noise PCE factors were obtained from the *CEQR Technical Manual*); (4) analyzing the potential for construction impacts from WSSO based on the estimated number of vehicles and noise PCEs that would be temporarily generated and the duration of the activity for the proposed construction vehicles within the Rondout Reservoir Study Area; (5) determining if the operational project-generated traffic for the additional alum deliveries to the Pleasantville Alum Plant Study Area would exceed the CEQR screening threshold by doubling or more the existing noise PCEs along major convergence roadways with noise-sensitive receptors, and would, therefore, require a detailed operational mobile noise analysis.

If warranted, the detailed operational mobile noise impact analysis also consisted of: (1) establishing and describing the baseline conditions within the applicable study area by identifying existing noise levels and traffic conditions in the immediate vicinity of the Pleasantville Alum Plant Study Area (existing noise levels within the study area were developed using typical noise levels for residential land uses obtained from American National Standard Institute/Acoustical Society of America S12.9 Part 3 (2013), as shown in **Table 10.2-4**); (2) establishing future conditions without WSSO by identifying proposed projects that would result in changes in land use or increases in traffic within the study area that are anticipated to be completed by the analysis year; (3) establishing the future conditions with WSSO based on the baseline traffic conditions and the temporal distribution of the proposed vehicles; and (4) analyzing the potential for impacts from WSSO using the FHWA Traffic Noise Model (TNM) to determine if the project-generated traffic within the study area would result in an increase of 3 dBA or more in baseline noise conditions.

10.2.3.15 Neighborhood Character

The neighborhood character assessment consisted of identifying the potential for WSSO to result in changes to neighborhood character, including land use, zoning, and public policy; socioeconomic conditions; open space; historic and cultural resources; urban design and visual resources; shadows; transportation; or noise, from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter the neighborhood character within the surrounding study areas.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing and describing the baseline neighborhood character conditions within the applicable study area; (2) establishing future conditions without WSSO by identifying proposed projects that would alter neighborhood character within the study areas that are anticipated to be completed by the analysis year; (3) establishing future conditions with WSSO based on the potential changes in reservoir elevations and flows downstream of reservoirs, construction of the siphons over Merriman Dam within the Rondout Reservoir Study Area, and operational changes at the Pleasantville Alum Plant Study Area; and (4) analyzing the potential for impacts from WSSO to neighborhood character through a qualitative assessment of the potential for impacts from WSSO based on adverse effects from one or a combination of the technical areas that could cumulatively affect a neighborhood’s defining features. If WSSO would potentially result in significant direct or indirect change(s) to a factor contributing to the study areas’ neighborhood character, the degree and type of such change was evaluated.

10.2.3.16 Public Health

The public health assessment consisted of identifying the potential for WSSO to result in changes to public health from the potential changes in reservoir elevations and flows downstream of reservoirs, construction and operation of siphons at Rondout Reservoir, and increased alum treatment during WSSO that could alter public health due to significant unmitigated adverse impacts in other assessment areas, such as air quality, water quality, hazardous materials, or noise.

Where applicable, based on construction or operation activities or predicted changes in reservoir elevations and flows between the temporary shutdown and typical operations for a study area, the impact analysis consisted of: (1) establishing future conditions with WSSO based on the potential changes in reservoir elevations and flows downstream of reservoirs, construction of the siphons over Merriman Dam within the Rondout Reservoir Study Area, and operational changes at the Pleasantville Alum Plant Study Area; (2) identifying the extent of potential environmental exposures to the public by determining if the potential changes from WSSO would result in increased mosquito breeding grounds or if they would alter public health due to significant unmitigated adverse impacts in one or more of the public health-related assessment areas. If WSSO would potentially result in an unmitigated significant adverse impact in one or more of the public health-related assessment areas, an evaluation of whether and how exposure to environmental contaminants may occur and the extent of that exposure; characterizing the relationship between exposures and health risks; and applying that relationship to the population exposed.

10.3 DELAWARE WATER SUPPLY SYSTEM ASSESSMENT AND IMPACT ANALYSIS

The Delaware System, planned in the 1920s and constructed between 1936 and 1964, typically provides approximately 50 percent of the City's daily water supply. As described in Section 10.1.2.1, "Description of the Surface Water Supply System," the Delaware System reservoirs are located west of the Hudson River in Delaware, Sullivan, and Ulster counties in New York. The total watershed area of the Delaware System is approximately 1,000 square miles.

Three of the Delaware System reservoirs impound the headwaters of the Delaware River: Cannonsville Reservoir which impounds the West Branch Delaware River; Pepacton Reservoir which impounds the East Branch Delaware River; and Neversink Reservoir which impounds the Neversink River. These reservoirs feed water eastward to Rondout Reservoir through separate diversion tunnels: the West Delaware, East Delaware, and Neversink tunnels respectively (see **Figure 10.1-1**). DEP maintains hydroelectric facilities as part of the diversion structures at Pepacton, Cannonsville, and Neversink reservoirs to produce electricity as water flows from each reservoir to Rondout Reservoir via the East Delaware, West Delaware, and Neversink tunnels. Hydropower facilities on the East Delaware and Neversink Tunnels are operated by DEP, while hydropower facilities on the West Delaware Tunnel have been leased to a private corporation. Hydropower production is considered secondary to both water supply operations and meeting regulatory release requirements.

Rondout Reservoir impounds Rondout Creek, which is a tributary to the Hudson River. Water from Cannonsville, Pepacton, Neversink, and Rondout Reservoirs is conveyed to West Branch Reservoir via the RWBT segment of the Delaware Aqueduct. The Delaware Aqueduct continues on to Kensico Reservoir and ultimately Hillview Reservoir. During the temporary shutdown, no water from the Delaware System reservoirs would be conveyed via the RWBT section of the Delaware Aqueduct; however, water from the West Branch Reservoir watershed (and the Boyd's Corners Reservoir watershed upstream of West Branch) would be conveyed to Kensico Reservoir via the Delaware Aqueduct.

The Delaware River watershed is over 13,000 square miles and is an important resource to over 15 million people in the eastern United States. The river provides water for drinking, agricultural, and industrial uses, and supports diverse habitat for wildlife and fisheries, including many protected species. Three reaches of the Delaware River (all downstream of the City reservoirs) have been included in the National Wild and Scenic Rivers System. The Delaware River offers numerous water resources-related recreational opportunities including fishing, boating, and swimming. The City's use of water originating in the Delaware River watershed was upheld by U.S. Supreme Court decisions in 1931 and 1954. The U.S. Supreme Court Decree of 1954 established the City's right to divert up to 800 mgd, on a rolling annual average basis, from the Delaware River watershed. The same Supreme Court ruling also stipulated that sufficient water be released from the reservoirs to maintain flow objectives on the Delaware River at Montague, New Jersey.

The Delaware River Basin Compact was later ratified between the four basin states (New York, Pennsylvania, New Jersey, and Delaware) in 1961, which created the Delaware River Basin

Commission. The Delaware River Basin Commission works with the four basin states, the City, and the federal government to develop operating criteria for reservoirs, releases, and diversions throughout the basin to help manage resource allocation. While the Delaware River Basin Commission has broad powers to plan, develop, conserve, regulate, allocate, and manage water resources in the basin, its authority over the City reservoirs is limited by the 1954 Supreme Court Decree.

The current management framework that governs the Delaware System reservoirs is referred to as the Flexible Flow Management Program (FFMP). The FFMP, which was unanimously agreed to by the decree parties, is intended to meet water supply demands, protect fisheries habitat, assist with flood mitigation, and repel the upstream movement of salt water in the Delaware Estuary. Releases are coordinated between Cannonsville, Pepacton, and Neversink reservoirs in order to balance reservoir storage and meet both water supply objectives and downstream flow objectives in the basin (e.g., ecological flows and flood management). The current FFMP agreement relies on the use of OST to manage the water that is forecasted to be available in Cannonsville, Pepacton, and Neversink reservoirs on the Delaware River and guide the selection of releases to achieve various flow objectives. As part of the management framework, the reservoirs have a storage target, referred to as the Conditional Seasonal Storage Objective, that fluctuates seasonally depending on whether the reservoirs need to be full for water supply or have a storage void to mitigate spills. Releases are used to control reservoir storage and maintain the Conditional Seasonal Storage Objective. Forecasts, which incorporate projected diversions, inflows, and downstream release requirements, are used to determine release rates. In general, when inflows are high and/or diversions are low, releases increase. Alternatively, when inflows are low and/or diversions are high, releases are lower.

Diversions from the Delaware System would not be possible during the RWBT temporary shutdown. Therefore, in order to maximize supply and minimize spills from the system during the RWBT temporary shutdown, the Delaware System reservoirs would be drawn down during the pre-shutdown phase by maximizing diversions to allow the Catskill and Croton System reservoirs to be full at the start of the shutdown. During the temporary shutdown, diversions out of the Delaware System would cease and the reservoirs would slowly begin to refill; thereafter, the natural inflow to the Delaware System reservoirs would be managed through controlled releases. Releases from Neversink, Pepacton, and Cannonsville Reservoirs would be managed pursuant to the FFMP during the pre-shutdown, shutdown, and post-shutdown phases. Because diversions would be curtailed during the RWBT temporary shutdown, releases would fluctuate primarily based on reservoir inflows.

Release capacity for Rondout Reservoir, which is not subject to the FFMP as it is not in the Delaware River watershed, would be increased under WSSO with the addition of siphons over Rondout Reservoir's Merriman Dam.[23] The following sections describe how the overall change in operations for the Delaware System from WSSO would alter operations at individual system reservoirs and associated flows to receiving waterbodies.

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[23] Modeling analysis for Pepacton, Cannonsville, and Neversink Reservoirs indicated there would be sufficient release capacity during the RWBT temporary shutdown; hence, siphons would not be necessary to manage natural inflows.

10.3.1 CANNONSVILLE RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.1.1 Study Area Location and Description

Cannonsville Reservoir is one of four reservoirs in the City's Delaware Water Supply System and was placed into service in 1964. The reservoir is located at the western edge of Delaware County and is formed by impounding the West Branch Delaware River approximately 3 miles upstream of Deposit, New York (see **Figure 10.3-1**). The reservoir consists of a single basin that is approximately 9 miles in length and holds approximately 96 billion gallons at full capacity.

Spills and releases discharge into the continuation of the West Branch Delaware River, and diversions flow to Rondout Reservoir via the West Delaware Tunnel. As stated previously, the West Delaware Tunnel includes a hydropower facility. While Cannonsville Reservoir serves the City’s customers as part of the larger Delaware System, no local communities draw directly from the reservoir.

The Cannonsville watershed’s drainage basin is approximately 455 square miles, and includes parts of 17 towns, all in Delaware County: Andes, Bovina, Delhi, Deposit, Franklin, Hamden, Harpersfield, Jefferson, Kortright, Masonville, Meredith, Middletown, Roxbury, Sidney, Stamford, Tompkins, and Walton. Cannonsville Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing and recreation is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is prohibited. The water quality classification for Cannonsville Reservoir is A(T), transitioning to AA(T) in proximity to the diversion intake.

10.3.1.2 Study Area Evaluation

Under typical operations, storage in Cannonsville Reservoir is managed by balancing inflows, water supply diversions via the West Delaware Tunnel, and releases to the West Branch Delaware River per the FFMP. The FFMP includes a Conditional Seasonal Storage Objective of 90 percent from September 1 through March 15 to reduce spills. However, spills to the West Branch Delaware River can occur at any time of the year, most often in the spring when inflows are highest and the reservoir is filling in advance of the summer drawdown season. When conditions are dry, releases per the FFMP and diversions for water supply purposes could result in drawdown in reservoir water surface elevation of 70 feet or more.

Cannonsville Reservoir operations would continue to follow the FFMP (or its successor), and no changes to operating rules for the reservoir would occur during WSSO. During the pre-shutdown period, water surface elevations in Cannonsville Reservoir would be marginally lower than typical conditions by up to 3 feet (see **Figure 10.3-2**). During the temporary shutdown of the RWBT, water surface elevations in Cannonsville Reservoir would be marginally higher than typical conditions by up to 8 feet (see **Figure 10.3-2**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project.

There would be no potential for significant adverse impacts from WSSO to Cannonsville Reservoir. Therefore, no further analysis is warranted for the Cannonsville Reservoir Study Area.

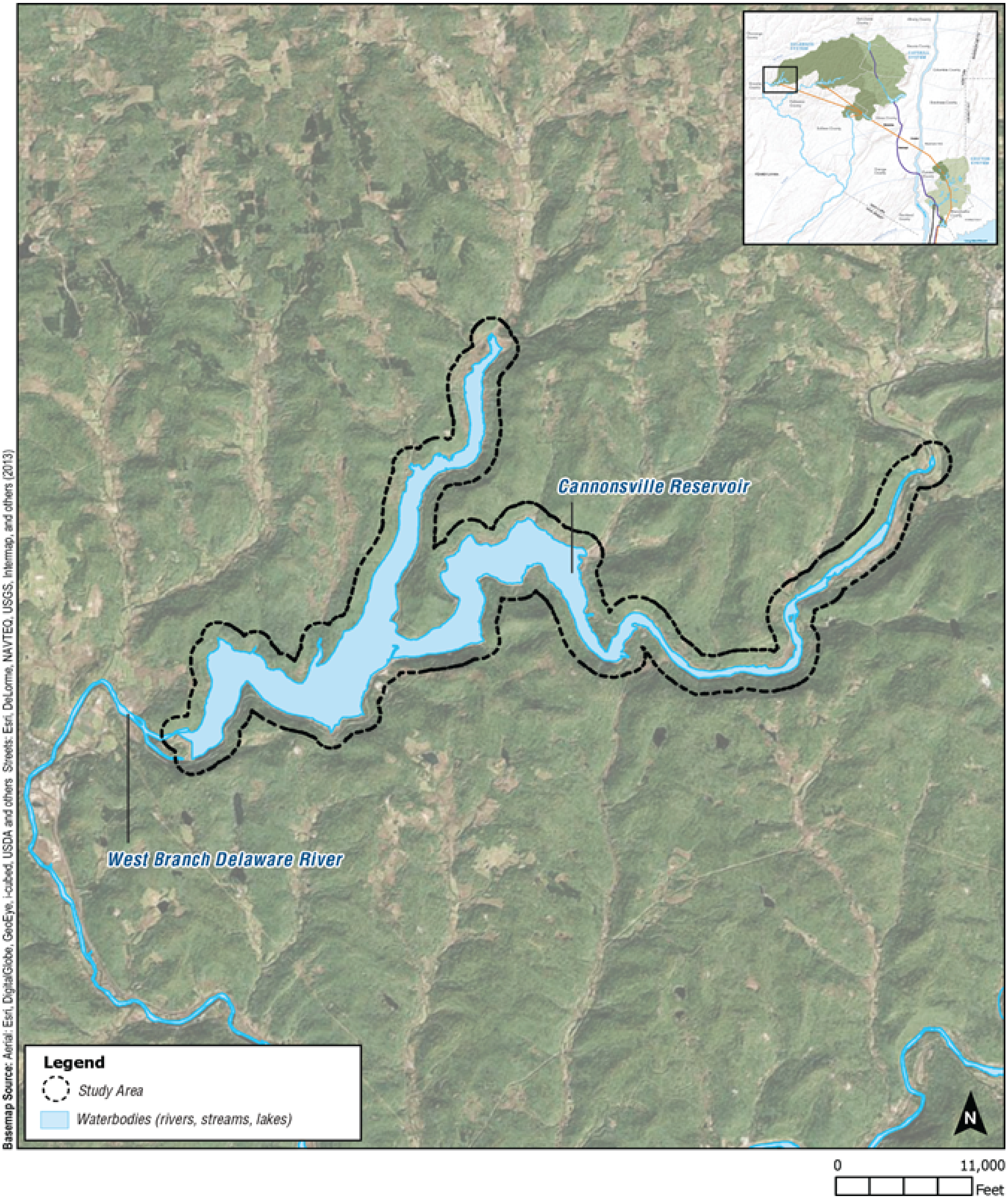
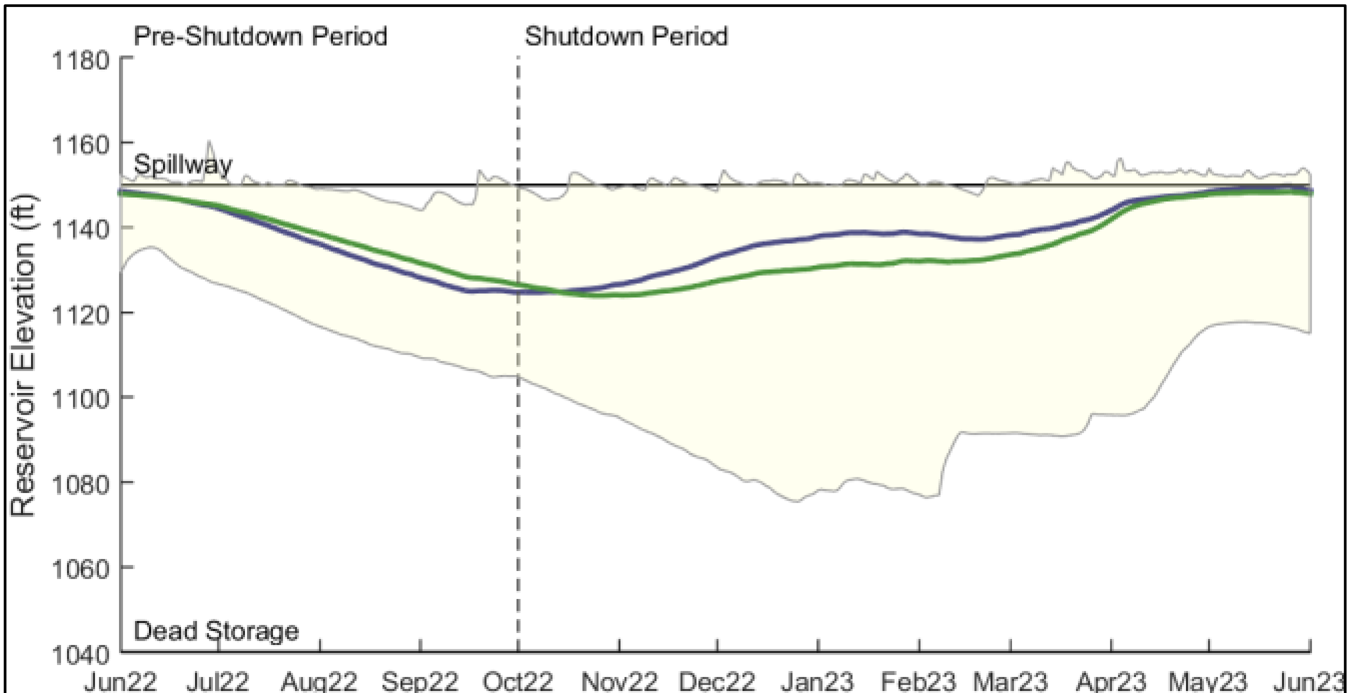


Figure 10.3-1: Cannonsville Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	1147	1133	1151	1147	0
	July	1142	1122	1150	1140	-2
	August	1135	1113	1147	1132	-3
	September	1129	1107	1146	1126	-3
Shutdown Period	October	1125	1100	1148	1125	0
	November	1125	1090	1150	1129	4
	December	1129	1079	1151	1136	7
	January	1131	1079	1149	1139	8
	February	1132	1088	1148	1138	6
	March	1137	1093	1149	1140	3
	April	1146	1104	1151	1147	1
	May	1148	1117	1151	1149	1

Note: There are no water utility intakes for drawing water directly from the reservoir.

Figure 10.3-2: Elevation Dataset Mean and Range for Typical Operations and WSSO – Cannonsville Reservoir Study Area

10.3.2 WEST BRANCH DELAWARE RIVER DOWNSTREAM OF THE CANNONSVILLE RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.2.1 Study Area Location and Description

West Branch Delaware River downstream of Cannonsville Reservoir flows approximately 17 miles along the borders of Broome and Delaware Counties where it joins with the East Branch Delaware River at Hancock, New York to form the main stem Delaware River (see **Figure 10.3-3**). Cannonsville Reservoir releases to this portion of the West Branch Delaware River at its southwestern point. The West Branch Delaware River flows northwesterly before turning sharply to flow southeasterly and passing towns and villages including Stilesville and Deposit, New York. The West Branch Delaware River is a high quality stream that supports diverse, healthy flora and fauna, including a population of endangered dwarf wedgemussel (*Alasmidonta heterodon*) on the main stem Delaware River. The river sustains numerous fish species, including wild trout, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, occur along the river, but to a more limited extent. The West Branch Delaware River is classified as B(T) immediately below the dam, transitioning to A(T) approximately 8 miles downstream of the dam.

10.3.2.2 Study Area Evaluation

Under typical operations, DEP releases water to the West Branch Delaware River from Cannonsville Reservoir per the FFMP and manages the reservoir storage to limit spills. Releases are highest during wet conditions and lowest when conditions are dry. The reservoir has the capacity to release up to approximately 970 mgd over a sustained period. Flows of this magnitude frequently occur when releases are made in accordance with the FFMP for the purpose of maintaining the Conditional Seasonal Storage Objective. Despite proactive management of Cannonsville Reservoir's storage, the reservoir can spill during wet weather conditions. Based on modeling analyses, under typical operations, monthly average daily releases could range from approximately 26 mgd up to approximately 970 mgd, the maximum release capacity (see **Figure 10.3-4**). Monthly average daily spills can range from 0 mgd to approximately 1,450 mgd and are generally lowest in the summer and fall and highest in the spring (see **Figure 10.3-5**). Daily spills can reach approximately 18,000 mgd. Spills can occur during any month but are more frequent and of larger magnitude during high inflow months (March through May).

During the pre-shutdown period, releases into the West Branch Delaware River would be marginally lower than typical conditions by up to approximately 24 mgd (see **Figure 10.3-4**). During this period, spills into the West Branch Delaware River would not change compared to typical conditions by more than approximately -2 mgd to +6 mgd (see **Figure 10.3-5**). During the temporary shutdown of the RWBT, releases into the West Branch Delaware River would be higher than typical conditions by up to approximately 325 mgd (see **Figure 10.3-5**).

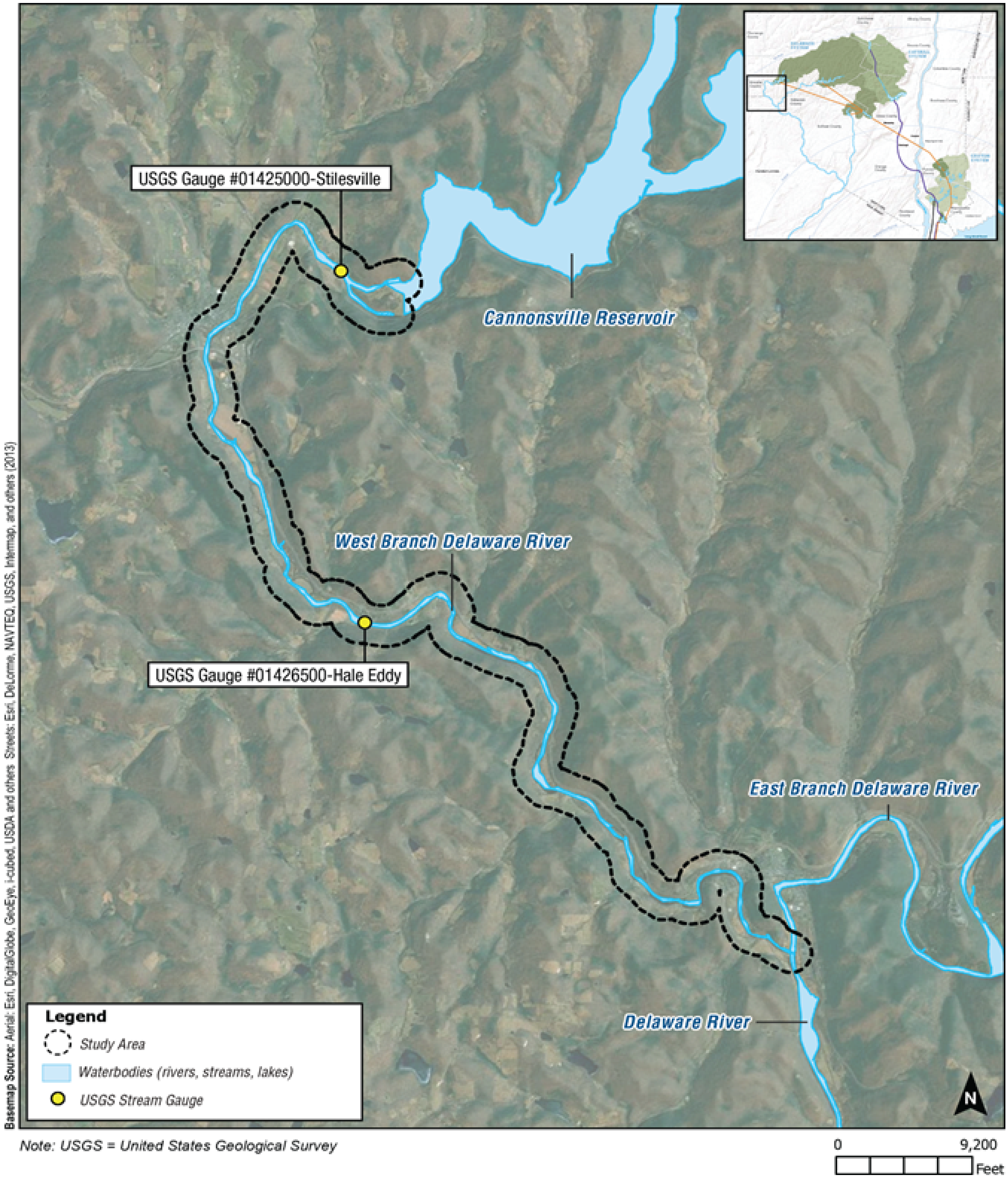
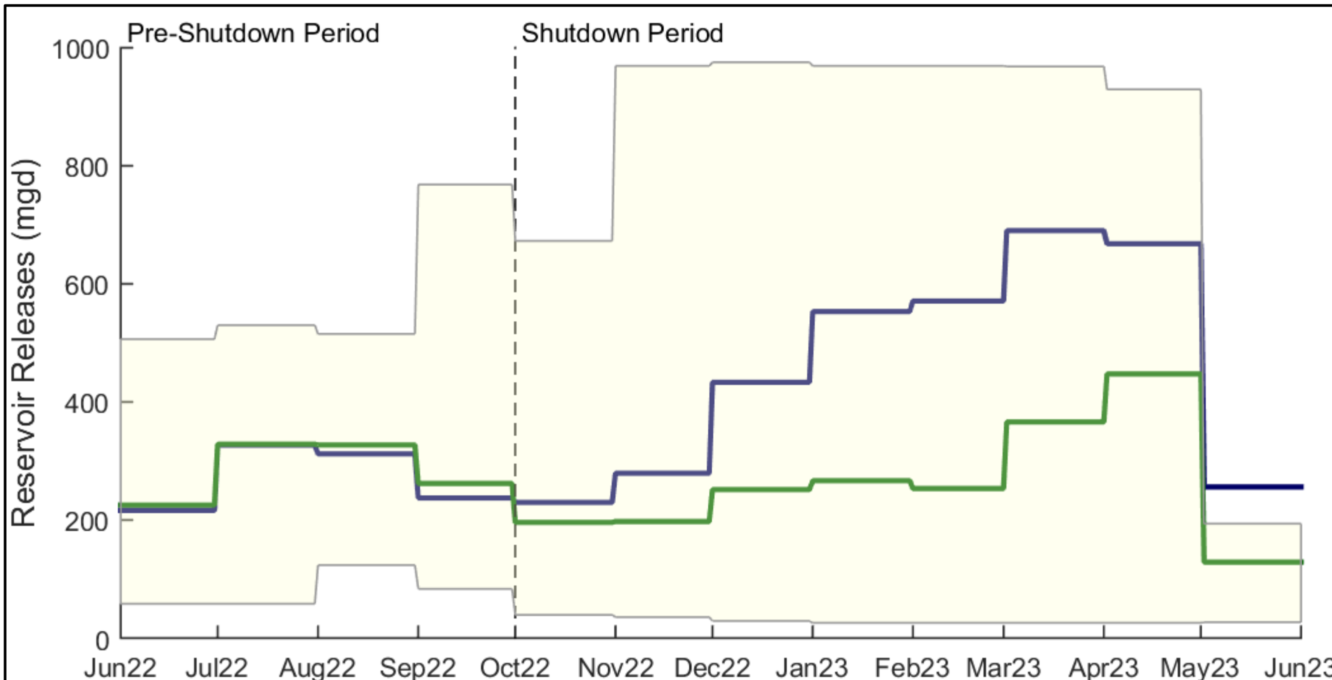
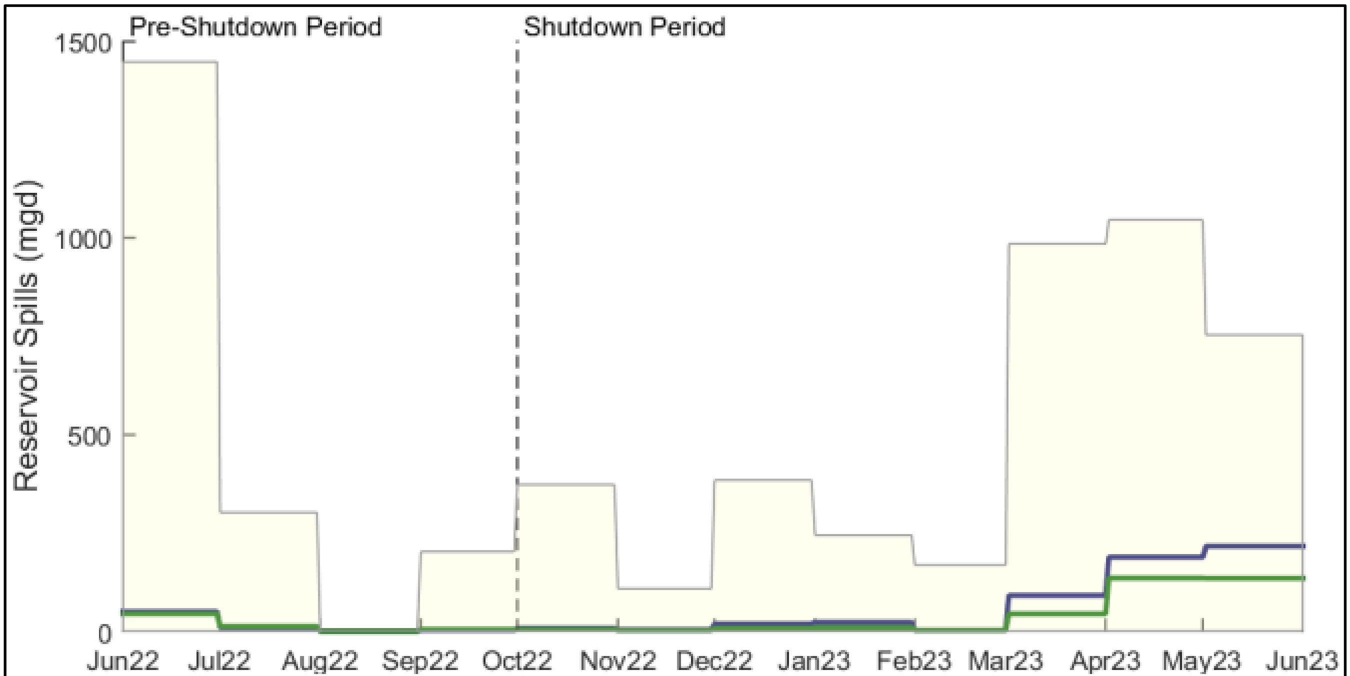


Figure 10.3-3: West Branch Delaware River Downstream of Cannonsville Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	225	58	507	216	-9
	July	329	58	530	327	-2
	August	327	124	515	312	-15
	September	262	84	768	238	-24
Shutdown Period	October	196	39	673	230	34
	November	198	36	969	279	81
	December	252	29	976	434	182
	January	267	26	969	553	286
	February	253	26	969	570	317
	March	361	26	968	686	325
	April	457	26	946	683	226
	May	129	26	203	259	130

Figure 10.3-4: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – West Branch Delaware River Downstream of Cannonsville Reservoir Study Area



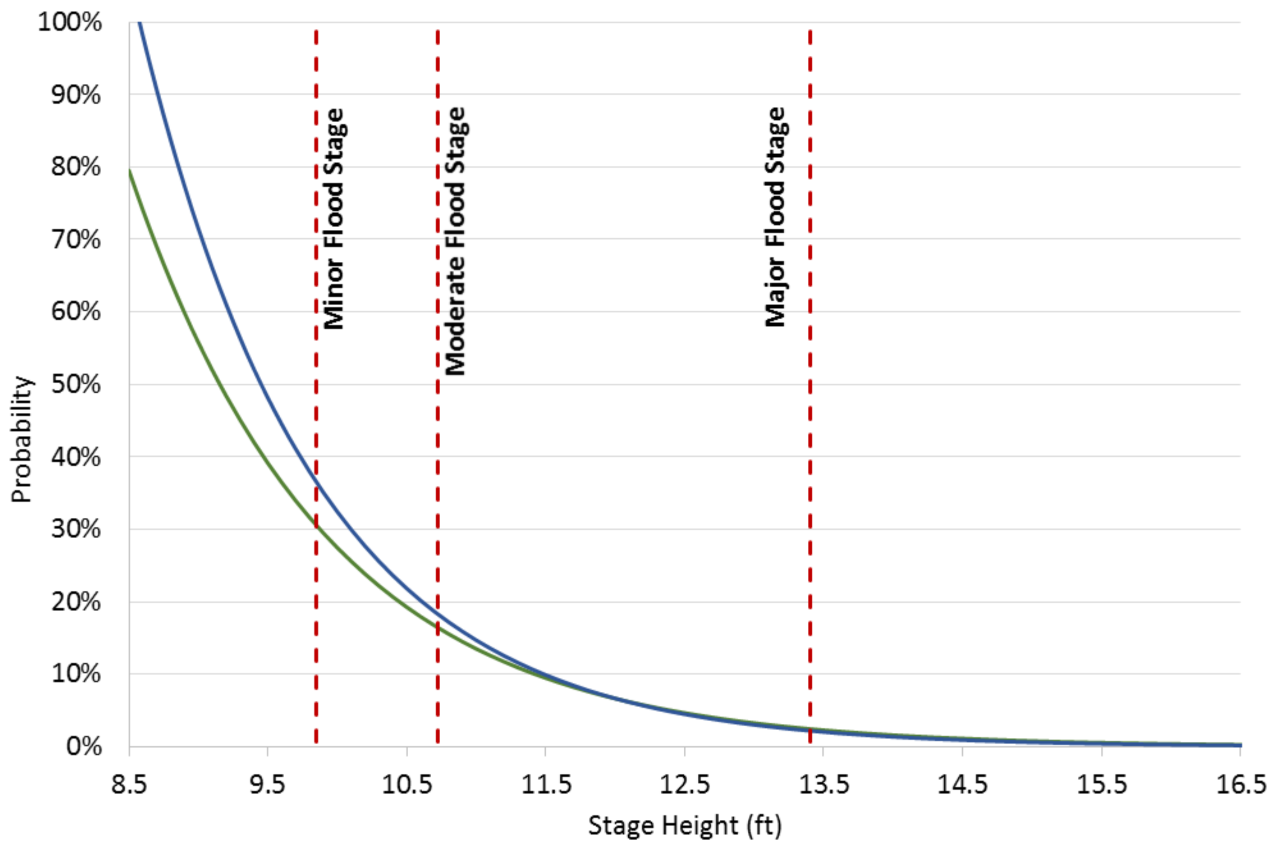
		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	44	0	1448	50	6
	July	12	0	301	10	-2
	August	0	0	0	0	0
	September	5	0	202	3	-2
Shutdown Period	October	5	0	374	8	3
	November	3	0	108	4	1
	December	8	0	385	19	11
	January	10	0	244	23	13
	February	3	0	168	3	0
	March	43	0	985	88	45
	April	134	0	1032	187	53
	May	134	0	743	218	84

Figure 10.3-5: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – West Branch Delaware River Downstream of Cannonsville Reservoir Study Area

During this period, spills into the West Branch Delaware River would be higher than typical conditions by up to approximately 84 mgd (see **Figure 10.3-5**). The dataset mean during WSSO for both spills and releases would remain within the range of typical operations. The one exception is a slight increase of approximately 56 mgd above the typical range for releases in May. However, this increase above the typical range would be small in comparison to the level of spills that could occur in May or the level of releases that could occur in other months of the year. As stated previously, releases from Cannonsville Reservoir would remain consistent with the FFMP, which includes compliance with required minimum releases.

During the RWBT temporary shutdown, the modeling results indicate that there would be a minor increase in the probability of high flows downstream of Cannonsville Reservoir due to large storm events (see **Figure 10.3-6** and **Figure 10.3-7**). The USGS gauge at Stilesville, immediately downstream of the dam, does not have NWS flood stages associated with it. Estimated flood stages are included for this location based on flood stages at the Cannonsville Dam. Additionally, the next gauge downstream at Hale Eddy with NWS flood stages delineated is also shown. However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would not be the cause of flooding. In fact, the reservoir would reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when the reservoir is full and spilling. The results of the modeling indicate that there would be a minor, temporary reduction in this attenuation during the RWBT temporary shutdown as indicated by the minor increase in probability of flows reaching flood stage, which would be an approximately six percentage point increase in minor flooding and an approximately two percentage point increase in moderate flooding at the Stilesville gauge. Alternately, the probability of major flooding at the Stilesville gauge would be slightly decreased (see **Figure 10.3-6**). The Hale Eddy gauge location would experience less than one percentage point increase of minor through major flooding (see **Figure 10.3-7**).

Modeling results indicate that the dataset mean for spills and releases (flows) would remain within the ranges observed during typical operations, that releases would remain in compliance with the FFMP, and that there would only be minor reductions in the ability of Cannonsville Reservoir to attenuate large storm events. Therefore, there would be no significant adverse impacts to West Delaware River downstream of Cannonsville Reservoir from WSSO, and further analysis is not warranted.

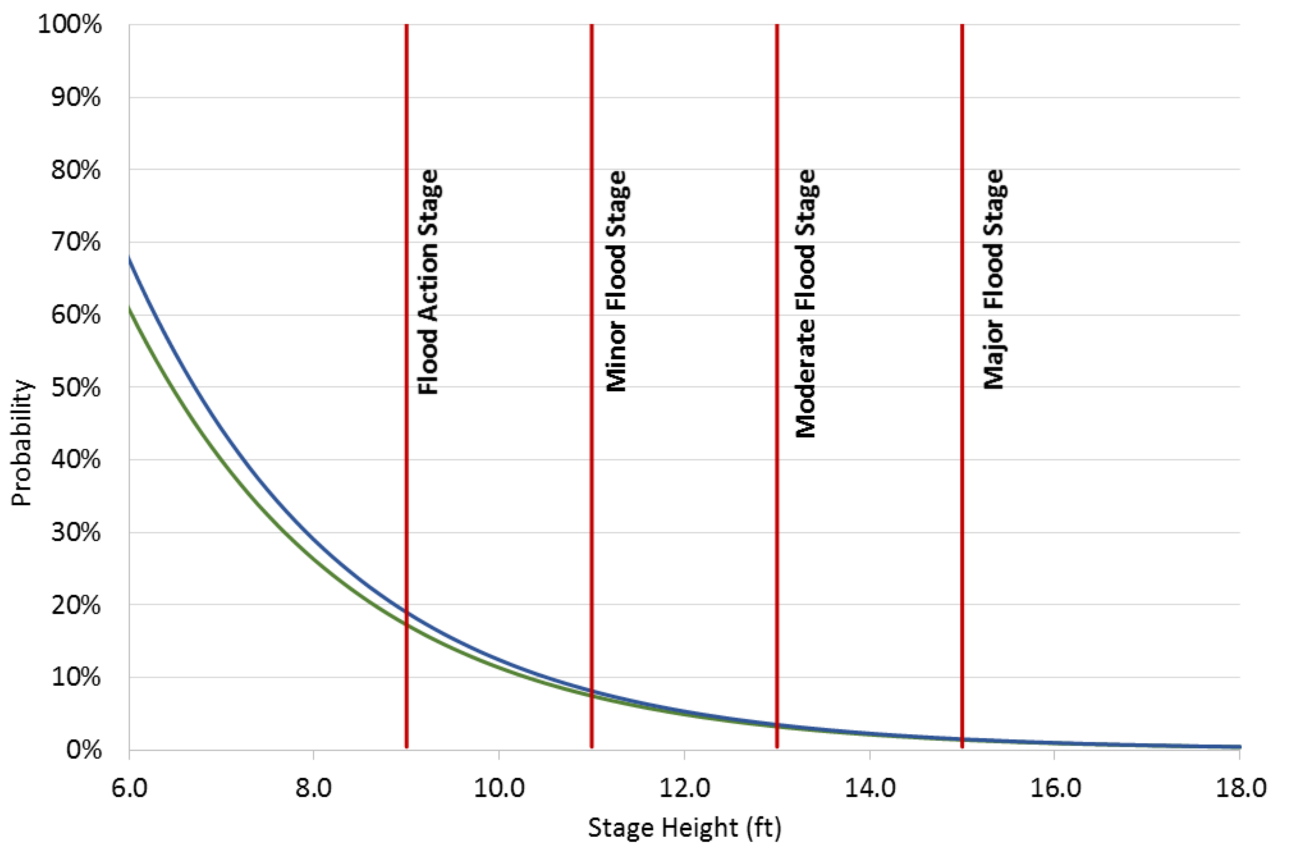


	Typical	WSSO	Difference (perc pts)
Minor Flood Stage	31.6%	38.0%	+6.3
Moderate Flood Stage	16.7%	18.6%	+1.9
Major Flood Stage	2.5%	2.2%	-0.3

Notes: *The USGS Stilesville Gauge is located approximately one mile downstream of the Cannonsville Dam. National Weather Service flood stages are not delineated for this location. Flood stages have been estimated based on the flood stage delineations at the Cannonsville Dam.*

Legend
WSSO — Typical

Figure 10.3-6: Annual Probability of High Flow Stage at Stilesville USGS Gauge – West Branch Delaware River Downstream of Cannonsville Reservoir Study Area



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	17.3%	19.0%	+1.7
Minor Flood Stage	7.4%	8.1%	+0.7
Moderate Flood Stage	3.2%	3.5%	+0.3
Major Flood Stage	1.4%	1.5%	+0.1

Note: The USGS Hale Eddy Gauge is located approximately eight miles downstream of the Cannonsville Dam.

Figure 10.3-7: Annual Probability of High Flow Stage at Hale Eddy USGS Gauge – West Branch Delaware River Downstream of Cannonsville Reservoir Study Area

10.3.3 PEPACTON RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.3.1 Study Area Location and Description

Pepacton Reservoir is one of four reservoirs in the City's Delaware Water Supply System and was placed into service in 1955. The reservoir is located in Delaware County along the southern edge of the State's forever-wild Catskill Park and is formed by impounding East Branch Delaware River approximately 1 mile upstream of Downsville, New York (see **Figure 10.3-8**). The reservoir consists of a single basin that is approximately 15 miles in length and holds approximately 140 billion gallons at full capacity. Spills and releases discharge into the continuation of the East Branch Delaware River, and diversions flow to Rondout Reservoir via the East Delaware Tunnel. As stated previously, the East Delaware Tunnel includes a hydropower facility. While Pepacton Reservoir serves the City's customers as part of the larger Delaware System, no local communities draw directly from the reservoir.

The Pepacton watershed's drainage basin is approximately 371 square miles, and includes parts of 13 towns in three counties: Andes, Bovina, Colchester, Delhi, Hamden, Middletown, Roxbury, and Stamford in Delaware County, New York; Denning, Hardenburgh, and Shandaken in Ulster County, New York; and Halcott and Lexington in Greene County, New York. Pepacton Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing and recreation is allowed by DEP at the reservoir and a DEP permit is required to access the reservoir. Ice fishing is prohibited. The water quality classification for Pepacton Reservoir is A(T), transitioning to AA(T) in proximity to the diversion intake.

10.3.3.2 Study Area Evaluation

Under typical operations, storage in Pepacton Reservoir is managed by balancing inflows, water supply diversions via the East Delaware Tunnel, and releases to the East Branch Delaware River per the FFMP. The FFMP includes a Conditional Seasonal Storage Objective of 90 percent from September 1 through March 15 to reduce spills. However, spills to the East Branch Delaware River can occur at any time of the year, most often in the spring when inflows are highest and the reservoir is filling in advance of the summer drawdown season. When conditions are dry, releases per the FFMP and diversions for water supply purposes could result in drawdown of 80 feet or more.

Pepacton Reservoir operations would continue to follow the FFMP, and no changes to operating rules for the reservoir would occur during WSSO. During the pre-shutdown period, water surface elevations in Pepacton Reservoir would be marginally lower than typical conditions by up to 2 feet (see **Figure 10.3-9**). During the temporary shutdown of the RWBT, water surface elevations in Pepacton Reservoir would be marginally higher than typical conditions by up to 11 feet (see **Figure 10.3-9**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Pepacton Reservoir. Therefore, no further analysis is warranted for the Pepacton Reservoir Study Area.

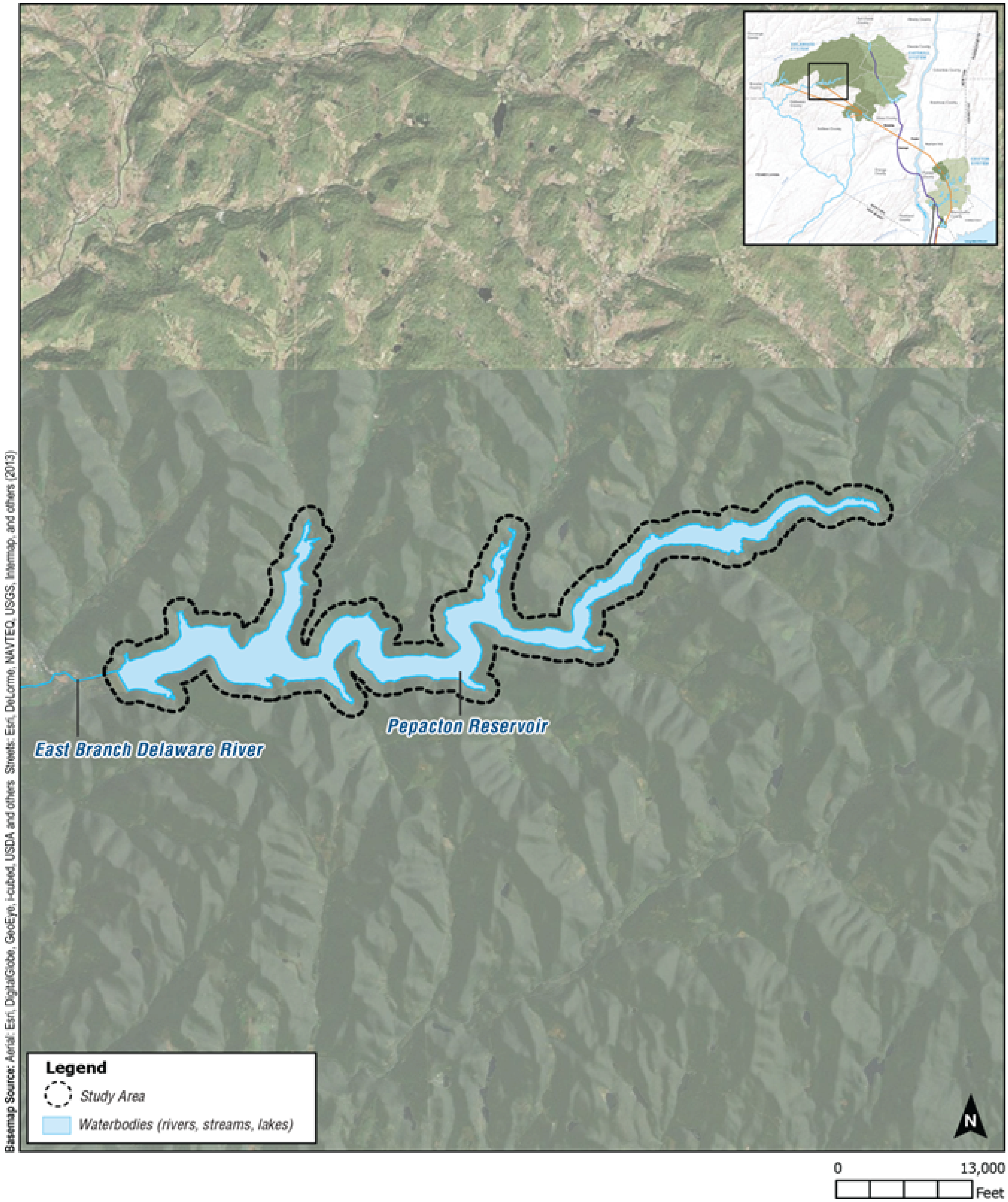
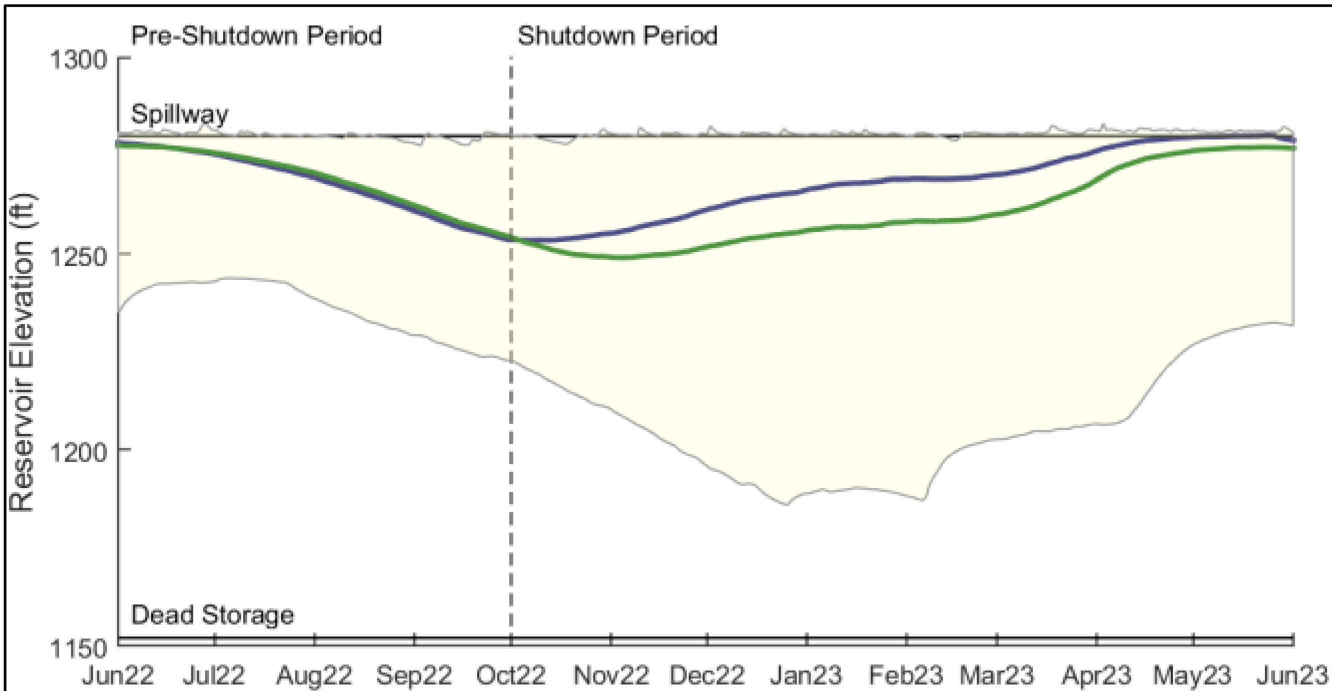


Figure 10.3-8: Pepacton Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	1277	1241	1280	1277	0
	July	1273	1243	1280	1273	0
	August	1267	1234	1278	1265	-2
	September	1258	1226	1279	1257	-1
Shutdown Period	October	1251	1216	1279	1254	3
	November	1250	1203	1280	1258	8
	December	1254	1190	1281	1264	10
	January	1257	1190	1279	1268	11
	February	1259	1196	1280	1269	10
	March	1264	1205	1279	1273	9
	April	1273	1214	1280	1278	5
	May	1277	1231	1281	1280	3

Figure 10.3-9: Elevation Dataset Mean and Range for Typical Operations and WSSO – Pepacton Reservoir Study Area

10.3.4 EAST BRANCH DELAWARE RIVER DOWNSTREAM OF THE PEPACTON RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.4.1 Study Area Location and Description

East Branch Delaware River downstream of Pepacton Reservoir flows approximately 31 miles through Delaware County where it joins with the West Branch Delaware River at Hancock, New York to form the main stem of the Delaware River **(see Figure 10.3-10**). The Pepacton Reservoir releases to this portion of the East Branch Delaware River at its southwestern point. The East Branch Delaware River flows southwesterly past several villages and hamlets, including Downsville, Gregorytown, Corbett, Shinhopple, and Harvard, New York. The East Branch Delaware River is a high quality stream that supports diverse, healthy flora and fauna, including a population of endangered dwarf wedgemussel (*Alasmidonta heterodon*) on the main stem Delaware River. The river sustains numerous fish species, including wild trout, and is stocked annually, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, occur along the river, but to a more limited extent. The East Branch Delaware River is classified as C(T) along its entire length from the Pepacton Dam to the confluence with the West Branch Delaware River.

10.3.4.2 Study Area Evaluation

Under typical operations, DEP releases water to the East Branch Delaware River from Pepacton Reservoir per the FFMP and manages the reservoir storage to limit spills. Releases are highest during wet conditions and lowest when conditions are dry. The reservoir has the capacity to release up to approximately 470 mgd over a sustained period. Releases of this magnitude frequently occur when releases are made in accordance with the FFMP for the purpose of maintaining the Conditional Seasonal Storage Objective. Despite proactive management of Pepacton Reservoir's storage, the reservoir can spill during wet weather conditions. Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 20 mgd up to approximately 470 mgd, the maximum release capacity (see **Figure 10.3-11**). Monthly average daily spills can range from 0 mgd to approximately 1,200 mgd and are generally lowest in the summer and fall and highest in the spring (see **Figure 10.3-12**). Daily spills can reach approximately 10,000 mgd. Spills can occur during any month but are more frequent and of larger magnitude during high inflow months (March through May).

During the pre-shutdown period, releases into the East Branch Delaware River would be lower than typical conditions by up to approximately 37 mgd (see **Figure 10.3-11**). During this period, spills into the East Branch Delaware River would be lower than typical conditions by up to approximately 28 mgd (see **Figure 10.3-12**). During the temporary shutdown of the RWBT, releases into the East Branch Delaware River would be higher than typical conditions by up to approximately 181 mgd (see **Figure 10.3-11**). During this period, spills into the East Branch Delaware River would be higher than typical conditions by up to approximately 258 mgd (see **Figure 10.3-12**). The dataset mean during WSSO for both spills and releases would remain within the range of typical operations. As stated previously, releases from Pepacton Reservoir would remain consistent with the FFMP, which includes compliance with required minimum releases.

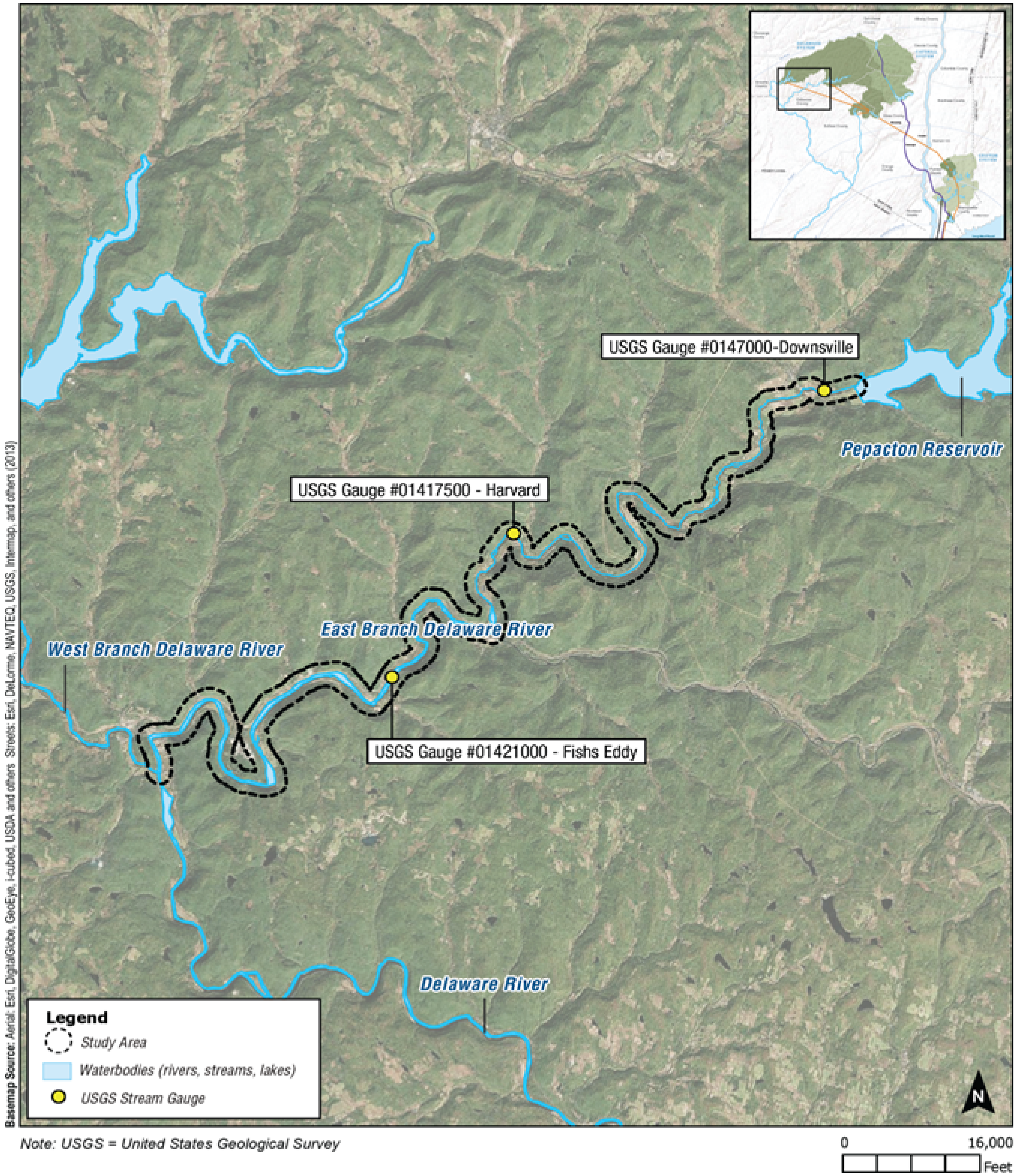
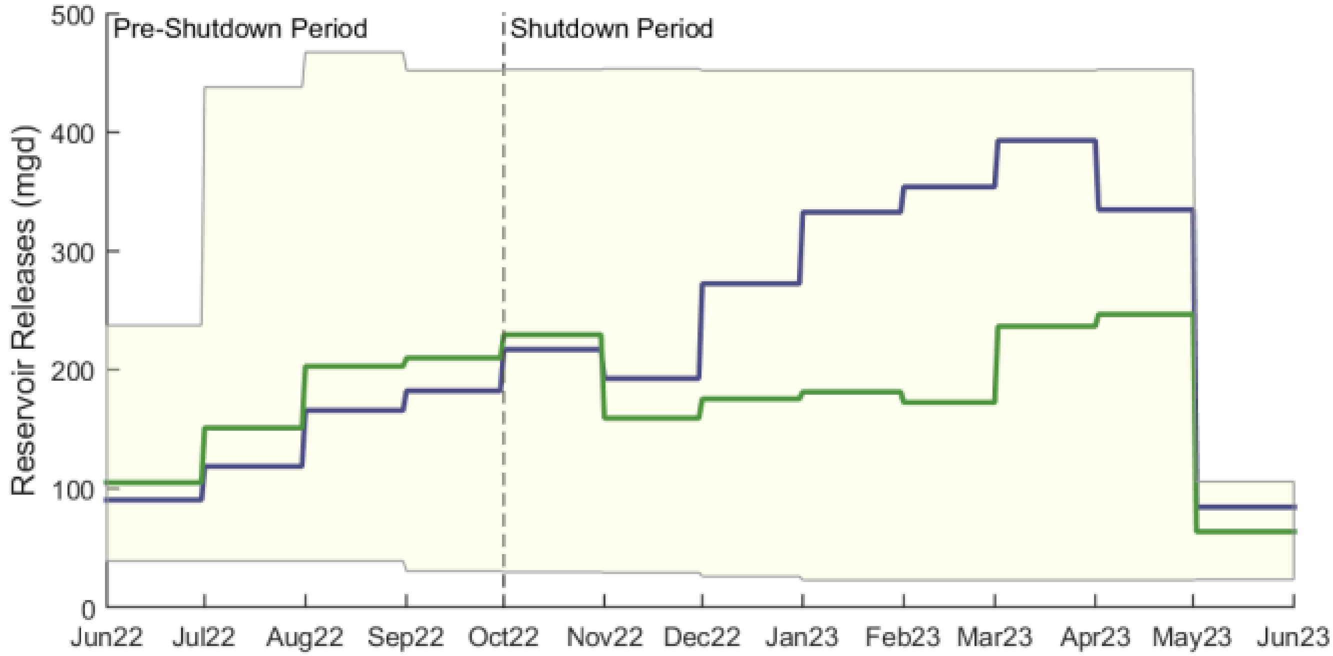
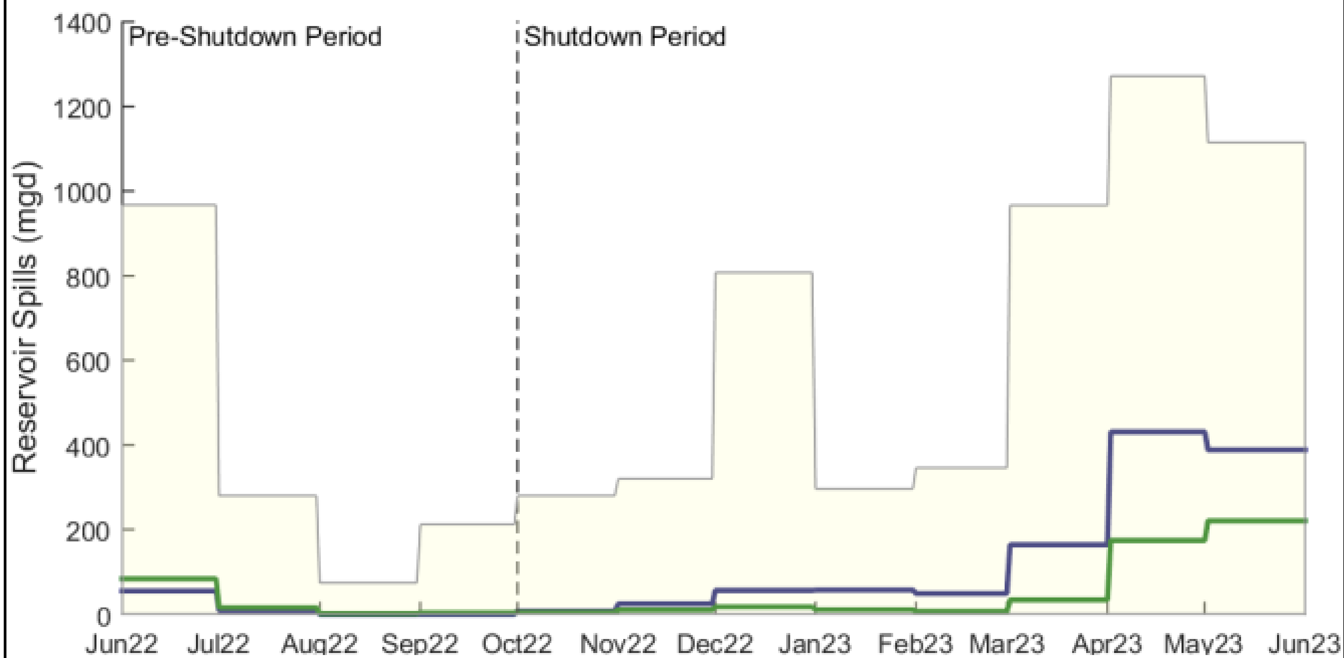


Figure 10.3-10: East Branch Delaware River Downstream of Pepacton Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	105	39	238	91	-14
	July	151	39	439	119	-32
	August	203	39	468	166	-37
	September	210	30	452	182	-28
Shutdown Period	October	229	30	453	217	-12
	November	159	29	454	193	34
	December	176	26	452	273	97
	January	181	23	452	333	152
	February	172	23	452	353	181
	March	235	23	452	393	158
	April	253	23	452	345	92
	May	64	23	105	84	20

Figure 10.3-11: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – East Branch Delaware River Downstream of Pepacton Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	84	0	967	56	-28
	July	16	0	280	9	-7
	August	1	0	75	0	-1
	September	3	0	212	0	-3
Shutdown Period	October	4	0	281	7	3
	November	11	0	320	25	14
	December	18	0	808	57	39
	January	11	0	297	58	47
	February	7	0	339	49	42
	March	33	0	945	154	121
	April	172	0	1229	430	258
	May	220	0	1123	400	180

Figure 10.3-12: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – East Branch Delaware River Downstream of Pepacton Reservoir Study Area

During the RWBT temporary shutdown, the modeling results indicate that there would be a minor increase in the probability of high flows downstream of Pepacton Reservoir due to large storm events (see **Figure 10.3-13**). However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when the reservoir is full and spilling. The results of the modeling indicate that there would be a minor, temporary reduction in this attenuation during the temporary shutdown as indicated by the minor increase in probability of flows reaching flood stage, which would range from an approximately 2 percentage point increase in minor flooding down to an approximately 0.5 percentage point increase in major flooding at the Downsville gauge (see **Figure 10.3-13**). Modeling results predict that the dataset mean for spills and releases (flows) would remain within those observed during typical operations, releases would remain in compliance with the FFMP, and there would only be minor reductions in the ability of Pepacton Reservoir to attenuate large storm events. Therefore, there would be no significant adverse impacts to East Delaware River downstream of Pepacton Reservoir from WSSO and no further analysis of East Delaware River downstream of Pepacton Reservoir is warranted.

10.3.5 NEVERSINK RESERVOIR STUDY AREA IMPACT ANALYSIS

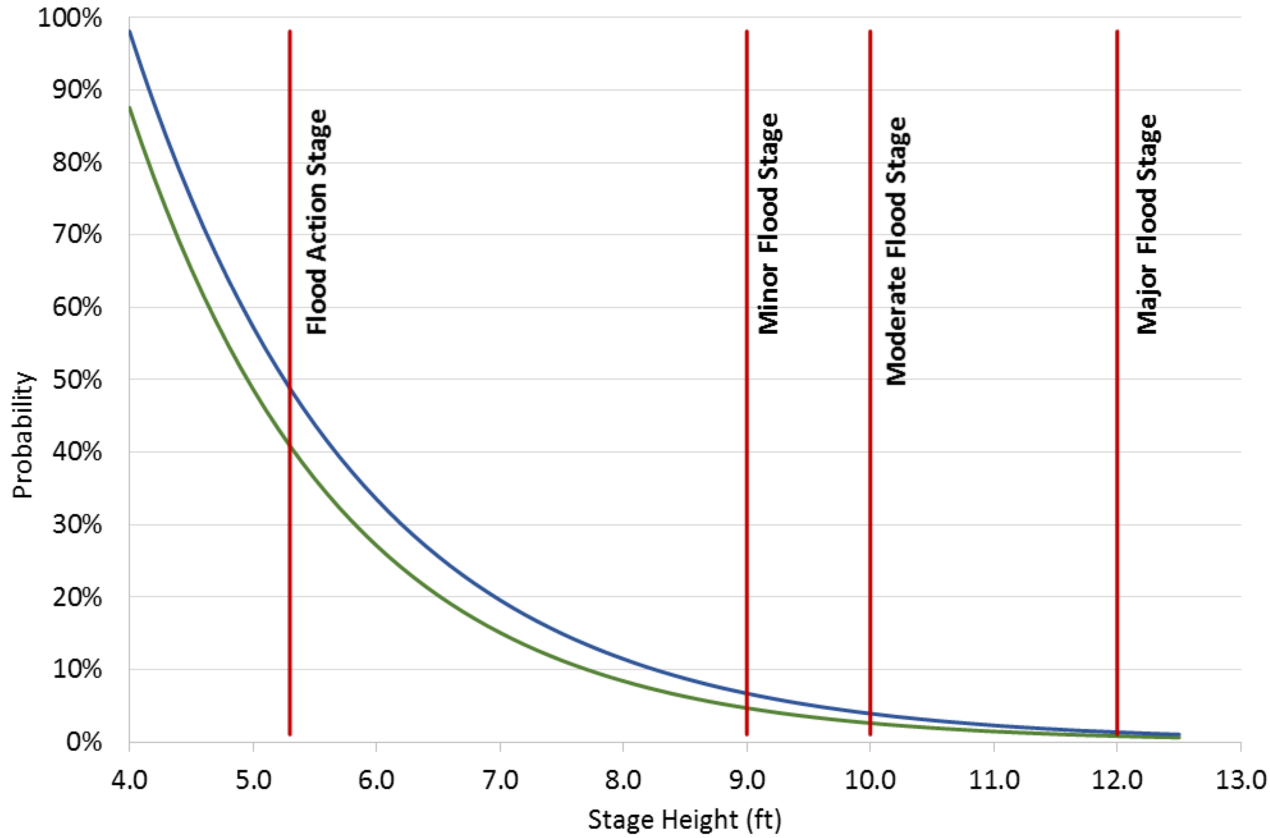
10.3.5.1 Study Area Location and Description

Neversink Reservoir is one of four reservoirs in the City's Delaware Water Supply System and was placed into service in 1954. The reservoir is located in Sullivan County and is formed by impounding the Neversink River approximately 5 miles upstream of Woodbourne, New York (see **Figure 10.3-14**). The reservoir consists of a single basin that is approximately 4 miles in length and holds approximately 35 billion gallons at full capacity. Spills and releases discharge into the continuation of the Neversink River, and diversions flow to Rondout Reservoir via the Neversink Tunnel. As stated previously, the Neversink Tunnel includes a hydropower facility. While Neversink Reservoir serves the City’s customers as part of the larger Delaware System, no local communities draw directly from the reservoir.

The Neversink watershed’s drainage basin is approximately 92 square miles and includes portions of six towns: Fallsburg, Liberty, and Neversink in Sullivan County, New York, and Denning, Hardenburgh, and Shandaken in Ulster County, New York. Neversink Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing and recreation is allowed by DEP at the reservoir and a DEP permit is required to access the reservoir. Ice fishing is prohibited. The water quality classification for Neversink Reservoir is AA(T) along its entire length.

10.3.5.2 Study Area Evaluation

Under typical operations, storage in Neversink Reservoir is managed by balancing inflows, water supply diversions via the Neversink Tunnel, and releases to the Neversink River per the FFMP. The FFMP includes a Conditional Seasonal Storage Objective of 90 percent from September 1 through March 15 to reduce spills. However, spills to the Neversink River can occur at any time of the year, most often in the spring when inflows are highest and the reservoir is filling in



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	40.9%	48.8%	+7.9
Minor Flood Stage	4.7%	6.7%	+2.0
Moderate Flood Stage	2.6%	3.9%	+1.3
Major Flood Stage	0.8%	1.3%	+0.5

Note: The USGS Downsville Gauge is located approximately 1/2 mile downstream of the Pepacton Dam.

Figure 10.3-13: Annual Probability of High Flow Stage at Downsville USGS Gauge – East Branch Delaware River Downstream of Pepacton Reservoir Study Area

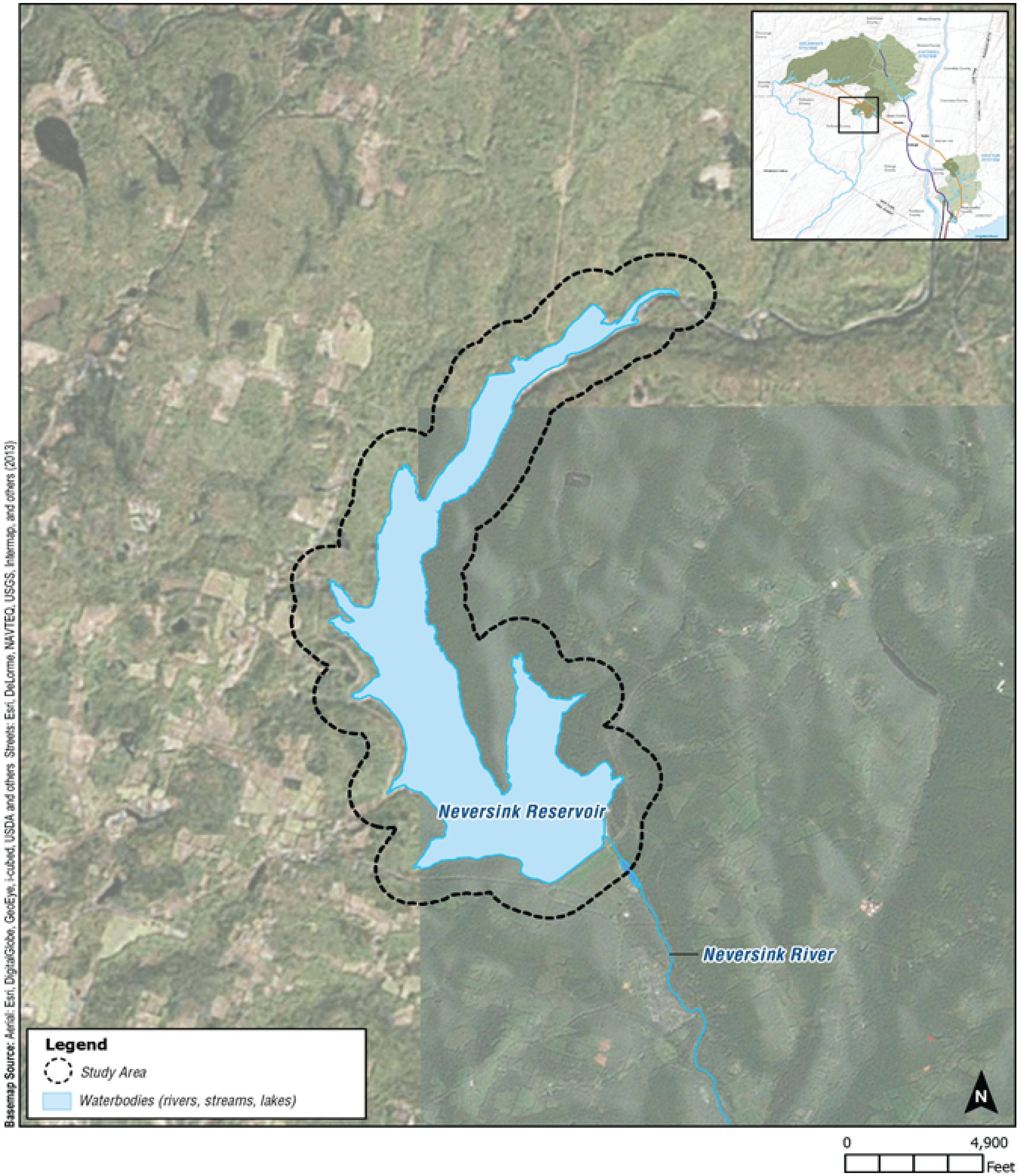


Figure 10.3-14: Neversink Reservoir Study Area

advance of the summer drawdown season. When conditions are dry, releases per the FFMP and diversions for water supply purposes could result in drawdown of 90 feet or more.

Neversink Reservoir operations would continue to follow the FFMP, and no changes to operating rules for the reservoir would occur during WSSO. During the pre-shutdown period, water surface elevations in Neversink Reservoir would be marginally lower than typical conditions by up to 4 feet (see **Figure 10.3-15**). During the temporary shutdown of the RWBT, water surface elevations in Neversink Reservoir would be marginally higher than typical conditions by up to 15 feet (see **Figure 10.3-15**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Neversink Reservoir. Therefore, no further analysis is warranted for the Neversink Reservoir Study Area.

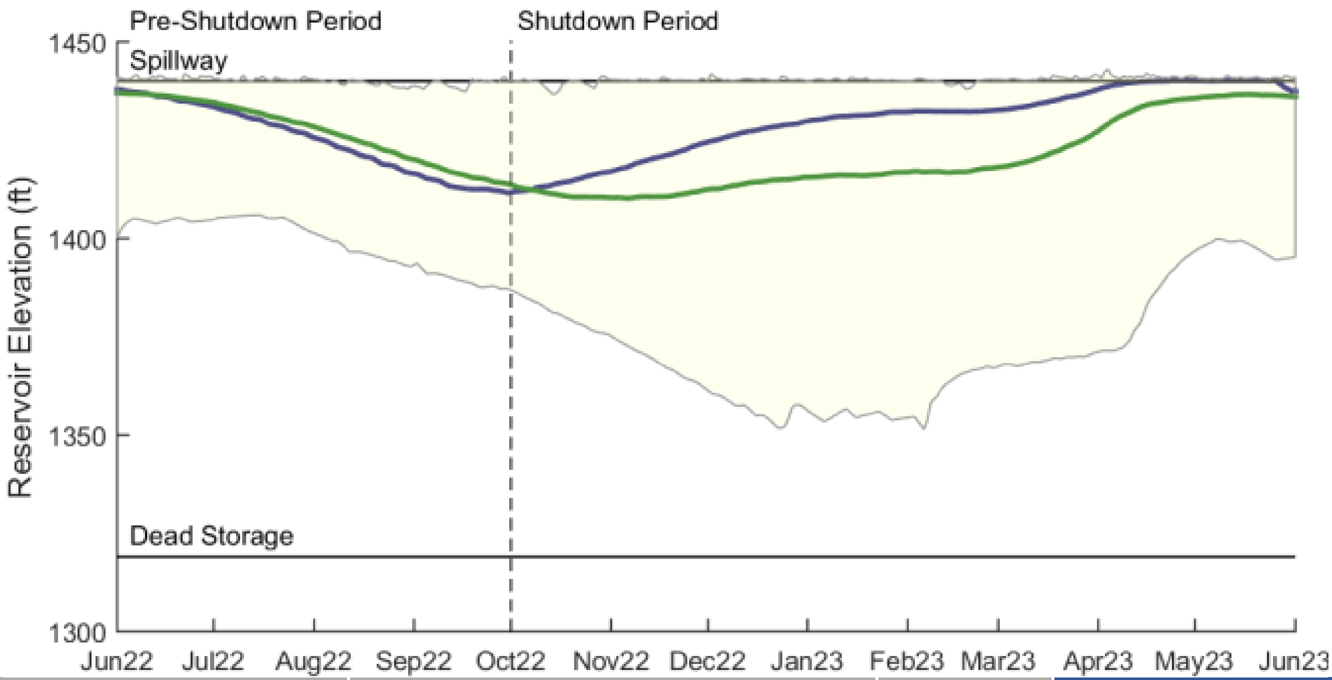
10.3.6 NEVERSINK RIVER DOWNSTREAM OF NEVERSINK RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.6.1 Study Area Location and Description

Neversink River downstream of Neversink Reservoir flows approximately 40 miles through several villages and hamlets, including Roses Point, Myers Grove, Oakland Valley, Fallsburg, South Fallsburg, Hasbrouck, and Woodbourne in Sullivan County, New York, and Huguenot, Cuddebackville, and Godeffroy in Orange County, New York, before joining with the Delaware River at Port Jervis, New York (see **Figure 10.3-16**). It is a high quality stream that supports diverse, healthy flora and fauna, including a population of endangered dwarf wedgemussel (*Alasmidonta heterodon*). The river sustains numerous fish species, including wild trout, and is stocked annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, occur along the river, but to a more limited extent. The Neversink River is classified as B(T) along its entire length from the Neversink Dam to the confluence with the Delaware River.

10.3.6.2 Study Area Evaluation

Under typical operations, DEP releases water to the Neversink River from Neversink Reservoir per the FFMP and manages the reservoir storage to limit spills. Releases are highest during wet conditions and lowest when conditions are dry. The reservoir has the capacity to release up to approximately 123 mgd over a sustained period. Flows of this magnitude frequently occur when releases are made in accordance with the FFMP for the purpose of maintaining the Conditional Seasonal Storage Objective. Despite proactive management of Neversink Reservoir's storage, the reservoir can spill during wet weather conditions. Based on modeling analyses, under typical operations, monthly average daily releases could range from approximately 13 mgd up to approximately 123 mgd, the maximum release capacity (see **Figure 10.3-17**). Monthly average daily spills can range from 0 mgd to approximately 440 mgd and are generally lowest in the summer and fall and highest in the spring (see **Figure 10.3-18**). Daily spills can reach approximately 4,300 mgd. Spills can occur during any month but are more frequent and of larger magnitude during high inflow months (March through May).



		Typical Operations			WSSO	
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	Difference between Typical and WSSO Dataset Means (feet)
Pre-Shutdown Period	June	1436	1404	1440	1436	0
	July	1432	1405	1440	1430	-2
	August	1424	1397	1438	1421	-3
	September	1417	1390	1438	1413	-4
Shutdown Period	October	1411	1381	1438	1414	3
	November	1411	1369	1440	1421	10
	December	1414	1357	1440	1427	13
	January	1416	1355	1439	1431	15
	February	1417	1362	1439	1432	15
	March	1422	1369	1439	1435	13
	April	1433	1382	1440	1440	7
	May	1436	1398	1440	1440	4

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.3-15: Elevation Dataset Mean and Range for Typical Operations and WSSO – Neversink Reservoir Study Area

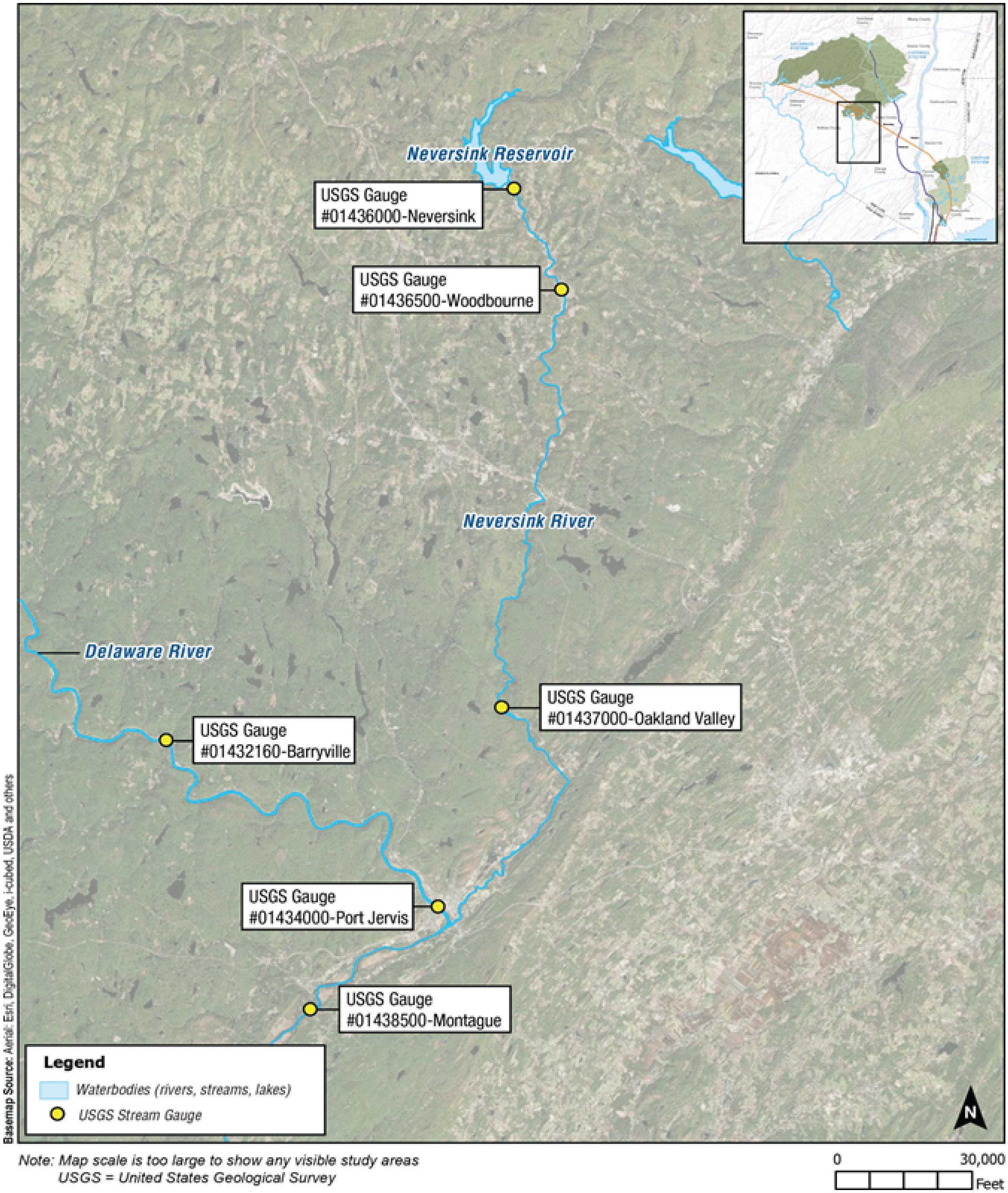
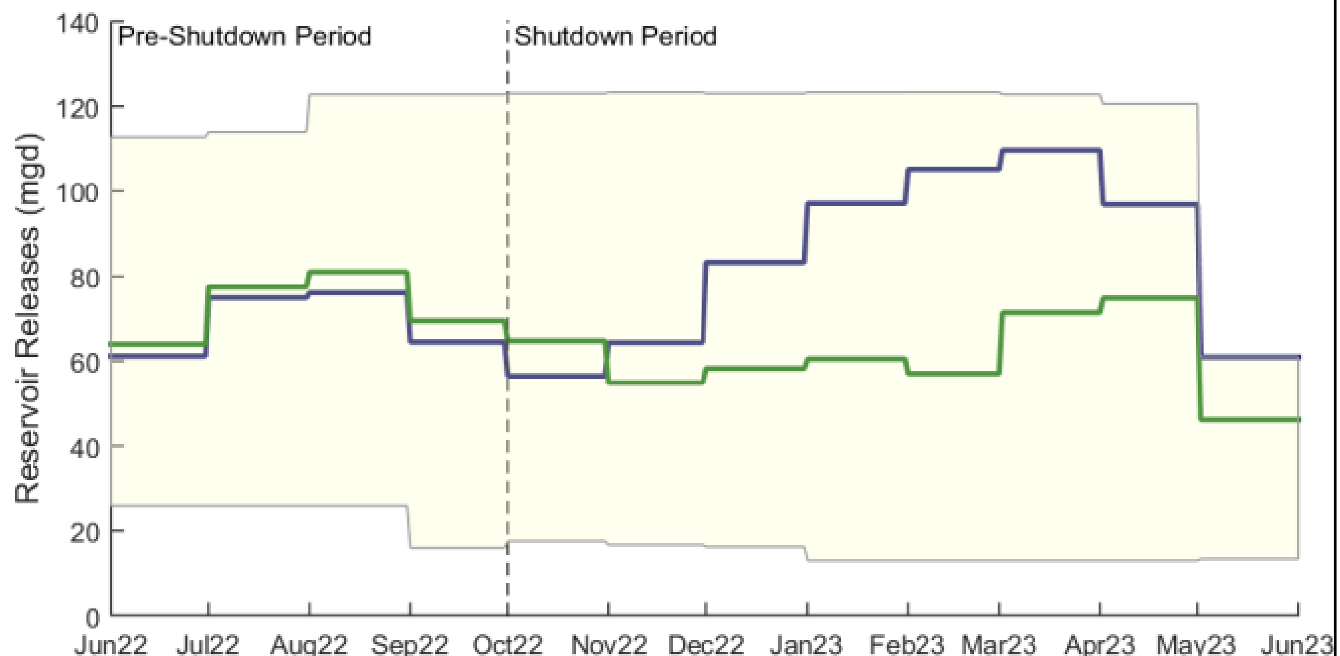
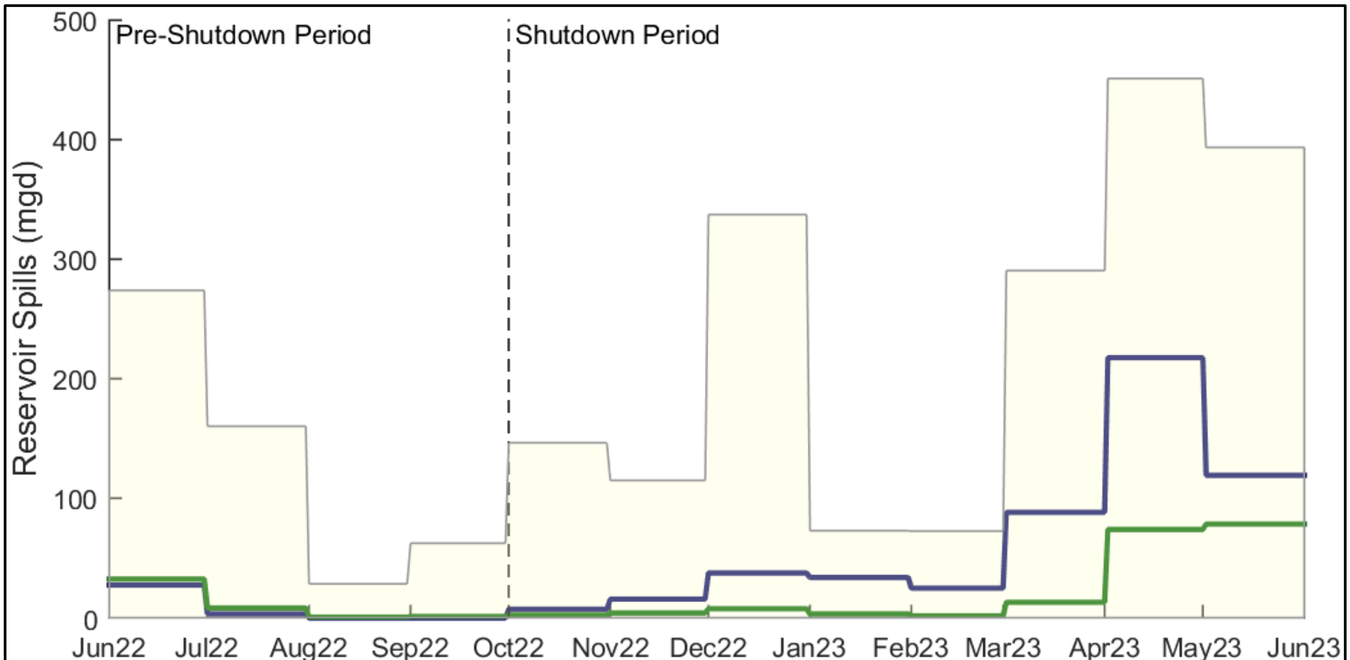


Figure 10.3-16: Neversink River Downstream of Neversink Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	64	26	113	61	-3
	July	77	26	114	75	-2
	August	81	26	123	76	-5
	September	69	16	123	64	-5
Shutdown Period	October	65	18	123	56	-9
	November	55	17	123	64	9
	December	58	16	123	83	25
	January	61	13	123	97	36
	February	57	13	123	105	48
	March	71	13	123	110	39
	April	76	13	123	98	22
	May	46	13	60	61	15

Figure 10.3-17: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Neversink River Downstream of Neversink Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	32	0	274	27	-5
	July	8	0	160	3	-5
	August	1	0	28	0	-1
	September	1	0	62	0	-1
Shutdown Period	October	2	0	146	7	5
	November	4	0	115	16	12
	December	8	0	337	38	30
	January	3	0	73	34	31
	February	2	0	75	25	23
	March	12	0	284	83	71
	April	73	0	441	219	146
	May	79	0	396	123	44

Figure 10.3-18: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Neversink River Downstream of Neversink Reservoir Study Area

During the pre-shutdown period, releases and spills into the Neversink River would be marginally lower than typical conditions by up to approximately 5 mgd (see **Figure 10.3-17** and **Figure 10.3-18**). During the temporary shutdown of the RWBT, releases into the Neversink River would be higher than typical conditions by up to approximately 48 mgd (see **Figure 10.3-17**). During this period, spills into the Neversink River would be higher than typical conditions by up to approximately 146 mgd (see **Figure 10.3-18**). The dataset mean during WSSO for both spills and releases would remain within the range of typical operations. As stated previously, releases from Neversink Reservoir would remain consistent with the FFMP, which includes compliance with required minimum releases.

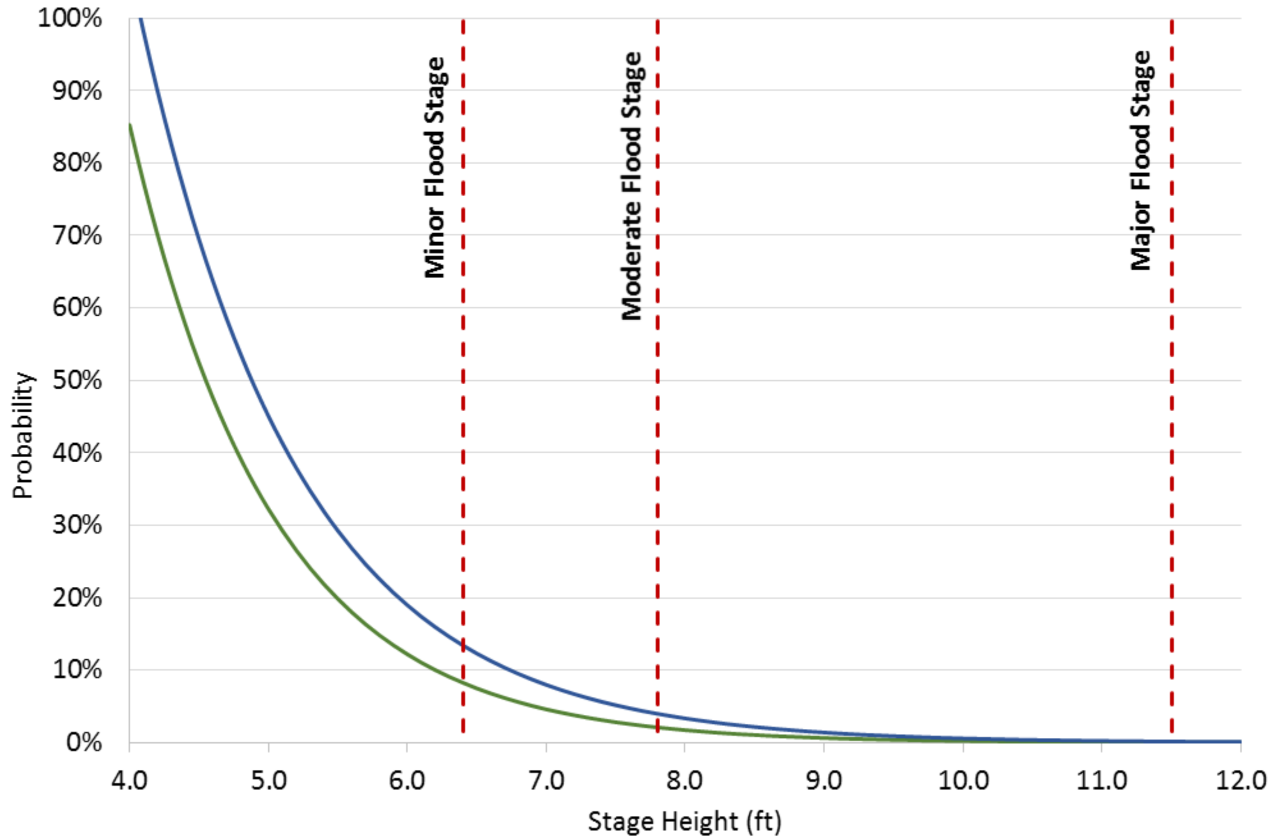
During the RWBT temporary shutdown, the modeling results indicate that there would be a minor increase in the probability of high flows downstream of Neversink Reservoir due to large storm events (see **Figure 10.3-19** and **Figure 10.3-20**). The USGS gauge at Neversink, immediately downstream of the dam does not have NWS flood stages associated with it. Estimated flood stages are included for this location based on flood stages at the Neversink Dam. Additionally, the next gauge downstream at Bridgeville with NWS flood stages delineated is also shown. However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would not be the cause of flooding. In fact, the reservoir would reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when it would be full and spilling. The results of the modeling indicate that there would be a minor, temporary reduction in this attenuation during the RWBT temporary shutdown as indicated by the minor increase in probability of flows reaching flood stage which would be an approximately five percentage point increase in minor flooding and an approximately two percentage point increase in moderate flooding at the Neversink gauge. There would be a slight increased probability of major flooding at this location (see **Figure 10.3-19**). The Bridgeville gauge location would experience similar increases for minor and moderate flooding, and would experience an approximately 1 percentage point increase in major flooding (see **Figure 10.3-20**).

Modeling results predict that the dataset mean for spills and releases (flows) would remain within those observed during typical operations, releases would remain in compliance with the FFMP, and there would only be minor reductions in the ability of Neversink Reservoir to attenuate large storm events. Therefore, there would be no significant adverse impacts to Neversink River downstream of Neversink Reservoir from WSSO and no further analysis of Neversink River downstream of Neversink Reservoir is warranted.

10.3.7 DELAWARE TUNNELS STUDY AREA IMPACT ANALYSIS

10.3.7.1 Study Area Location and Description

The Delaware Tunnels Study Area consists of the West Delaware Tunnel between Cannonsville Reservoir and Rondout Reservoir, East Delaware Tunnel between Pepacton Reservoir and Rondout Reservoir, and Neversink Tunnel between Neversink Reservoir and Rondout Reservoir. The sole purpose of the tunnels is to convey water between the respective reservoirs for water supply purposes. Each of these tunnels is equipped with hydroelectric turbines that generate electricity when the tunnels are in operation. Hydropower facilities on the East Delaware and Neversink Tunnels are operated by DEP, while hydropower facilities on the West Delaware Tunnel have been leased to a private corporation.

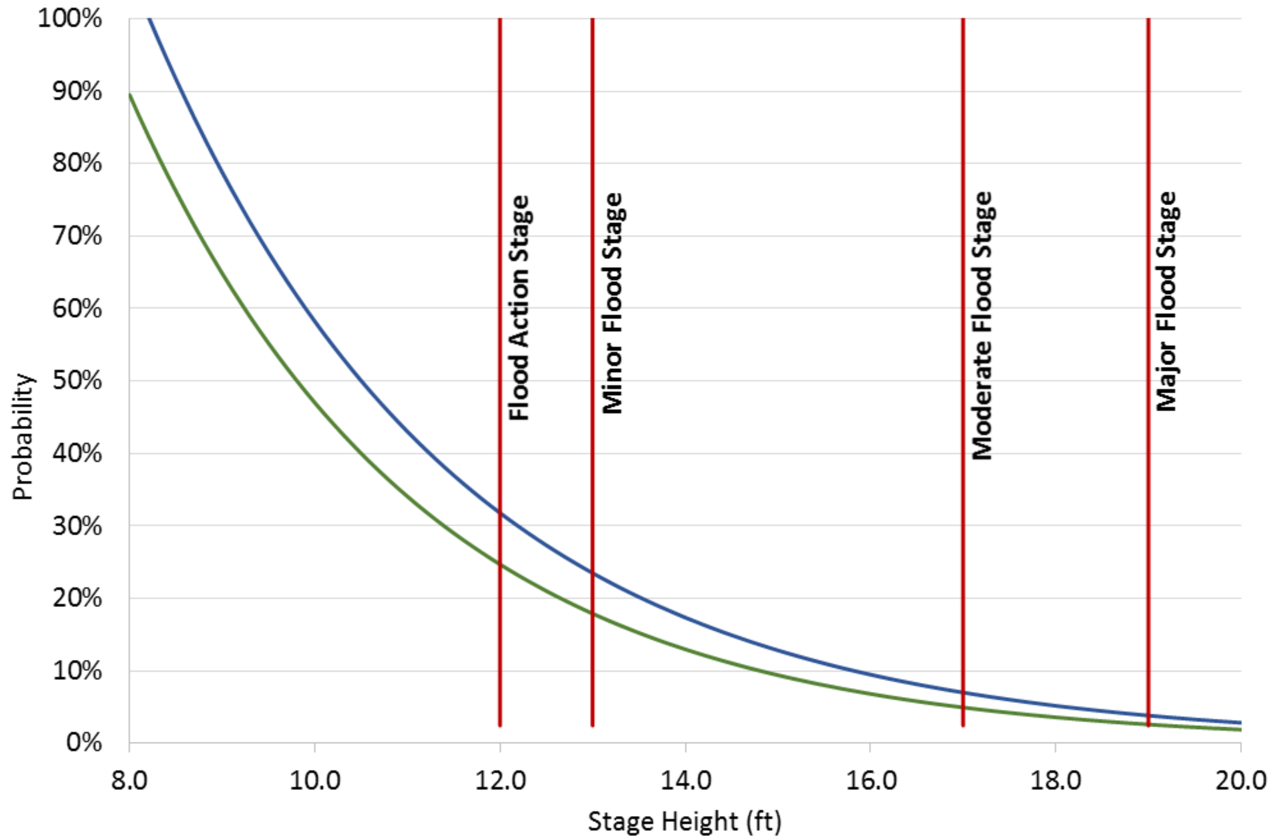


	Typical	WSSO	Difference (perc pts)
Minor Flood Stage	8.3%	13.4%	+5.2
Moderate Flood Stage	2.1%	4.0%	+1.9
Major Flood Stage	0.1%	0.2%	+0.1

Notes: The USGS Neversink Gauge is located approximately 1/3 mile downstream of the Neversink Dam. National Weather Service flood stages are not delineated for this location. Flood stages have been estimated based on the flood stage delineations at the Neversink Dam.

Legend
WSSO
Typical

Figure 10.3-19: Annual Probability of High Flow Stage at Neversink USGS Gauge – Neversink River Downstream of Neversink Reservoir Study Area



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	24.7%	31.8%	+7.1
Minor Flood Stage	17.9%	23.5%	+5.6
Moderate Flood Stage	4.9%	7.0%	+2.1
Major Flood Stage	2.6%	3.8%	+1.2

Note: The USGS Bridgeville Gauge is located approximately 15 miles downstream of the Neversink Dam.

Legend
WSSO Typical

Figure 10.3-20: Annual Probability of High Flow Stage at Bridgeville USGS Gauge – Neversink River Downstream of Neversink Reservoir Study Area

10.3.7.2 Study Area Evaluation

Maximum flow through the West Delaware Tunnel, East Delaware Tunnel, and Neversink Tunnel is 485 mgd, 715 mgd, and 500 mgd, respectively. During the RWBT temporary shutdown from October through May, flows would drop to zero for the full 8 months. While tunnel flows fluctuate regularly based on water supply system operational needs, the change that would occur during the RWBT temporary shutdown represents a deviation from typical operations.

10.3.7.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature, and would not affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because variations would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Delaware Tunnels Study Area and no further analysis is warranted.

The consistency of reduced tunnel flows as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in tunnel flows. Therefore, WSSO would not result in significant adverse impacts to public policy within the Delaware Tunnels Study Area.

10.3.7.4 Socioeconomic Conditions

While reduced tunnel flows would result in the temporary reduction in electricity generation across a portion of 2 years at the respective tunnel hydropower facilities, the overall electricity production at these facilities is small and is not expected to affect utility rates. The hydropower facilities are not manned, so there are no anticipated changes to the private power corporation or DEP personnel. Further, reduced tunnel flows during the temporary shutdown would not cause other indirect or direct effects to factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and would not physically impact, or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.6 Open Space and Recreation

Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and would not impact open space and recreation resources in the study area. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.7 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and not impact historic and cultural resources. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.9 Visual Resources

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and not impact visual resources in the study area. Therefore, WSSO would not result in significant adverse impacts to visual resources within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.10 Natural Resources

There would be no construction associated with WSSO in the Delaware Tunnels Study Area and the tunnels have no surface expressions. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact natural resources in the study area. Therefore, WSSO would not result in significant adverse impacts to natural resources within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.11 Hazardous Materials

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact hazardous materials in the study area. Therefore, WSSO would not result in significant adverse impacts to hazardous materials within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.12 Water and Sewer Infrastructure

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact water and sewer infrastructure in the study area. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure within the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.13 Energy

All of the power generated by Delaware Tunnels Study Area is transmitted through the electricity grid administered by New York Independent System Operator (NYISO). NYISO manages the electricity grid in New York and ensures that sufficient power is continuously available throughout the State. NYISO also administers and monitors New York’s wholesale electricity market, which has more than $10 billion in annual transactions, over 400 market participants, and daily and hourly auctions that match producers and consumers of power. Through NYISO, electricity can be sold and consumed from any location on the grid.

The Neversink Tunnel and East Delaware Tunnel hydropower plants are owned and operated by DEP. The electricity generated by both plants is sold on the wholesale market through NYISO and supplied to the grid. The West Delaware Tunnel hydropower plant is owned by DEP and leased to private power corporation. The private corporation sells the electricity directly through Power Purchase Agreements, which are transmitted via the grid, or on the wholesale electricity market through NYISO.

The average net electricity generation in New York between 1990 and 2013 was approximately 137,000,000 megawatt hours (MWh) per year (see **Figure 10.3-21**). Based on the October through May generation data for the hydropower facilities between 2007 and 2014, the total generation from all three facilities ranged between approximately 97,000 and 145,000 MWh. In the future without the temporary shutdown, it is assumed that use of the Delaware Tunnels would generally remain the same as baseline conditions.

The total loss of electricity generation during the RWBT temporary shutdown would represent a maximum of 0.1 percent reduction in the average annual generation in the State. Further, the annual net generation fluctuates by approximately +/- 4,500,000 MWh from year to year in the State; the loss of electricity generation during the RWBT temporary shutdown would be less than 4 percent of the annual variability over the past 20-plus years.

The temporary loss of generation during the RWBT shutdown would not impact regional availability of electricity. Therefore, WSSO would not result in significant adverse impacts to energy in the Delaware Tunnels Study Area and no further analysis is warranted.

10.3.7.14 Transportation

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact transportation in the study area. Therefore, a transportation impact analysis from WSSO within the study area is not warranted.

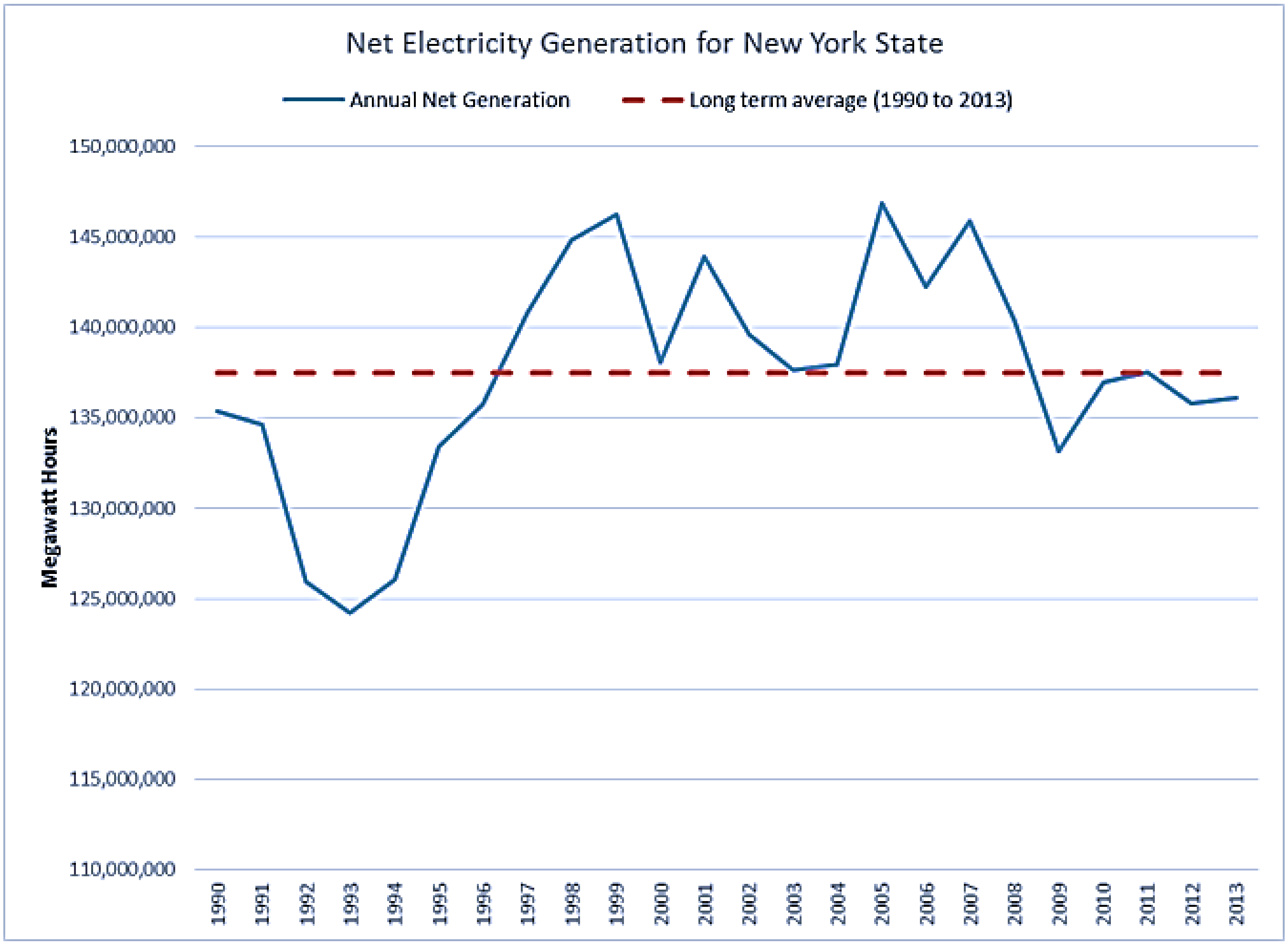


Figure 10.3-21: Net Electricity Generation in New York State

10.3.7.15 Air Quality

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact air quality in the study area. Therefore, an air quality impact analysis from WSSO within the study area is not warranted.

10.3.7.16 Noise

There would be no construction associated with WSSO in the Delaware Tunnels Study Area. Activities at this study area would consist of reduced tunnel flows, which would be temporary in nature and are not anticipated to impact noise in the study area. Therefore, a noise impact analysis from WSSO within the study area is not warranted.

10.3.7.17 Neighborhood Character

Reduced tunnel flows associated with WSSO in the Delaware Tunnels Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, a neighborhood character impact analysis from WSSO within the study area is not warranted.

10.3.7.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from reduced tunnel flows associated with WSSO to the Delaware Tunnels Study Area during the temporary shutdown. Therefore, a public health impact analysis from WSSO within the study area is not warranted.

10.3.8 RONDOUT RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.8.1 Study Area Location and Description

Rondout Reservoir is one of four reservoirs in the City's Delaware Water Supply System and was placed into service in 1950. The reservoir serves as the central collecting reservoir for the Delaware System, receiving water from Pepacton, Cannonsville, and Neversink reservoirs. The reservoir is located along the Ulster and Sullivan County border along the southern edge of the State's forever-wild Catskill Park and is formed by impounding Rondout Creek approximately 5 miles upstream of Napanoch, New York (see **Figure 10.3-22**). The reservoir consists of a single basin that is approximately 6 miles in length and holds approximately 50 billion gallons at full capacity. Spills and releases discharge into the continuation of Rondout Creek, and diversions flow to West Branch Reservoir via the RWBT.

The Rondout Reservoir's watershed drainage basin is approximately 95 square miles and includes parts of seven towns in two counties: Fallsburg and Neversink in Sullivan County, and Denning, Olive, Rochester, Shandaken, and Wawarsing in Ulster County. Rondout Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports

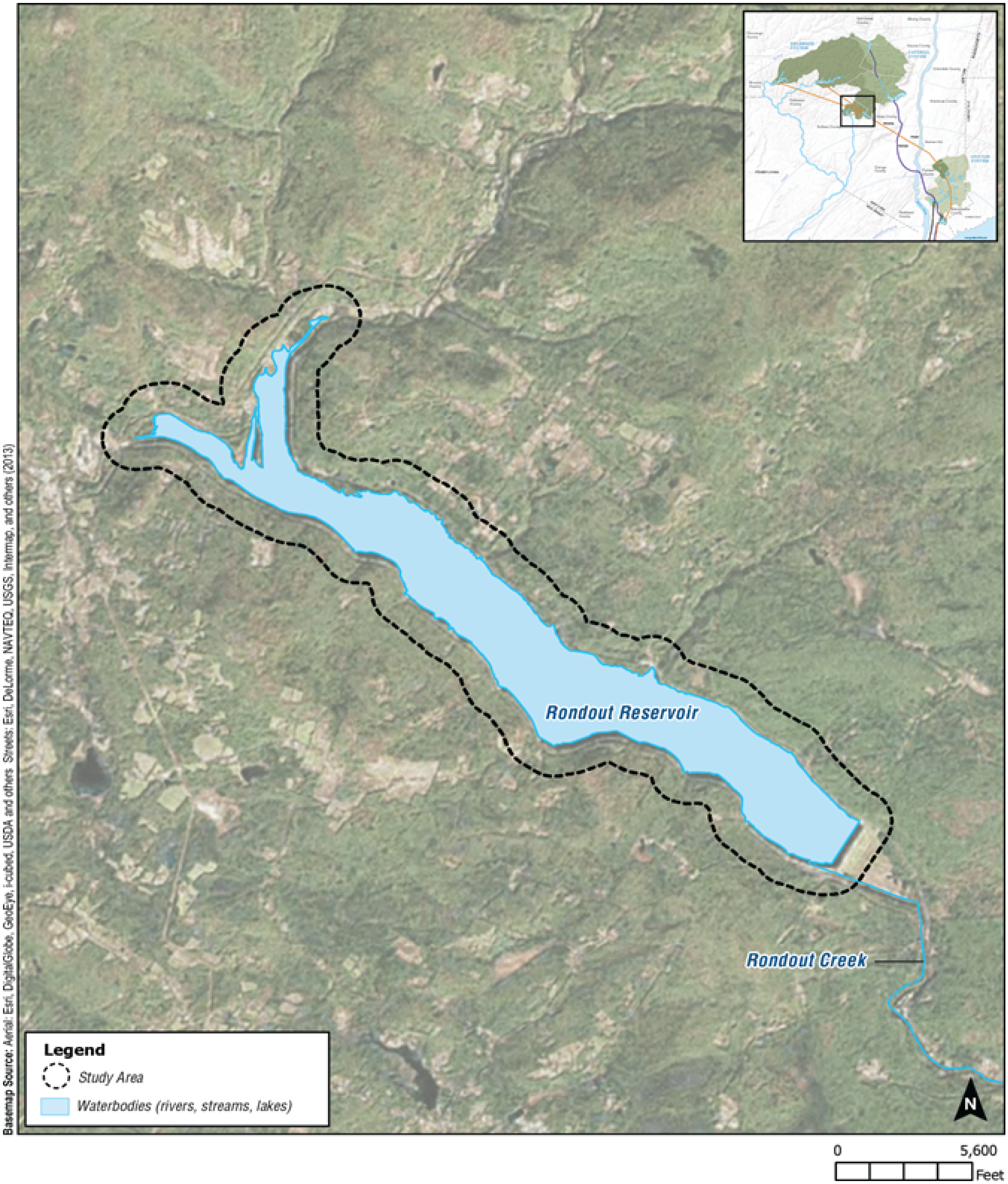


Figure 10.3-22: Rondout Reservoir Study Area

numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, though a DEP permit is required to access the reservoir. Ice fishing is prohibited. The water quality classification for Rondout Reservoir is AA(T) along its entire length. While Rondout Reservoir serves the City's customers as part of the larger Delaware System, no local communities draw directly from the reservoir.

10.3.8.2 Study Area Evaluation

In addition to changes to operations of Rondout Reservoir during WSSO described below, this study area also includes evaluation of the construction of the siphons across Merriman Dam. Under typical operations, storage is managed in Rondout Reservoir by balancing inflows, diversions from Pepacton, Neversink, and Cannonsville reservoirs, diversions to West Branch Reservoir, and releases to Rondout Creek per NYSDEC regulations. Because of its role as the central collecting reservoir for the Delaware System, current operations are designed to manage water surface elevations typically within 5 to 10 feet of the spillway (spillway water surface elevation is 840 feet), but the reservoir can be drawn down by 10 to 20 feet occasionally due to drought conditions, fluctuating supply from Pepacton, Neversink, and Cannonsville reservoirs, demand variations, and available supply from the Catskill and Croton systems (see **Figure 10.3-23**). While current operations of the reservoir are designed to limit drawdown, water surface elevations have fluctuated more under historical operations. **Table 10.3-1** presents historical drawdowns of Rondout Reservoir, which are also shown on **Figure 10.3-23**). The reservoir is managed such that it spills infrequently, typically only due to extreme storm events.

Table 10.3-1: Rondout Reservoir Historical Drawdowns [1,2]

Start Date	End Date	Max Drawdown Water Surface Elevation (Feet)	Average Drawdown Water Surface Elevation (Feet)	Duration (Months)
July 1980	May 1981	756	793	11
September 1982	January 1983	802	816	5
October 1984	December 1985	794	809	15
June 1991	April 1992	774	800	11
September 1993	March 1994	798	813	7

Notes:
1 Spillway water surface elevation is 840 feet, and dead storage water surface elevation is 723 feet.
2 Water quality information from DEP for historical drawdown and refill indicated there was no adverse change to water quality of diversions due to the large fluctuations in water surface elevations.

During the pre-shutdown from June through September, diversions from Rondout Reservoir via the RWBT would increase in order to draw down the reservoir water surface elevation to 800 feet by the start of the temporary shutdown in October. Releases to Rondout Creek would continue per NYSDEC regulations during this period. Once the shutdown commences, diversions from Pepacton, Neversink, and Cannonsville reservoirs would cease along with diversions to West Branch Reservoir via the RWBT.

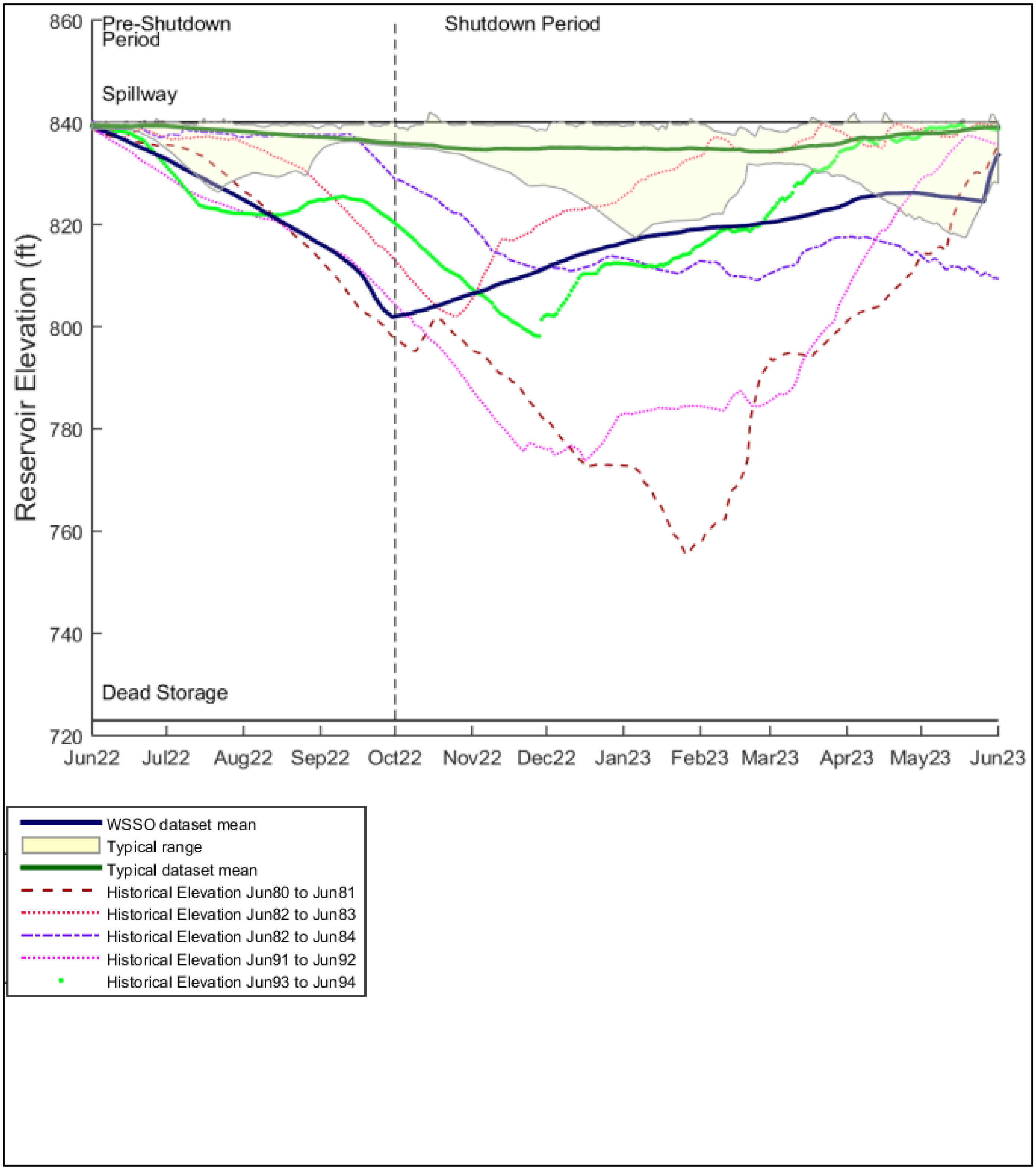


Figure 10.3-23: Elevation Dataset Mean and Range for Typical Operations and WSSO – Rondout Reservoir Study Area (Sheet 1)

		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	839	838	840	836	-3
	July	839	830	839	829	-10
	August	838	830	839	821	-17
	September	837	836	839	810	-27
Shutdown Period	October	835	835	839	804	-31
	November	835	830	839	809	-26
	December	835	824	839	814	-21
	January	835	820	838	818	-17
	February	835	827	838	820	-15
	March	835	831	838	822	-13
	April	837	825	840	826	-11
	May	838	821	840	826	-12

Figure 10.3-23: Elevation Dataset Mean and Range for Typical Operations and WSSO – Rondout Reservoir Study Area (Sheet 2)

Because the existing release structure is hydraulically limited to approximately 15 mgd, three temporary siphons would be constructed over Merriman Dam to transfer water to Rondout Creek and manage natural inflows to minimize spills. These siphons would provide additional release capacity from Rondout Reservoir. Each siphon would have a maximum release capacity of approximately 80 mgd, making the total maximum release capacity to Rondout Creek approximately 260 mgd for three siphons and the existing release structure. The potential impacts associated with additional releases from the siphons to Rondout Creek are addressed as part of Section 10.3.9, "Rondout Creek Downstream of Rondout Reservoir Study Area Impact Analysis." Siphons would be available at the beginning of the shutdown in October, but would only begin operation when water surface elevation is either equal to or greater than approximately 820 feet (see **Table 10.3-2**).

Table 10.3-2: Rondout Reservoir Siphon Hydraulic Performance Design

Water Surface Elevation (Feet)	One Siphon Operation (mgd)	Two Siphon Operation (mgd)	Three Siphon Operation (mgd)
819.1	0	0	0
819.2	10	20	30
820.2	40	80	120
821.8	65	130	195
822.7	75	150	225
823.7	82	164	246
826.2	82	164	246
829.9	82	164	246
835.0	82	164	246
839.5	82	164	246

Notes:

Siphon flows would be regulated with valves to maintain individual siphon flow below approximately 82 mgd to prevent excessive suction pressure on the siphon pipes. The effective capacity is, therefore, less than the hydraulic capacity at reservoir water surface elevations above approximately 823.7 feet.

Total release from Rondout Reservoir would be the siphon flow plus the flow through the existing releases structure (maximum release rate of approximately 15 mgd).

In addition to the siphons, the existing release structure, which can release up to approximately 15 mgd, would continue to operate through the duration of WSSO. Siphons would be available for the duration of the shutdown and flows would fluctuate based on reservoir elevations per the hydraulic design presented in **Table 10.3-2**. However, DEP would temporarily cease siphon operation when flows along Rondout Creek at the USGS Rosendale Gauge are within 1 foot of the flood action stage in order to not contribute to downstream flooding. Following a temporary curtailment of flows, the siphons would be reactivated and flow control valves would be used to ramp flows back up slowly over a number of days to prevent scour of stream banks. Upon completion of the RWBT temporary shutdown, the siphons would no longer be operated and would be removed.

During the pre-shutdown period, water surface elevations in Rondout Reservoir would be lower than typical by up to approximately 27 feet (see **Figure 10.3-23**). During the temporary shutdown of the RWBT, water surface elevations in Rondout Reservoir would be lower than typical by up to approximately 31 feet (see **Figure 10.3-23**). The dataset mean for water surface elevations for Rondout Reservoir during WSSO fall outside of the typical range from July during the pre-shutdown through the following May. Water surface elevations in Rondout Reservoir are anticipated to return to typical conditions in June following the end of the temporary shutdown of the RWBT. While the level of drawdown anticipated for Rondout Reservoir is not unprecedented, the reservoir has not experienced sustained drawdown in many years. Therefore, additional analysis of the potential for impacts was warranted for Rondout Reservoir.

10.3.8.3 Land Use, Zoning, and Public Policy

The only construction activities in the Rondout Reservoir Study Area would be the construction of siphons and associated control equipment, which would occur on DEP property. Construction activities and variations in water surface elevations would be temporary in nature and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alter existing zoning within the surrounding area. For these reasons, and because variations would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Rondout Reservoir Study Area and no further analysis is warranted.

The consistency of variations in water surface elevations as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in reservoir water surface elevations or receiving waterbody flows. For the Rondout Reservoir Study Area, which includes construction of siphons, local codes were also evaluated for implications to construction work. Therefore, WSSO would not result in significant adverse impacts to public policy within the Rondout Reservoir Study Area and no further analysis is warranted.

The zoning code of the Town of Wawarsing regulates the use of land and any structures placed on a property, including the existing public service/utility land use at Rondout Reservoir. Public and semi-public uses are permitted within rural residential districts subject to site plan review and compliance with §112-5, supplementary regulations applicable to public utilities.

> *§112-18f, General commercial and industrial standards, Lighting*
>
> *Lighting standards require that illumination be the minimal amount necessary for security and safety, and all lighting over 2,000 lumens meet the full cut-off standard of the Illuminating Engineering Society of North America (IESNA).*

Additionally, the Town of Wawarsing Noise Control Law (§78-4) prohibits "the operation of any source of sound" that exceeds the sound level limit of 73 dBA between the hours of 6 AM and 10 PM and 63 dBA between the hours of 10 PM and 6 AM "when determined by a sound-level measure at the adjoining property line nearest to the sound source." Construction at the Rondout Reservoir Study Area would be in compliance with these local codes.

10.3.8.4 Socioeconomic Conditions

Potentially substantial changes in water surface elevation for Rondout Reservoir during the temporary shutdown would not cause indirect or direct effects to factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.5 Community Facilities and Services

The only construction activities in the Rondout Reservoir Study Area would be the construction of siphons and associated control equipment, which would not be a staffed facility. Construction would occur on DEP property and would not be located near existing community facilities. Construction would be temporary and is estimated to occur over approximately 7 months, which would not result in changes to demands on community services. Otherwise, reduced water surface elevations would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.6 Open Space and Recreation

The Rondout Reservoir and surrounding watershed lands provide recreational opportunities in the form of fishing and is stocked with trout by NYSDEC. DEP provides site access via 30 access gates surrounding Rondout Reservoir (see **Figure 10.3-24**). Fishing at Rondout Reservoir occurs at the shoreline or while in non-motorized boats. Boat storage for use in the reservoir is provided by DEP along the shoreline. There are approximately 1,130 privately owned boats stored at the Rondout Reservoir, which are launched from the shoreline.

DEP has consulted with the Towns of Wawarsing and Neversink and Ulster and Sullivan Counties, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the Rondout Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, would continue. Therefore, in the future without WSSO, it is assumed that use of the Rondout Reservoir would generally remain the same as baseline conditions. While some changes in use could occur as a result of State and local fishing regulations in response to normal fluctuations in user interaction across the State, it is assumed that future open space and recreation conditions without WSSO would be the same as baseline conditions.

As described above, changes could occur to the water surface elevation of the reservoir as a result of the temporary shutdown and drawdown of the Rondout Reservoir. Further, construction of the siphons could temporarily limit access at 1 of the 30 gates surrounding the reservoir.

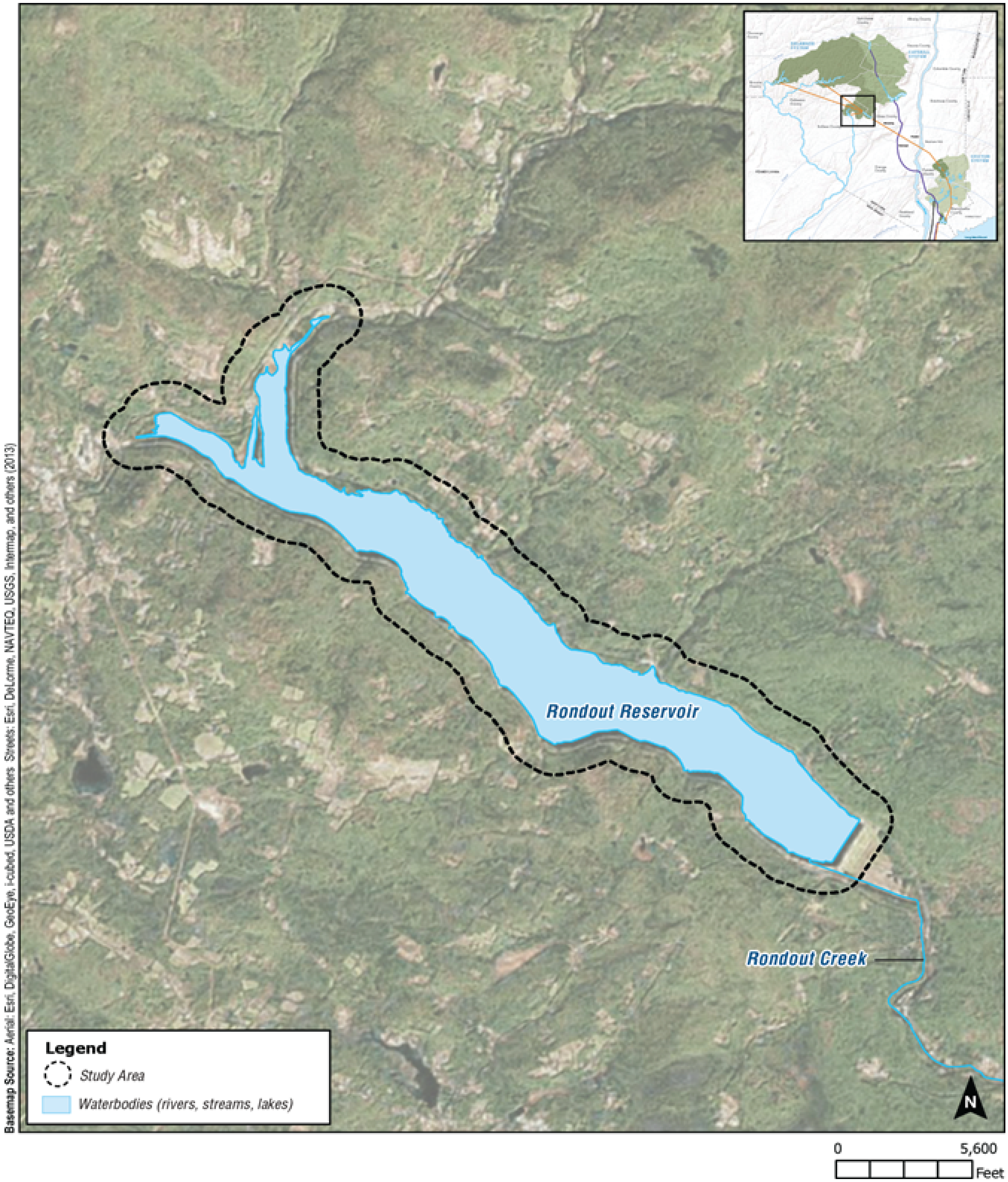


Figure 10.3-24: Open Space and Recreation Resources – Rondout Reservoir Study Area

Drawdown associated with the pre-shutdown period and the first 2 months of the shutdown would coincide with peak angling in the Catskill System, which generally occurs from April through November, due to a combination of angler-interest and NYSDEC angling regulations. During WSSO, reservoir drawdown could create difficulties for launching and retrieving DEP-permitted boats. However, lower water surface elevations would not be anticipated to affect fisheries in Rondout Reservoir (see Aquatic and Benthic Resources in Section 10.3.8.10, "Natural Resources").

DEP outreach efforts would serve to notify recreational users of potential changes to reservoir access in advance of the RWBT temporary shutdown, as is standard for planned changes at DEP reservoirs. Notifications would disclose any special regulations required during shutdown operations.

While fishing from the shore would still be possible under drawdown conditions, minor inconveniences related to boat usage and fishing could occur during shutdown operations. If permitted boat users wanted to move boats to another DEP reservoir, they would need to follow DEP protocol for obtaining new permits and washing boats before moving boats to a different reservoir. Temporary inconveniences to boating for the purpose of fishing would be similar to those that occurred during historical drawdowns of a similar magnitude anticipated during WSSO (see **Table 10.3-1**). Therefore, WSSO would not result in significant adverse impacts to recreation and open space within the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.7 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.8 Historic and Cultural Resources

The only construction activities in the Rondout Reservoir Study Area would be the construction of siphons and associated control equipment, which would occur on fill material from the original dam construction. Land disturbance would be minimal and consist of grading for slab-on-grade construction of an approximately 10-foot by 10-foot shed. The only mechanism for potential historic or cultural resources impacts from WSSO would be through erosion. While water surface elevations at Rondout Reservoir would be lower during the RWBT temporary shutdown than typical operations, erosion is not likely (see Geology and Soils in Section 10.3.8.10 "Natural Resources").

The State Historic Preservation Office was consulted, and their review, dated September 15, 2015, indicated WSSO would have no impact to historic and cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.9 Visual Resources

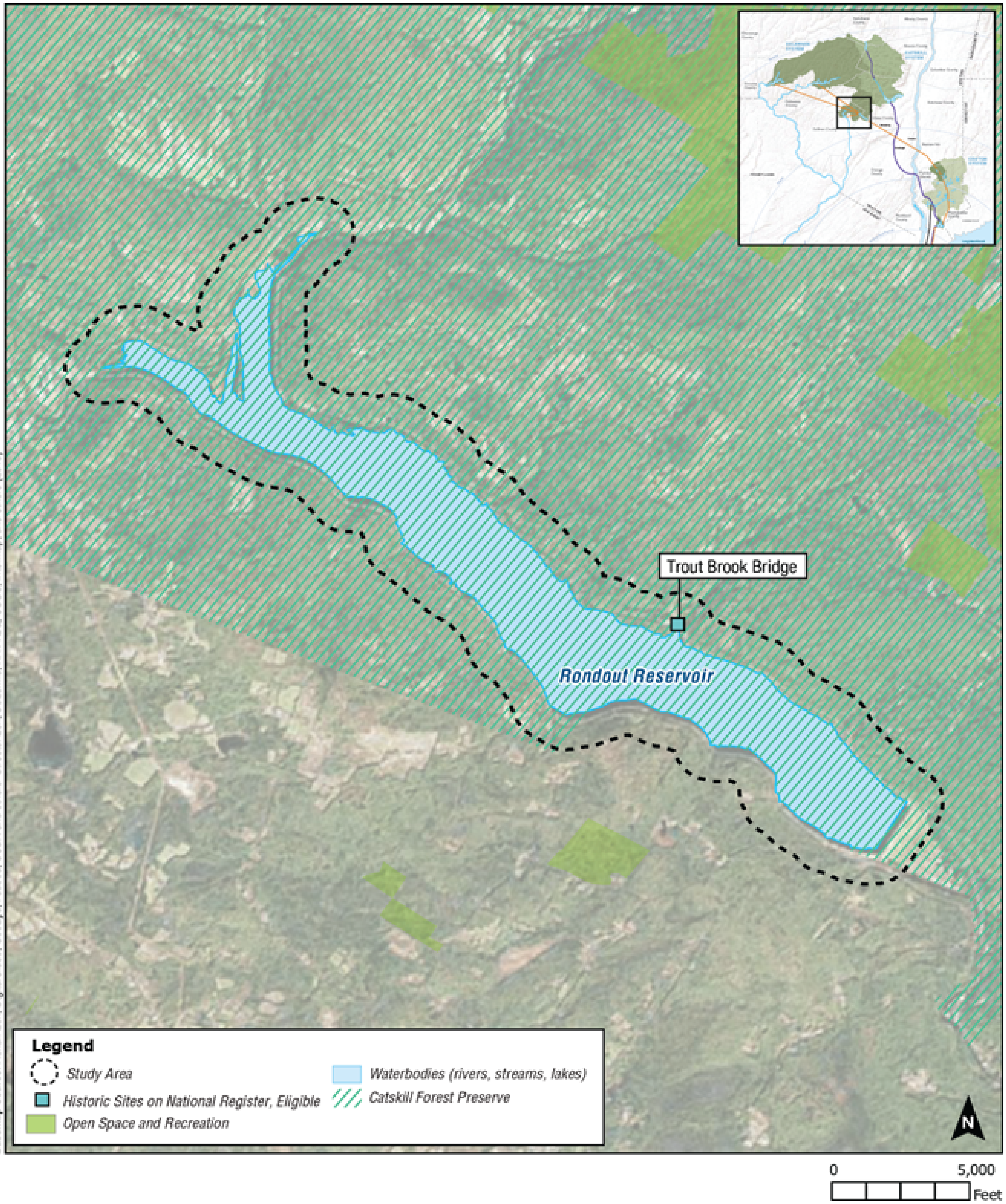
The boundary of the Rondout Reservoir Study Area is a 0.25-mile buffer around the reservoir. It also includes view corridors that extend further based on the locations that are publicly accessible. Visual resources, consisting of one structure eligible for listing on the National Register of Historic Places, one State park, and one local resource (the reservoir itself and its surrounding watershed lands) were identified within the Rondout Reservoir Study Area, as shown on **Figure 10.3-25**.

The structure that is eligible for listing under the National Register of Historic Places is the Trout Brook Bridge. The State park is the Catskill Park, which includes the Catskill Forest Preserve. The local resource includes the reservoir, Rondout Reservoir. As described above, changes could occur to the water surface elevation of the reservoir as a result of the temporary shutdown and drawdown of the Rondout Reservoir.

The Trout Brook Bridge is State Route 55A as it crosses over the Trout Brook, just north of the Rondout Reservoir. The Catskill Park includes approximately 700,000 acres with approximately 287,500 acres preserved as State Forests. It covers mountainous areas of public and private lands in Ulster, Greene, Delaware, and Sullivan counties, New York. Rondout Reservoir is the local resource and is situated near the southern perimeter of the Catskill Park's boundary, but it is not located in a section dedicated to tourism or recreation and there are no view corridors or viewsheds specific to the study area. The Rondout Reservoir is almost completely surrounded by heavily forested watershed lands, limiting many views of the reservoir from the visual resources noted above. Recreational users with valid permits would have direct views of Rondout Reservoir.

DEP has consulted with the Towns of Wawarsing and Neversink and Ulster and Sullivan Counties, and it is DEP's understanding that no new projects or structures that would alter views from visual or aesthetic resources are anticipated within the Rondout Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Therefore, in the future without WSSO, it is assumed that visual resources within the Rondout Reservoir Study Area would be the same as baseline conditions.

During the temporary shutdown, releases from Rondout Reservoir would result in lower than typical water surface elevations in the reservoir (see **Figure 10.3-23**). This would occur during the pre-shutdown operations, and may persist through the duration of the RWBT temporary shutdown. The operations would be temporary in nature and, as noted above, the views of Rondout Reservoir from the Catskill Park are limited due to the vegetation surrounding the reservoir. Limited, obstructed views could occur through the vegetation during WSSO. Views of Rondout Reservoir from the Trout Brook Bridge could reveal a very limited unobstructed view of a small portion the reservoir with potential lower water levels, although the glancing views would occur while traveling along State Route 55A and would not be anticipated to impact the enjoyment of the visual resources. As noted above, Rondout Reservoir is a local visual resource that provides recreational shoreline fishing and non-motorized boat fishing to the public with a DEP watershed access permit. Recreational users of Rondout Reservoir would be expected to have an unobstructed view of the reservoir with potential lower water levels, although these



GIS Data Source: NYS OPRHP - Pub. Date: February 2007
Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Figure 10.3-25: Visual Resources – Rondout Reservoir Study Area

would be temporary in nature, with views restored to baseline conditions upon completion of WSSO. Temporary effects to visual resources would be similar to those that occurred during historical drawdowns of a similar magnitude anticipated during WSSO (see **Table 10.3-1**). Views during these events consisted of large expanses of dry, rocky soil around the edge of the reservoir. Therefore, a visual resources impact analysis related to temporary reservoir drawdown within the study areas is not warranted.

During shutdown operations, releases from Rondout Reservoir would be increased through the use of siphons. The siphons would be located along a portion of the reservoir that is not located within Catskill Park and is not visible from Trout Brook Bridge. However, the siphons would be visible from the adjacent public road. The installation and operation of the siphons would be visible from only one visual resource, the southern portion of the Rondout Reservoir. The siphons consist of three pipes that would be installed up and over Merriman Dam. Due to the small footprint associated with their construction and distance from a majority of the reservoir, construction and operation of the siphons would have minimal effects to visual resources in the study area (see **Figure 10.3-26).** Therefore, a visual resources impact analysis related to temporary siphons within the study areas is not warranted.

For the Rondout Reservoir Study Area, which includes construction of siphons, changes in views to and from visual resources may have the potential to occur with the use of nighttime lighting. The assessment considered applicable local codes pertaining to lighting, the most recent edition of the Illuminating Engineering Society Handbook, and the most recent edition of the American National Standard Practice for Roadway Lighting (RP-8) approved by the American National Standards Institute to evaluate whether nighttime lighting has the potential to affect nearby sensitive resources. Lighting to be used during construction at the Rondout Reservoir Study Area would be the minimal amount necessary for security and safety, and all lighting over 2,000 lumens would meet the full cut-off standard of the Illuminating Engineering Society of North America. Full cut-off standards generally include shielding of the lights to avoid light spilling onto adjacent properties. As such, construction at the Rondout Reservoir Study Area would comply with the Town of Wawarsing code related to lighting standards. Therefore, a visual resources impact analysis related to temporary nighttime lighting within the study areas is not warranted.

Therefore, WSSO would not result in significant adverse impacts to visual resources in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.10 Natural Resources

The potential for impacts to natural resources from WSSO within the Rondout Reservoir Study Area is discussed below.

Geology and Soils

While the reservoir has the potential to be drawn down more than typical, the reservoir is drawn down on a regular basis up to approximately 5 to 10 feet under typical operations. As such, much of the reservoir shoreline is rocky, and therefore shallower sections of the reservoir within this 5-foot to 10-foot range would not be anticipated to be impacted by the deeper drawdown.

Figure 10.3-26: Rendering of Rondout Reservoir Siphons – Rondout Reservoir Study Area

The drawdown could expose unconsolidated sediment in the sections of the reservoir that have not been exposed in a number of years (see **Table 10.3-1**). Rainfall and runoff could mobilize this unconsolidated material into the reservoir. This movement of material would not be widespread since tributary inflows tend to become channelized, and, as such, form stable streambeds within the reservoir over time that would not be susceptible to erosion. Temporary effects to geology and soils would be similar to those that occurred during historical drawdowns of a similar magnitude anticipated during WSSO (see **Table 10.3-1**). Therefore, WSSO would not result in significant adverse impacts to geology and soils in the Rondout Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted for the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. During the period of the temporary reservoir drawdown, it is possible that the fringe areas around the reservoir would experience a lower water table than under typical operating conditions. During the drawdown period, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor but is not anticipated to be significantly affected by the drawdown. While the reservoir has the potential to be drawn down more than typical and for a longer duration than typical, as described previously, the reservoir has been drawn down considerably under prior historical operations (see **Table 10.3-1**). Temporary drawdown of the reservoir more than typical or for a longer duration would not result in any permanent changes to ecological communities in the vicinity of the Rondout Reservoir Study Area from WSSO.

Construction of the temporary siphons at Rondout Reservoir would occur on previously disturbed property. This property is primarily composed of mowed lawn and some tree cover. No tree clearing would be needed to facilitate construction of the temporary siphons. Any disturbance related to the construction of the temporary siphons would occur on previously disturbed land and would be returned to baseline conditions following the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the Rondout Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary drawdown of the Rondout Reservoir would not result in substantive changes within the study area to critical wildlife habitat, wildlife movement, or its ability to forage or breed. As discussed previously, the reservoir would be drawn down below typical conditions, which would result in a temporarily altered shoreline. These temporary changes would not prevent terrestrial wildlife from using the reservoir for behaviors such as foraging or breeding. The drawdown is not anticipated to result in effects on the fish community (see Aquatic and Benthic Resources in Section 10.3.8.10, "Natural Resources"). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the reservoir would still have a source of prey in the reservoir. Much of the reservoir shoreline is rocky, which is not conducive to supporting abundant wildlife. Any changes experienced by wildlife from WSSO would be temporary and minor.

Construction of the temporary siphons at Rondout Reservoir would result in the disturbance to a small amount of area on DEP property for a small shed and generator pad, along with area for staging during construction. This work would occur on existing disturbed area that includes gravel and mowed lawn. Any loss of habitat would be minor and temporary and the area would be restored to baseline conditions after WSSO. Therefore, WSSO would not result in significant adverse impacts to wildlife in the Rondout Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Rondout Reservoir Study Area were identified based on consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Rondout Reservoir Study Area include the following: Blocks 5363C, 5363D, 5463C, 5362B, and 5462A. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the Rondout Reservoir Study Area include the Grahamsville and Rondout Reservoir Quadrangles. In total, these sources identified species with the potential to occur in the Rondout Reservoir Study Area. Desktop assessments were conducted to assess the potential habitat for these species. Baseline ecological information and assessments for the Rondout Reservoir Study Area for these species can be found in **Table 10.3-3**. Based on the assessment results, there would be no significant adverse impacts to federal/State Threatened, Endangered and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species as a result of changes in reservoir water surface elevations at Rondout Reservoir. Construction of the temporary siphons at Rondout Reservoir would result in the grading and clearing of a small area of DEP property. No tree clearing would occur as a result of this construction.

Table 10.3-3: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Amphibians and Reptiles				
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Bog turtles prefer fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and mucky. Vegetation commonly includes calciphile species. Vegetation is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of core bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require large open water environments for any part of their natural history.	Desktop assessments of wetlands occurring in the study area were conducted. Wetlands in the study area with a water table connected to the reservoir may experience minor temporary effects to wetland vegetation resulting from reservoir drawdown. Any wetlands that share a water table with the reservoir would have historically experienced fluctuating conditions. Fluctuating water tables are not typical of suitable bog turtle habitat (Feaga et al. 2012). Drawdown of the reservoir would not influence other wetlands in the study area that are not hydrologically connected to the reservoir and that potentially contain suitable bog turtle habitat. Construction of the temporary siphons would not result in impacts to any wetlands. Therefore, no effects to bog turtles are anticipated and no further analysis for bog turtles is warranted for this study area.
Timber Rattlesnake (*Crotalus horridus*)	None	Threatened	Timber rattlesnakes primarily inhabit deciduous forests in mountainous terrain; however, in summer they can be found in lower elevation coniferous forests, mixed forests, old fields, and near wetlands. Timber rattlesnakes find dens to overwinter in that are located on mountain slopes with southern exposure, where canopy coverage is less than complete, and where there is access to subterranean environments. The timber rattlesnake is found in the Hudson Highlands, with concentrations in the Catskill and Shawangunk Mountains (Gibbs et al. 2007). Timber rattlesnakes do not require open water environments for any part of their natural history.	During the summer, timber rattlesnakes could be found at lower elevations including at Rondout Reservoir. However, timber rattlesnakes are not aquatic species and do not utilize open water for any aspect of their natural history. The drawdown would not affect the upland environments that they could be using for foraging or basking. Reproduction and hibernation occur in mountainous environments well outside the influence of Rondout Reservoir. Construction of the temporary siphons would not result in the disturbance to any timber rattlesnake habitat. Therefore, no effects to timber rattlesnakes are anticipated and no further analysis for timber rattlesnakes is warranted for this study area.

Table 10.3-3: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments for their natural history.	NYNHP identified breeding Bald Eagles that occur on the shoreline of Rondout Reservoir. The temporary Rondout Reservoir drawdown would have temporary effects on the reservoir's fishery and Bald Eagle foraging habitat. Therefore, WSSO may affect, but is unlikely to adversely affect Bald Eagles in this study area. Potential effects to Bald Eagles were assessed for this study area.
Cooper's Hawk (*Accipiter cooperii*)	None	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests, but they are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require open water environments for any part of their natural history.	Cooper's Hawks prey primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to Rondout Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Construction of the temporary siphons at Rondout Reservoir would not include any tree clearing. Therefore, no effects to Cooper's Hawks are anticipated further analysis for Cooper's Hawks is warranted for this study area.
Sharp-shinned Hawk (*Accipiter striatus*)	Protected - MBTA	Special Concern	Sharp-shinned Hawks nest in mixed, coniferous, and deciduous forests, but nest sites are most frequently in wooded areas with a dense canopy cover, small-diameter trees, and high tree density (Hames and Lowe 2008). Sharp-shinned Hawks do not require open water environments for any part of their natural history.	Sharp-shinned Hawks prey primarily on other woodland birds and inhabit a variety of forested habitats. Temporary drawdown of Rondout Reservoir would not affect Sharp-shinned Hawk habitat, breeding, or foraging. Construction of the temporary siphons at Rondout Reservoir would not include any tree clearing. Therefore, no effects to Sharp-shinned Hawks are anticipated and no further analysis for Sharp-shinned Hawks is warranted for this study area.

Table 10.3-3: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-shouldered Hawk (*Buteo lineatus*)	Protected - MBTA	Special Concern	In New York, Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas or flooded swamps/wetlands. Breeding Bird Atlas data show a steady increase in Red-shouldered Hawk populations, particularly in the Hudson River, as farmland reverts to forest, resulting in increased habitat. Red-shouldered Hawks occasionally nest in suburban areas where forest cover is less contiguous. Migration and wintering habitats are similar to breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Crocoll 2008). Red-shouldered Hawks do not require open water environments for any part of their natural history.	Drawdown in Rondout Reservoir would not affect Red-shouldered Hawk habitat adjacent to the reservoir or affect any breeding or hunting behaviors. Construction of the temporary siphons would not include any tree clearing. Therefore, no effects to Red-shouldered Hawks are anticipated and no further analysis for Red-shouldered Hawks is warranted for this study area.
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize open water environments for foraging and migrating when they are available.	Indiana bats have the potential to utilize Rondout Reservoir for migration and feeding purposes. Drawdown of Rondout Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Construction of the temporary siphons would not include any tree clearing. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.

Table 10.3-3: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees that are 3 inches or more in diameter. These bats are opportunistic and will also roost in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize open water environments for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize Rondout Reservoir for migration and feeding purposes. Drawdown of Rondout Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Construction of the temporary siphons would not include any tree clearing. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.

Table 10.3-3: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Benthic Macroinvertebrates - Mussels				
Dwarf Wedgemussel (*Alasmidonta heterodon*) continued Dwarf Wedgemussel (*Alasmidonta heterodon*)	Endangered	Endangered	In New York, dwarf wedgemussel populations are only known to occur in reaches of the Delaware and Neversink Rivers. The Neversink River population of dwarf wedgemussel is the largest across its range. The dwarf wedgemussel lives in cool, shallow freshwater streams and rivers with moderate current and fine sediments. Dwarf wedgemussel uses a variety of substrates; however, substrates composed only of large cobble are not known to support dwarf wedgemussel. The dwarf wedgemussel has a complex life history that includes external fertilization, egg development in the female, and release of larvae/glochidia which need to contact a host fish within a few days or they die. The attached glochidium develop on the host fish and undergo metamorphosis into a juvenile mussel and then they release from the host and drift and settle on the bottom in habitat frequented by the host fish. The location they land in could or could not be suitable habitat. Pollution, erosion, sedimentation, invasive species, and hydrologic alterations are all primary drivers behind their decline across their range. Known host fish for the dwarf wedgemussel include tessellated darter (*Etheostoma olmstedi*), Johnny darter (*Etheostoma nigrum*), and mottled sculpin (*Cottus bairdi*) (USFWS 1993; Michaelson and Neves 1995; NYNHP 2013).	Rondout Reservoir is a deep lacustrine system that does not contain the geomorphology, water quality, or substrate characteristics suitable for dwarf wedgemussel habitation. Therefore, no effects to dwarf wedgemussels are anticipated and no further analysis for dwarf wedgemussels is warranted for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act.
MBTA: Migratory Bird Treaty Act.

Following the initial analysis, one species was identified as having the potential to be affected by increased drawdown in Rondout Reservoir that would occur as a result of WSSO. Therefore, an impact analyses for this species is provided below.

Bald Eagle (*Haliaeetus leucocephalus*)

Breeding Bald Eagles (*Haliaeetus leucocephalus*) were identified by NYNHP as occurring on the shores of Rondout Reservoir. Rondout Reservoir represents high quality habitat for Bald Eagles and provides ample foraging opportunities on the fisheries within the reservoir and ample nesting, perching, and roosting habitat in the trees along the reservoir shoreline. In the future without WSSO, Rondout Reservoir would continue to provide high quality habitat for Bald Eagles.

In the future with WSSO, Rondout Reservoir would be drawn down steadily during the pre-shutdown summer and into the start of the temporary shutdown. During the temporary shutdown, Rondout Reservoir would slowly recharge and return to typical water surface elevations in May at the end of the temporary shutdown. Rondout Reservoir would be drawn down when Bald Eagle mating behaviors begin in the fall. During the period of drawdown, Bald Eagles would be constructing nests, laying eggs, incubating, and hatching and rearing of young. Bald Eagles most commonly forage in the shallows of open water environments such as Rondout Reservoir; however, in the winter, they are known to forage more commonly over deeper open water. The drawdown would result in an altered shoreline, changing how the fish use the shallow areas of the reservoir. This drawdown would not cause significant adverse impacts to the fishery (see Aquatic and Benthic Resources in Section 10.3.8.10, “Natural Resources”). Both the shallows and open water areas of the reservoir would continue to be habitat for Bald Eagle prey species. Therefore, drawdown as a result of WSSO at Rondout Reservoir may affect, but is not anticipated to adversely affect, breeding, overwintering, or foraging Bald Eagles.

Construction of the temporary siphons at Merriman Dam, which would occur during the summer of 2021, would occur outside the managed range of any currently known breeding Bald Eagles at Rondout Reservoir. Prior to construction, NYSDEC would be contacted to determine if any new Bald Eagles are present at Rondout Reservoir in the vicinity of Merriman Dam and DEP would comply with all applicable Bald Eagle management regulations. Thus, there would be no effects to Bald Eagles from construction of the siphons at Rondout Reservoir.

Therefore, WSSO would not result in significant adverse impacts to Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the Rondout Reservoir Study Area and no further analysis is warranted.

Aquatic and Benthic Resources

Rondout Reservoir has a full pool surface area of approximately 2,052 acres, a mean depth of approximately 74 feet, and a maximum depth of approximately 160 feet. Most of the basin is narrow and deep with steep slopes in the littoral zone.[24] The upper one third of the basin is

[24] The littoral zone is the area along the shore of the reservoir.

moderately deep with a gently sloping shoreline. The reservoir stratifies annually, providing habitat for coldwater fishes.

The fish community in Rondout is a mix of coolwater and coldwater species. Lake trout (*Salvelinus namaycush*) and brown trout (*Salmo trutta*) are the predominant game species, which are supported by a forage base of alewife (*Alosa pseudoharengus*) and rainbow smelt (*Osmerus mordax*). Brown trout are maintained by stocking. Smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), and yellow perch (*Perca flavescens*) are also important species for anglers. Rondout Reservoir experiences minor annual drawdowns, thus the littoral zone is relatively stable compared to other Delaware basin reservoirs. However, due to the steep slopes and rocky substrates, there is a limited amount of aquatic macrophyte habitat. The relatively stable water levels may enhance spawning of shoreline nesting species compared to reservoirs with substantial drawdowns.

In the future without WSSO, typical reservoir operations would continue, and it is assumed that aquatic resources would remain as described previously.

Under typical operating conditions, Rondout Reservoir could fluctuate 5 to 10 feet over the course of a year with occasional drawdowns up to 20 feet. This mode of operation has created a relatively stable reservoir environment for aquatic life. As described previously, during the pre-shutdown, Rondout Reservoir would be drawn down more than typical. While the reservoir water surface elevation would remain lower than typical for the duration of the temporary shutdown, water surface elevations would gradually increase over the winter and spring, refilling completely once diversions from the Delaware System reservoirs resume at the end of the temporary shutdown. This change in operation would expose up to approximately 500 acres of reservoir substrate that is not typically exposed. The extent of exposed substrate would gradually decrease from the pre-shutdown through the end of the temporary shutdown.

The drawdown of the reservoir would most likely result in a temporary loss of benthic habitat in the exposed substrate. Following the shutdown, Rondout Reservoir would return to typical operations, which would renew the stable conditions and facilitate a recovery of the benthic invertebrate community. The temporary loss of benthos would have an adverse effect on feeding by littoral zone fish species, such as smallmouth bass, rock bass, and yellow perch, but the open water fish community would experience little adverse effect. The growth rate of littoral zone fishes could be reduced until the benthic community recovers from the drawdown. Timing of the drawdown may overlap with the early spring spawning of yellow perch, but this species is generally capable of accommodating reservoir drawdowns. If the drawdown adversely impacted spawning, the effect would be limited to one age class. The reservoir would be refilling during the time of spawning for smallmouth bass and other shoreline spawners, which should be able to complete spawning as the water level is rising.

Installation and use of temporary siphons would occur at Merriman Dam. The existing release structure is limited to approximately 15 mgd. The proposed siphons would have a maximum capacity of approximately 82 mgd each for a total maximum withdrawal from Rondout Reservoir of approximately 260 mgd for three temporary siphons and the existing release structure. At maximum flow, the intake velocities of the siphons would exceed 2 feet per second within a zone approximately 4 feet from the siphon intake. Beyond this zone, velocities would drop below 2 feet per second. Maximum flow, and thus maximum velocities, would occur when the reservoir water surface is at or above approximately elevation 823.7 feet. The top of the siphon intake, which is designed to be installed at elevation 805 feet, would be over 18 feet deeper. At water surface elevations below 823.7 feet, velocities would be reduced as flow decreased.

The use of the siphons has the potential to temporarily impact aquatic resources in the reservoir due to a change in water circulation within the zone of influence of each siphon, entrainment (i.e., uptake) of planktonic organisms, entrainment of mobile organisms, and mortality of entrained organisms. Entrainment of mobile organisms mainly occurs to ichthyoplankton (i.e., fish eggs and larvae) and juvenile fish, although some entrainment of adult fish can occur. Additionally, siphon modeling indicates the potential for localized scour 4 to 6 feet upstream of the siphons, which would be anticipated to entrain benthos.

The intake locations and zones of influence of the temporary siphons would be below the littoral zone. In the fall and winter, fish will be larger and more able to swim out of the zone of influence, and will also tend to be at lower depths and less active. Entrainment of eggs and larvae of yellow perch, as well as other fish species that would spawn during use of the temporary siphons, could occur; however, the effects would be limited to one year and to ichthyoplankton that enter the zone of influence.

During the RWBT temporary shutdown, diversions through the Rondout Effluent Chamber would be discontinued. Typical flows through the Rondout Effluent Chamber, which has operated nearly continuously for more than 60 years, can exceed 800 mgd. Annual average flows range between 650 and 750 mgd. The Rondout Effluent Chamber is constructed with a series of rectangular gates for diverting water located at multiple depths ranging from elevation 820 feet to elevation 720 feet. Under typical operations, DEP selectively withdraws water from the reservoir at the elevation with the best water quality. Velocities through these gates can reach 4 feet per second.

There is minimal shoreline habitat near the siphon intake structures, the zone of influence of the siphons is small compared to the overall size of the reservoir, and the risk of entrainment for fry, juvenile fishes, eggs, and larvae is minimal, regardless of intake velocities. Further, entrainment through temporary operation of the siphons is expected to be no worse than typical operation of the Rondout Effluent Chamber.

Therefore, temporary effects to aquatic and benthic resources from reservoir drawdown would be similar to those that occurred during historical drawdowns of a similar magnitude anticipated during WSSO (see **Table 10.3-1**). Further, other reservoirs in the Catskills, with a fish community similar to Rondout Reservoir, experience substantial drawdowns and maintain healthy fish populations that provide good sport fishery resources. In addition, DEP's experience during drought years, when notable reservoir drawdowns have occurred throughout the water supply system, has been that healthy fish populations within the reservoirs have been maintained. Use of temporary siphons would temporarily impact benthic organisms, ichthyoplankton, juvenile fish, and adult fish due to entrainment of individuals. However, the increased drawdown or siphon operation at Rondout Reservoir would not have a long-term adverse impact to aquatic or benthic resources and be similar to typical conditions associated with use of the Rondout Effluent Chamber. Therefore, WSSO would not result in significant adverse impacts to aquatic and benthic resources in the Rondout Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.3.8.2, "Study Area Evaluation"), WSSO includes the construction of siphons in this study area. The siphons include a small shed and concrete generator pad that would be constructed on an existing gravel area. As such, runoff from the Rondout Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the Rondout Reservoir Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the Rondout Reservoir Study Area within existing floodplains. Lower than typical water surface elevations that would occur in the Rondout Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the Rondout Reservoir Study Area and no further analysis is warranted.

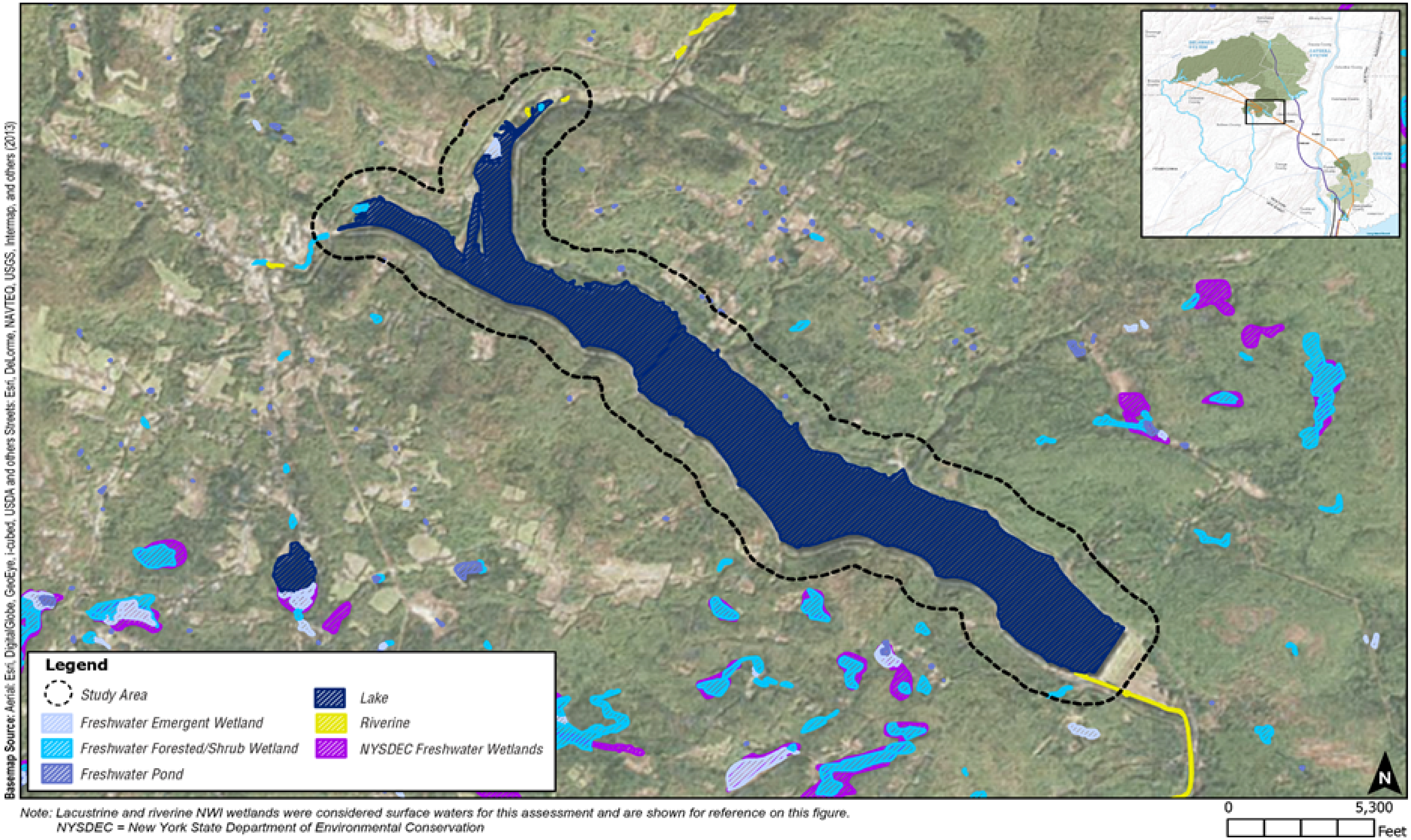
Groundwater

While the reservoir has the potential to be drawn down more than typical and for a longer duration, similar or more severe drawdown has occurred in the past and may occur in the future under typical operations. Further, groundwater movement is typically from hilltops to streams and reservoirs in the region. Therefore, aside from minor, temporary changes to the surficial aquifer immediately adjacent to the reservoir, there would not be any widespread changes to groundwater from WSSO in the Rondout Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to groundwater in the Rondout Reservoir Study Area and no further analysis is warranted.

Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the Rondout Reservoir Study Area (see **Figure 10.3-27**). The study area extends 0.25 mile around the reservoir and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on Rondout Reservoir. There are no NYSDEC-mapped wetlands within or intersecting the study area. There are 14 USFWS NWI-mapped wetlands within or intersecting the study area. The 14 USFWS NWI wetlands cover approximately 18 acres and consist of 1 emergent wetlands, 6 scrub/shrub or forested wetlands, and 7 ponds.

In the future without WSSO, there would be no change from typical operations and management of Rondout Reservoir. Adjacent and nearby wetlands would not be affected in the future without the project. Therefore, wetlands within the Rondout Reservoir Study Area in the future without WSSO are assumed to be the same as baseline conditions. Wetlands along the tributary streams or located inland at higher elevations would be unaffected by reservoir drawdown during the shutdown because they are above the full pool elevation and are not influenced by reservoir water, and lowered reservoir elevations are not anticipated to impact groundwater that may source some of these wetlands. Most of the mapped wetlands in the Rondout Reservoir Study Area occur in landscape positions (i.e., separated from the reservoir by elevation or landform)



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

Figure 10.3-27: Wetlands Resources – Rondout Reservoir Study Area

that would not be influenced by the proposed drawdown of Rondout Reservoir. Some of the mapped wetlands are located in shallow areas along the reservoir edge, also referred to as fringe wetlands.

Drawdown at Rondout Reservoir is anticipated to begin in June preceding the temporary shutdown in October, and extend into the following spring. Typical reservoir elevations are anticipated to return in June following the temporary shutdown. Drawdown of Rondout Reservoir is part of the normal operation of the water supply system. The level of drawdown anticipated for the temporary shutdown of the RWBT has been experienced during past operation of the reservoir, including the summer of 1980 through the spring of 1981, the winter of 1984 through the winter of 1985, the summer of 1991 through the spring of 1992, and the fall of 1993 through winter of 1994, and is anticipated under future typical operation of the Delaware System (see **Figure 10.3-23**).

Drawdowns that occur at different times of year can affect fringe wetland vegetation differently. Drawdowns in the middle of the growing season in summer would affect fringe wetland vegetation differently than reservoir drawdown in the spring when the growing season is beginning. During winter through spring drawdowns, under typical climactic conditions, early spring vegetation such as spring ephemerals may not emerge or would be stressed due to the different hydrologic conditions. Emergence of other vegetation may similarly be affected. During summer drawdowns, under typical climactic conditions, vegetation that has emerged may experience adverse effects to vegetation growth, flowering, or fruit production. Regardless of season, stress to fringe wetland vegetation can be triggered by even small drawdowns of a foot or less depending on rooting depth and other characteristics of individual plants. Surface water fluctuations of this magnitude are typical for water supply reservoirs and are part of the typical hydrologic conditions for wetlands occurring on the fringes of water supply reservoirs. Furthermore, the seed bank and root stock of the fringe wetlands are typically robust and would not be anticipated to be permanently impacted by up to one growing season of lowered reservoir elevations.

Additionally, because the temporary shutdown of the RWBT would only commence in non-drought conditions, it is anticipated that Rondout Reservoir, its watershed, and the fringe wetlands of Rondout Reservoir would still receive rainfall and runoff in amounts consistent with typical (i.e., non-drought) conditions. Upon refilling of Rondout Reservoir, the fringe wetlands would be anticipated to return to their typical condition. Therefore, WSSO would not result in significant adverse impacts to wetlands in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes). The only construction activities in the Rondout Reservoir Study Area would be the construction of siphons and associated control equipment, which would occur on fill material from the original dam construction. Land disturbance would be minimal and consist of grading for slab-on-grade construction of an approximately 10-foot by 10-foot shed. Further, the potential for erosion within the reservoir is low and is not anticipated to result in widespread changes to the reservoir bed (see Geology and Soils in Section 10.3.8.10, “Natural Resources”).

Based on the limited land disturbance and low potential for erosion at Rondout Reservoir, WSSO would not result in significant adverse impacts to hazardous materials in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls at the study area. While water surface elevations would be lower than typical, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.3.8.10, “Natural Resources”). Further, WSSO would not include any construction that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.13 Energy

Changes to water surface elevations in the Rondout Reservoir Study Area during the temporary shutdown would have no effect on energy usage or consumption. Operation of the siphons would primarily be by gravity flow, but would require minimal power for initial priming, control equipment, and valve actuators. Therefore, WSSO would not result in significant adverse impacts to energy in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.14 Transportation

Most project-generated traffic would use Interstate 87 and State Route 299 to reach the study area, and State Route 55 and State Route 55A to access the work site. State Route 55 is classified as a two-lane rural major collector with a posted speed limit of 45 mph. The 2011 traffic volume along State Route 55 was approximately 790 vehicles per day for both directions combined (NYSDOT) with 60 vehicles in the AM peak hour and 70 vehicles in the PM peak hour. State Route 55A is a two-lane rural minor collector with a posted speed limit of 45 mph. The 2010 traffic volume along State Route 55A was approximately 1,080 vehicles per day for both directions combined (NYSDOT) with 80 vehicles in the AM peak hour and 120 vehicles in the PM peak hour. There are no recent traffic counts conducted in this study area and no known changes in land use since 2010. There is no public transportation and little to no pedestrian activity in the immediate vicinity of the study area.

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP’s understanding that no changes in land use or an increase in traffic due to outside developments are anticipated within the Rondout Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that traffic, public transportation, and pedestrian activities within the study area would be similar to baseline conditions.

The proposed construction would not generate a high level of project-related traffic (e.g., employees or material delivery trucks). Activities associated with construction in the Rondout Reservoir Study Area would be short term, with work occurring during daytime hours (e.g., between 7 AM and 7 PM). The specific activity identified for the Rondout Reservoir Study Area is the construction of three temporary siphons on the spillway at Merriman Dam. This activity could generate up to approximately 29 vehicles (58 vehicle trip ends corresponding to 111 Passenger Car Equivalents [PCE]) traveling to and from the site on a peak activity day. This would increase the traffic on State Route 55 by 6 percent. The generated peak hour traffic on a peak day would be approximately 24 vehicles or 46 PCEs, of which approximately 9 vehicle trip ends (9 PCEs) would be workers and 15 vehicle trip ends (37 PCEs) would be trucks or other construction vehicles. The construction-generated traffic would not have a substantial impact to traffic operations, public transportation, or pedestrian activity on State Route 55. For the Rondout Reservoir Study Area, both the trip generation and the construction activity duration are below the CEQR-defined thresholds for further detailed traffic analysis.

Following construction, the operation of the siphons would not require additional staff. The siphons would be constructed at the location of an existing DEP facility and would not require additional staff visits beyond what is typically required at the site. Based on the limited increase in traffic volume expected during construction and operation of the siphons, WSSO would not result in significant adverse impacts to transportation in the Rondout Reservoir Study Area and no further analysis is warranted.

WSSO would result in 24 peak hour vehicle trip ends within the Rondout Reservoir Study Area, which is below the *CEQR Technical Manual* screening threshold of 50 peak hour vehicle trip ends as described in Section 10.2.3.12, "Transportation." Therefore, a traffic analysis is not warranted.

WSSO would not generate demands for public parking or transportation within the study area, and would not spur an increase in pedestrian activity within the study area. Following completion of WSSO, the Rondout Reservoir Study Area would be restored to baseline conditions. Therefore, although there would be a temporary increase in traffic, WSSO would not result in significant adverse impacts to transportation within the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.15 Air Quality

Applicable air quality data collected at the air quality monitoring station(s) nearest to the Rondout Reservoir Study Area are shown in **Table 10.3-4**. These data were compiled by NYSDEC and also includes the corresponding national ambient air quality standard (NAAQS) for each of these criteria pollutants. As indicated in the table, monitored concentrations of each pollutant are well below the NAAQS.

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP's understanding that no projects are expected to be completed within the Rondou Reservoir Study Area that would result in a change in land use, or new air emission sources that would contribute to an increase in ambient air quality pollutant concentrations within the timeframe of the impact analysis. In addition, air quality regulations associated with stationary and mobile construction

Table 10.3-4: Representative Ambient Air Quality Data Baseline Conditions

Pollutant	Monitor	Averaging Time	Value	NAAQS
CO[1]	Albany	8-Hour	0.8 ppm	9.0 ppm
		1-Hour	1.0 ppm	35.0 ppm
NO_2[2]	Botanical Gardens - Pfizer Lab	1-Hour	59.7 ppb	100 ppb
		Annual	18.4 ppb	53 ppb
$PM_{2.5}$[3]	Newburgh	24-Hour	20.2 μg/m^3	35 μg/m^3
		Annual	7.1 μg/m^3	12 μg/m^3
PM_{10}[4]	IS 52	24-Hour	39 μg/m^3	150 μg/m^3
SO_2[5]	Fishkill (Mount Ninham)	1-Hour	20.7 μg/m^3	197 μg/m^3

Notes:
1 CO monitored concentration is the highest second maximum values from the latest year of available monitoring data from NYSDEC (2013).
2 The 1-hour NO_2 monitored concentration is the 3-year average (2011-2013) of the 98th percentile of daily maximum 1-hour concentrations. Annual NO_2 monitored concentration is the maximum annual average from the latest year of available monitoring data from NYSDEC (2013).
3 24-hour $PM_{2.5}$ background concentration is the average of the 98th percentile for the latest 3 years of available monitoring data from NYSDEC (2011-2013). Annual $PM_{2.5}$ monitored concentration is the maximum annual average from the latest year of available monitoring data from NYSDEC (2013).
4 24-hour PM_{10} monitored concentration is the highest 1 maximum values from the latest year of available monitoring data from NYSDEC (2013).
5 The 1-hour SO_2 monitored concentration is the 3-year average (2011-2013) of the 99th percentile of daily maximum 1-hour average concentrations.
Source: NYSDEC, July 2014

related sources (e.g., equipment) mandated by the Clean Air Act would maintain or improve air quality in the region. Therefore, in the future without WSSO, it is assumed that air quality conditions within the study area would be the same as baseline conditions, and could improve given nationwide trends toward lower emissions.

The specific activity identified at the Rondout Reservoir Study Area that could contribute air emissions is the construction and operation of three temporary siphons on the spillway at Merriman Dam. Construction activities would result in worker vehicle trips, equipment, and supply delivery vehicles to and from the study area. For these activities, the number of units of heavy equipment would be limited (e.g., generator, compressor, cranes, front-end loader). The siphons themselves are powered by electricity from the grid and would not be a source of emissions. However, there is a small back-up generator for emergency operations during power outages. The sources of air emissions and the pollutants of concern from those types of activities are summarized in **Table 10.3-5**.

The Rondout Reservoir Study Area is surrounded by public service, residential, vacant land, and open space. However, there are no uniquely sensitive receptors immediately adjacent to the study area. The nearest sensitive receptor is a residential parcel located approximately 600 feet away from the site. The proposed construction activities would be short term over a period of up to

Table 10.3-5: Types of Construction Emission Sources

Type of Construction Emission Source	Pollutant of Concern
Fugitive dust (from grading activities)	PM
Diesel Exhaust (from heavy equipment and delivery vehicles)	NO_x/PM
Diesel Exhaust (from generator)	NO_x/PM
Notes: PM = Particulate Matter NO_x = Nitrogen Oxides	

7 months, with most work occurring during daytime hours (e.g., between 7 AM and 7 PM). Construction and operations would not generate a high level of project-related traffic in the study area. Therefore, due to the short duration and the limited number of air emission sources proposed, construction and operation of the siphons would not result in significant adverse impacts to air quality from stationary or mobile sources within the Rondout Reservoir Study Area.

Based on the limited increase in air emissions expected during construction and operation of the siphons, WSSO would not result in significant adverse impacts to air quality in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.16 Noise

The nearest representative receptor is within 1,500 feet of the siphons (see **Figure 10.3-28**). The primary noise-producing activity in the Rondout Reservoir Study Area is the construction and operation of three temporary siphons at Merriman Dam.

The study area includes two residential land uses approximately 600 and 800 feet away from the site. Peak activities in the Rondout Reservoir Study Area would occur for approximately 7 months during construction and 8 months during operation of the siphons. The construction activities were evaluated to determine compliance with local noise ordinances. The siphon construction is subject to the Town of Wawarsing Noise Control Law. The Town of Wawarsing Noise Control Law (§78-4) prohibits “the operation of any source of sound” that exceeds the sound level limit of 73 dBA between the hours of 6 AM and 10 PM and 63 dBA between the hours of 10 PM and 6 AM “when determined by a sound-level measure at the adjoining property line nearest to the sound source.” The nearest adjoining property line is a residential parcel; compliance with applicable local noise regulations in the Town of Wawarsing was evaluated at this residential parcel.

Existing noise levels within the Rondout Reservoir Study Area consist of noise created by activities and events within and immediately surrounding the study area. Existing ambient noise levels are influenced by vehicular traffic on State Route 55. **Table 10.3-6** presents daytime and nighttime noise levels for typical residential land use categories. The existing noise condition within the study area is comparable to a very quiet suburban and rural residential environment, based on proximity to major transportation corridors, population density of the area, and other noise-producing elements. Typical noise levels for very quiet suburban and rural communities are 40 dBA L_{eq} during the day and 34 dBA L_{eq} at night.

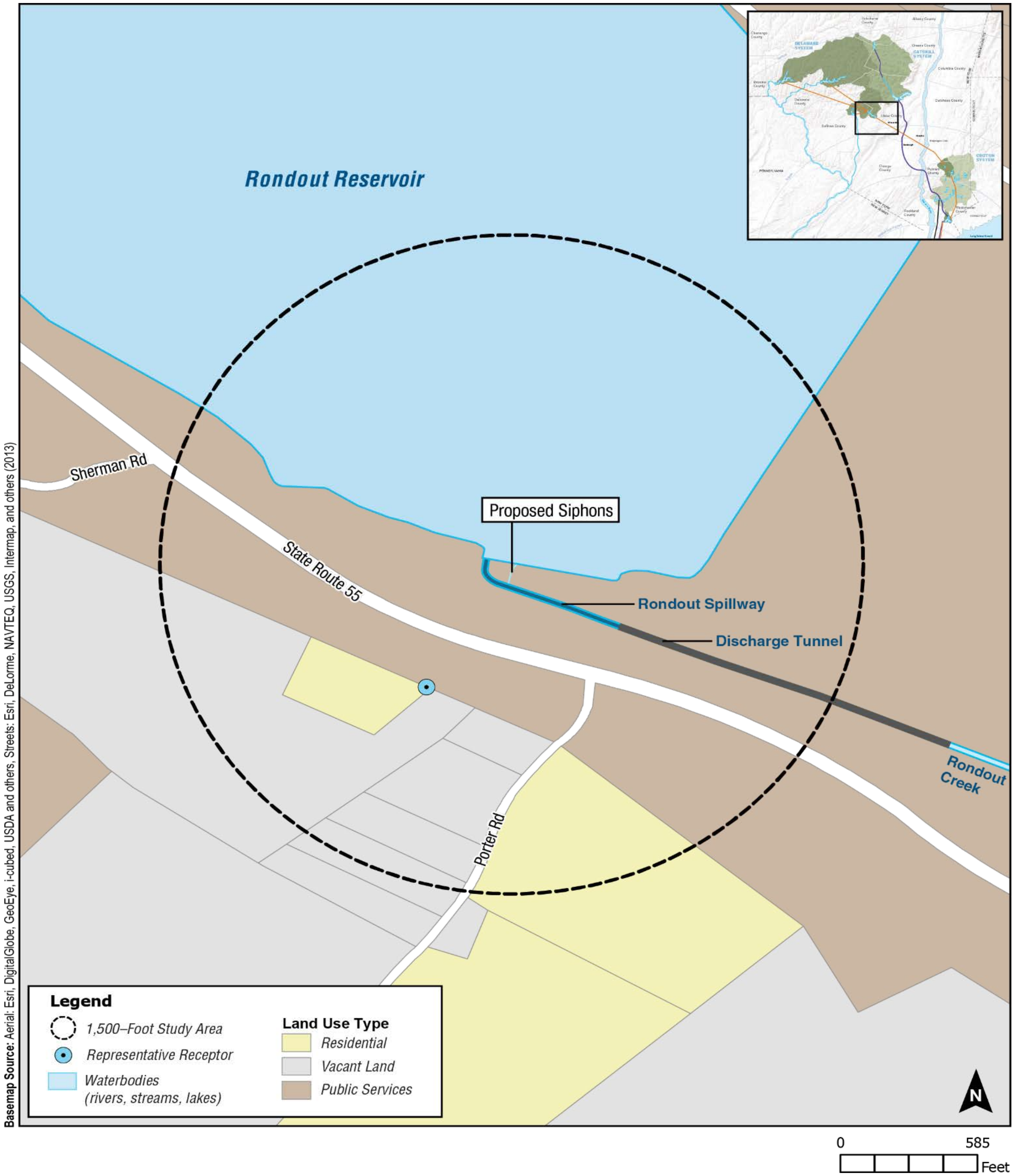


Figure 10.3-28: Noise-Sensitive Land Uses – Rondout Reservoir Study Area

NYC Environmental Protection

Table 10.3-6: Typical Daytime and Nighttime Noise Levels for Residential Land Use Categories

Residential Land Use Category	Daytime Noise Levels (L_{eq}, dBA)	Nighttime Noise Levels (L_{eq}, dBA)
Very noisy urban residential	66	58
Noisy urban residential	61	54
Urban and noisy suburban residential	55	49
Quiet urban and typical suburban residential	50	44
Quiet suburban residential	45	39
Very quiet suburban and rural residential	40	34
Source: American National Standards Institute/Acoustical Society of America S12.9 Part 3 (2013).		

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP's understanding that no projects are anticipated within the Rondout Reservoir Study Area that would result in a change in land use, or new noise-generating sources that would contribute to an increase in ambient noise conditions within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that ambient noise levels within the Rondout Reservoir Study Area would be the same as baseline conditions.

In the future with WSSO, stationary noise-producing activities would occur on DEP-owned land adjacent to the Rondout Reservoir and would include site preparation, operation of a staging area, siphon construction and operation of siphons. Five phases of construction were analyzed in the stationary construction noise analysis for the Rondout Reservoir Study Area: site preparation, structural concrete work, pipe installation, mechanical work, and electrical work. Peak noise-producing construction activities in the Rondout Reservoir site would occur between 7 AM and 7 PM, 7 days a week for approximately 7 months.

Overnight operation of heavy equipment is not anticipated during siphon construction. The equipment assumed to be operating during the primary construction phases and their reference noise levels are summarized in **Table 10.3-7**. The number and types of noise-generating equipment analyzed were conservatively based on peak construction operating conditions. ArcGIS was used to determine the distances between the siphon spillway and the nearest noise receptors. The equipment was conservatively assumed to be located in close proximity to each other at the center of the work site.

The reference noise levels were adjusted to the appropriate distances for each noise receptor assuming free field conditions with attenuation from dense tree zones where applicable.[25]

The amount of tree zone attenuation was based on methods from the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment*, May 2006. Tree zones would be expected to provide some attenuation for the residences depending on the depth and width of

[25] Free field conditions refer to an environment free from obstructions that could affect the way sound travels away from the noise source.

Table 10.3-7: Stationary Source Construction Equipment Modeled in the Rondout Reservoir Study Area and Reference Noise Levels (L_{max})

Construction Phase	Equipment Type (Quantity)	Maximum Sound Pressure Level (L_{max}) at 50 feet	Utilization (%)
Mobilization/Site Preparation	Bulldozer (1)	85	75
	Compressor (1)	80	50
	Excavator (2)	85	100
	Front end loader (1)	80	100
	Generator (1)	82	50
	Water truck (4)	85	100
Structural Concrete Work	Air track (1)	85	100
	Compressor (1)	80	100
	Concrete pump (1)	82	100
	Crane (2) [1]	85	100
	Front end loader (1)	80	100
	Generator (2) [1]	82	100
	Welder (2) [1]	73	100
	Compressor (1)	80	100
	Crane (3) [1]	85	100
	Excavator (1)	85	100
	Front end loader (1)	80	100
	Generator (2) [1]	82	100
	Welder (2) [1]	73	100
Mechanical Work	Compressor (1)	80	100
	Crane (1)	85	100
	Front end loader (1)	80	100
	Generator (1)	82	100
	Welder (1)	73	100
Electrical Work	Compressor (1)	80	100
	Crane (1)	85	100
	Front end loader (1)	80	100
	Generator (1)	82	100

Notes:
[1] One to be located on barge.
Source: *CEQR Technical Manual* Chapter 22.

the tree zone; 7.5 dBA of attenuation were applied for the nearest residence. **Table 10.3-8** shows the results of the stationary noise analysis.

As shown in **Table 10.3-8,** construction related activities in the Rondout Reservoir Study Area would comply with the Town of Wawarsing Noise Control Law during each construction phase at the nearest adjoining property line (residential parcel). Following completion of construction, the siphon construction staging area would be restored to baseline conditions. WSSO

Table 10.3-8: Results of the Noise Analysis at the Rondout Reservoir Study Area

Receptor	Distance from Site (Feet)	Calculated Project Noise Level at Noise-Sensitive Receptor (dBA)					Wawarsing Noise Limit (dBA)	Potential for Exceedance (Yes or No)
		Mobilization/ Site Prep	Structural Concrete Work	Pipe Installation	Mechanical Work	Electrical Work		
Nearest Adjoining Property Line (Residential Parcel)	600	65	63	64	59	59	73	No

construction activities would be temporary in nature with the peak construction activities occurring for a limited period. Therefore, stationary noise associated with siphon construction activities to support WSSO would not result in significant adverse impacts to sensitive receptors within the Rondout Reservoir Study Area.

Mobile construction noise sources would also be present on site in addition to the stationary noise sources described above. Mobile noise sources would include vehicles traveling to and from the work site and would include up to approximately 24 peak hour vehicle trips (714 noise PCE) and 58 peak day vehicle trips (1,806 noise PCEs). However, siphon construction would be short in duration, occurring over an approximately 7-month period. Therefore, a noise impact analysis related to mobile noise from siphon construction within the Rondout Reservoir Study Areas is not warranted.

Noise-producing activities in the Rondout Reservoir Study Area during operations would include the operation of temporary siphons. Siphons would be in operation for a maximum of 8 months during the RWBT temporary shutdown. Noise levels through the siphons at the spillway would vary based on the amount of discharge, outlet design, and environmental conditions. However, it is anticipated that sounds associated with siphon operation would be similar to the sound of water flowing over the spillway under typical conditions. Noise levels at the nearest residences would be further reduced due to the local topography, distance and the presence of dense trees zones between the spillway and residences. The siphon outfall would be located 150 feet below the nearest residential parcels without a direct line-of-sight between the siphons and the residential parcels. Therefore, any noise from operation of the siphons could potentially be audible at these locations but would be partially attenuated by the ground topography. However, any noise generated by siphon operation would be short in duration, for approximately 8 months, including fall and winter months when residents typically would have their windows closed. Therefore, operation of the siphons during WSSO would not result in significant adverse noise impacts to sensitive receptors in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.17 Neighborhood Character

The character of the Rondout Reservoir Study Area is largely defined by public service/utility and vacant land uses, as well as its physical setting within a rural location (see **Figure 10.3-22**). The southern portion of the Rondout Reservoir and Merriman Dam are located within the study area. State Route 55 traverses the study area in an east to west direction. Proposed work includes the construction of siphons and associated control equipment, which would occur on DEP property. Construction activities and variations in water surface elevations would be temporary in nature.

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the study area within the timeframe of the impact analysis. Therefore, in the future without the temporary shutdown, it is assumed that neighborhood character within the Rondout Reservoir Study Area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the Rondout Reservoir Study Area was not warranted. As described in Section 10.3.8.3, "Land Use, Zoning, and Public Policy," Section 10.3.8.4, "Socioeconomic Conditions," Section 10.3.8.6, "Open Space and Recreation," Section 10.2.3.5, "Historic and Cultural Resources," and Section 10.3.8.9, "Visual Resources," there would be no potential for WSSO activities to affect land use, zoning, and public policy; socioeconomic conditions; open space and recreation; historic and cultural resources; or visual resources.

As described in Section 10.3.8.14, "Transportation," and Section 10.3.8.16, "Noise," the work activities in the Rondout Reservoir Study Area would be short-term and would result in a temporary increase in traffic and noise. Following construction, the operation of the siphons would not result in an increase in traffic and noise. These temporary increases in traffic and noise levels would not result in a density of activity or service conditions that would affect the overall character of the study area.

Water surface elevations and siphon construction at the Rondout Reservoir Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, urban design and visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.8.18 Public Health

As described in Section 10.3.8.15, "Air Quality," Section 10.3.8.11, "Hazardous Materials," and Section 10.3.8.12, "Water and Sewer Infrastructure," WSSO would not result in significant adverse impacts to air quality; hazardous materials; or water and sewer infrastructure in the Rondout Reservoir Study Area and no further analysis is warranted.

As described in Section 10.3.8.16, “Noise,” the work activities in the Rondout Reservoir Study Area would be short-term and would result in a temporary increase in noise. Following construction, the operation of the siphons would not result in an increase in noise.

While the reservoir would be drawn down lower than typical, water quality information from DEP for historical drawdown conditions and subsequent refill indicated there was no adverse change to water quality for diversions due to the large fluctuations in water surface elevations. In addition, refill of Rondout Reservoir would most likely occur when the Delaware System is offline because of the temporary shutdown, providing ample time for the system to recover before the RWBT is brought back online and diversions to West Branch start again. Further flow would continue through the reservoir from inflows into the reservoir and releases downstream through the siphons. The reservoir would not be stagnant and there would be no increase in potential for mosquito breeding at the reservoir. Additionally, there would be no potential significant adverse impacts related to air quality, water quality, hazardous materials, or noise from water surface elevations or siphon construction at the Rondout Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to public health in the Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9 RONDOUT CREEK DOWNSTREAM OF RONDOUT RESERVOIR STUDY AREA IMPACT ANALYSIS

10.3.9.1 Study Area Location and Description

Rondout Creek downstream of Rondout Reservoir flows approximately 7.5 miles in a southeasterly direction before turning northeasterly and flowing another 38 miles through Ulster County to the Hudson River (see **Figure 10.3-29**). There are two major tributaries along its length; Sandburg Creek and Wallkill River, in addition to a number of minor tributaries (see **Figure 10.3-30**). The confluence with Sandburg Creek occurs approximately 7.5 miles downstream of Rondout Reservoir. Sandburg Creek contributes approximately 100 square miles of drainage area or approximately 9 percent of the entire Rondout Creek watershed, which is approximately 1,190 square miles. The second major tributary, Wallkill River, converges with Rondout Creek approximately 6.5 miles upstream of the Hudson River and contributes approximately 785 square miles of drainage area or approximately 71 percent of the Rondout Creek watershed. The Rondout Reservoir itself has a drainage area of approximately 95 square miles, or approximately 9 percent of the entire Rondout Creek watershed. Because of its relatively small watershed and role as the central collecting reservoir for the Delaware System, receiving water from the Pepacton, Cannonsville, and Neversink reservoirs, the reservoir rarely spills. Further, releases are limited to minimum conservation flows required per NYSDEC regulation part 672-2.3. These releases range from 0 to 15 mgd depending on the time of year and drought condition. Therefore, the reservoir has a minimal contribution to the overall flow of the Rondout Creek.

In addition to Merriman Dam that forms Rondout Reservoir, there is one other dam on Rondout Creek, a small impoundment (referred to as Honk Lake) approximately 1.5 miles upstream of the confluence with Sandburg Creek. This dam predates Merriman Dam, and it was drawn down in 2014 pending a decision to rehabilitate or decommission (i.e., breach or remove) the dam.

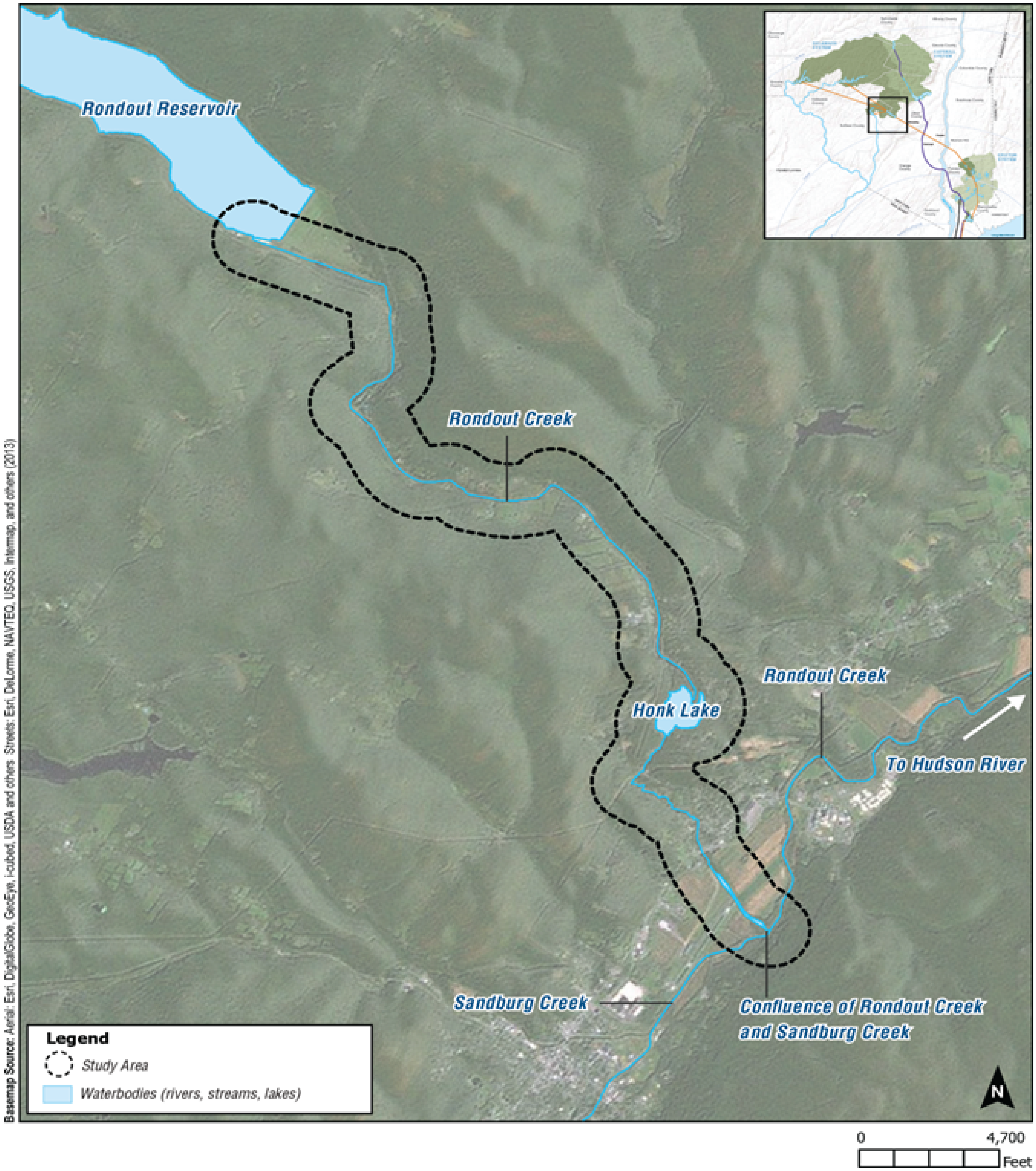


Figure 10.3-29: Rondout Creek Downstream of Rondout Reservoir Study Area

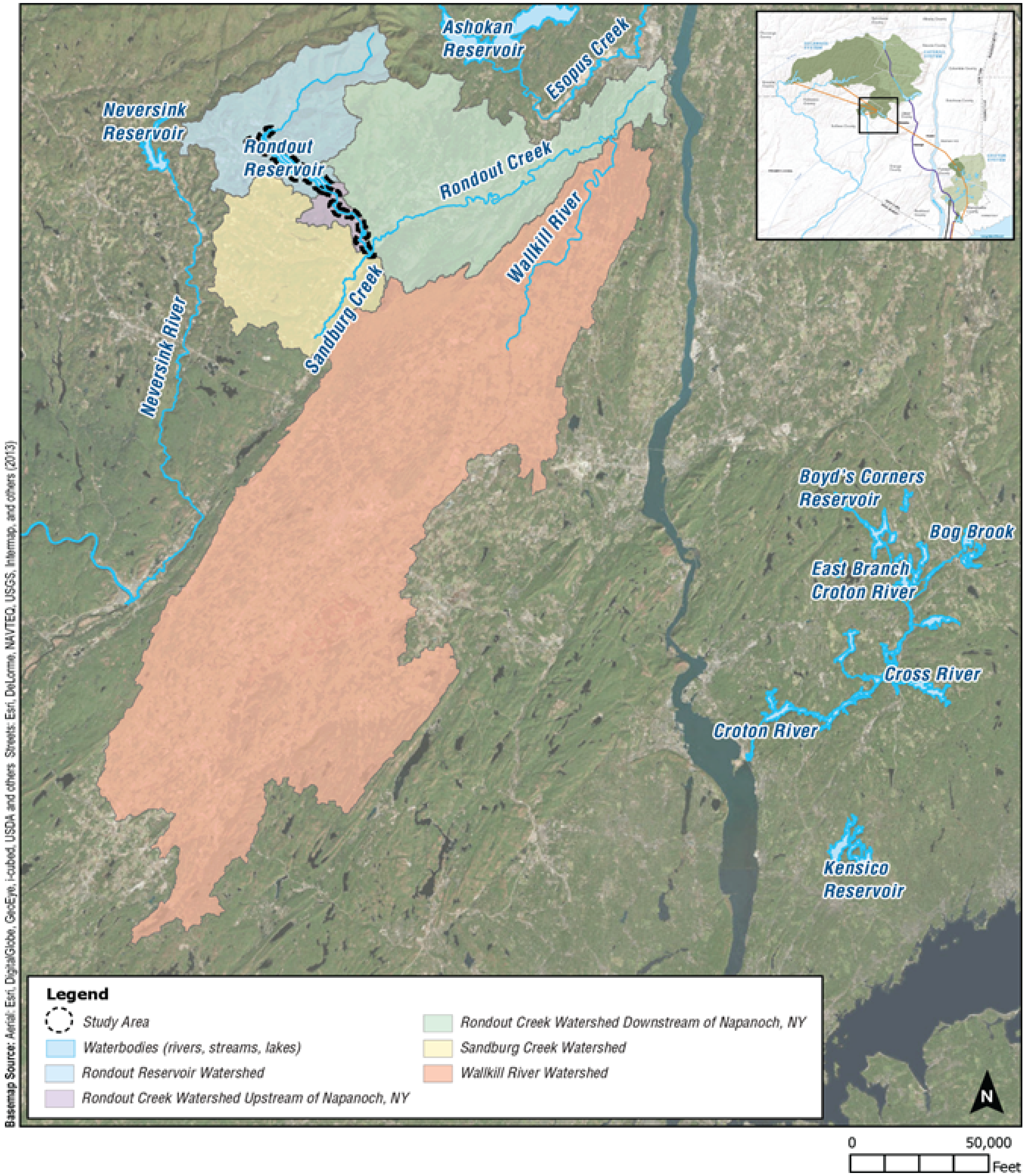


Figure 10.3-30: Subwatershed Areas – Rondout Creek Downstream of Rondout Reservoir Study Area

NYC Environmental Protection

Any action related to the Honk Lake Dam is independent of WSSO or the RWBT temporary shutdown. At the time of the temporary shutdown, it is anticipated that the dam would be fully rehabilitated or decommissioned. However, because rehabilitation or decommissioning represents two potential future environmental conditions (lake or stream) in the future without WSSO, both are assessed in this section.

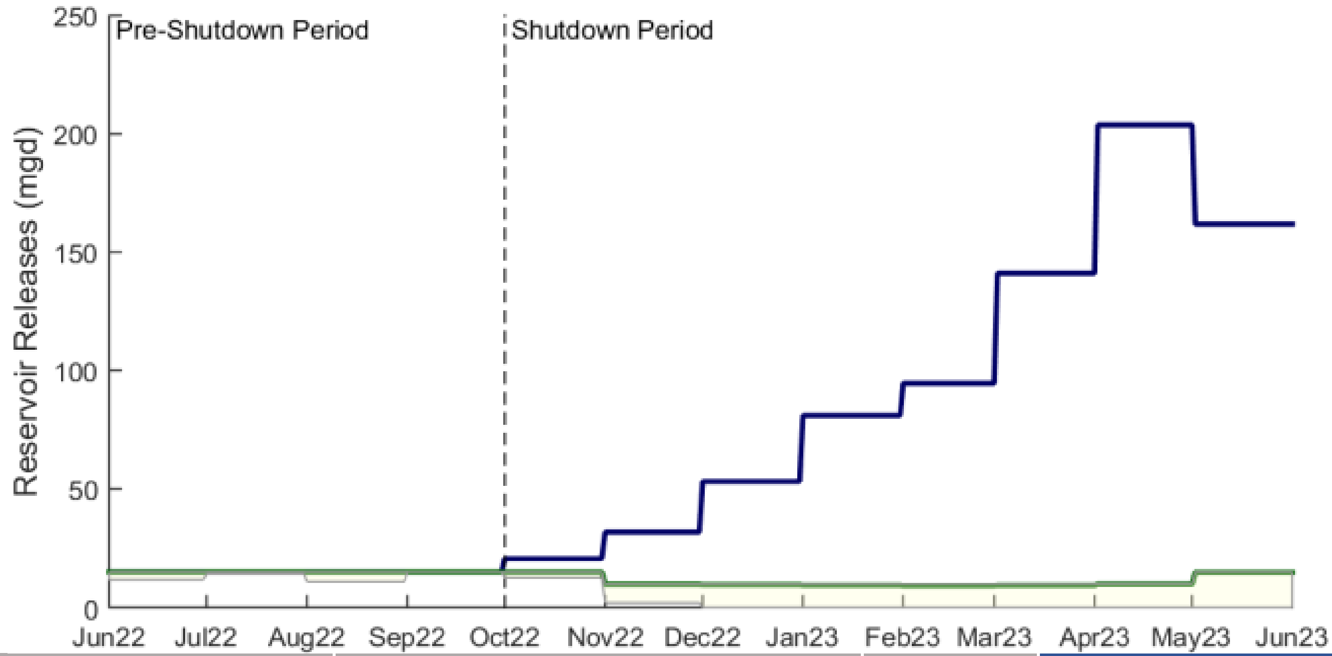
The water quality classification for Rondout Creek is Class C(TS) for the segment between Merriman Dam and Honk Lake, Class C below Honk Lake and Class B/B(T) below the confluence with Sandburg Creek. As Rondout Creek flows to the Hudson River, it transitions to Class C.

10.3.9.2 Study Area Evaluation

Under typical operations, DEP releases the minimum required flows to Rondout Creek (e.g., 0 to 15 mgd) from Rondout Reservoir and manages the reservoir storage to limit spills and maintain sufficient storage within the reservoir. When spills do occur, which is a rare occurrence, it is typically due to extreme storms, when daily flows over Merriman Dam can reach as high as approximately 2,800 mgd.

During the RWBT temporary shutdown, Rondout Reservoir would not receive diversions of water from Pepacton, Cannonsville, and Neversink reservoirs, nor would water be diverted from the reservoir through the RWBT. Therefore, the full natural inflow (approximately 150 mgd on average) would be managed through releases to Rondout Creek. However, the existing release structure is hydraulically limited to approximately 15 mgd. Therefore, to better manage reservoir storage during WSSO and reduce reservoir spills during the shutdown, three temporary siphons would be constructed over Merriman Dam to release water to Rondout Creek and manage natural inflows to minimize spills. These siphons would provide additional release capacity from Rondout Reservoir. Each siphon would have a maximum release capacity of approximately 82 mgd, making the total maximum release capacity to Rondout Creek approximately 260 mgd for three siphons and the existing release structure. The potential for impacts associated with construction of the siphons is addressed as part of the Rondout Reservoir Study Area Impact Analysis in Section 10.3.8, “Rondout Reservoir Study Area Impact Analysis.” Siphons would operate continuously during the temporary shutdown when reservoir elevations are above approximately elevation 820 feet. However, DEP would temporarily cease operation when flows at the USGS Rosendale Gauge are within 1 foot of the flood action stage in order to not contribute to downstream flooding. Following a temporary curtailment of flows, the siphons would be reactivated and flow control valves used to ramp flows back up slowly over a number of days to prevent potential scour of stream banks.

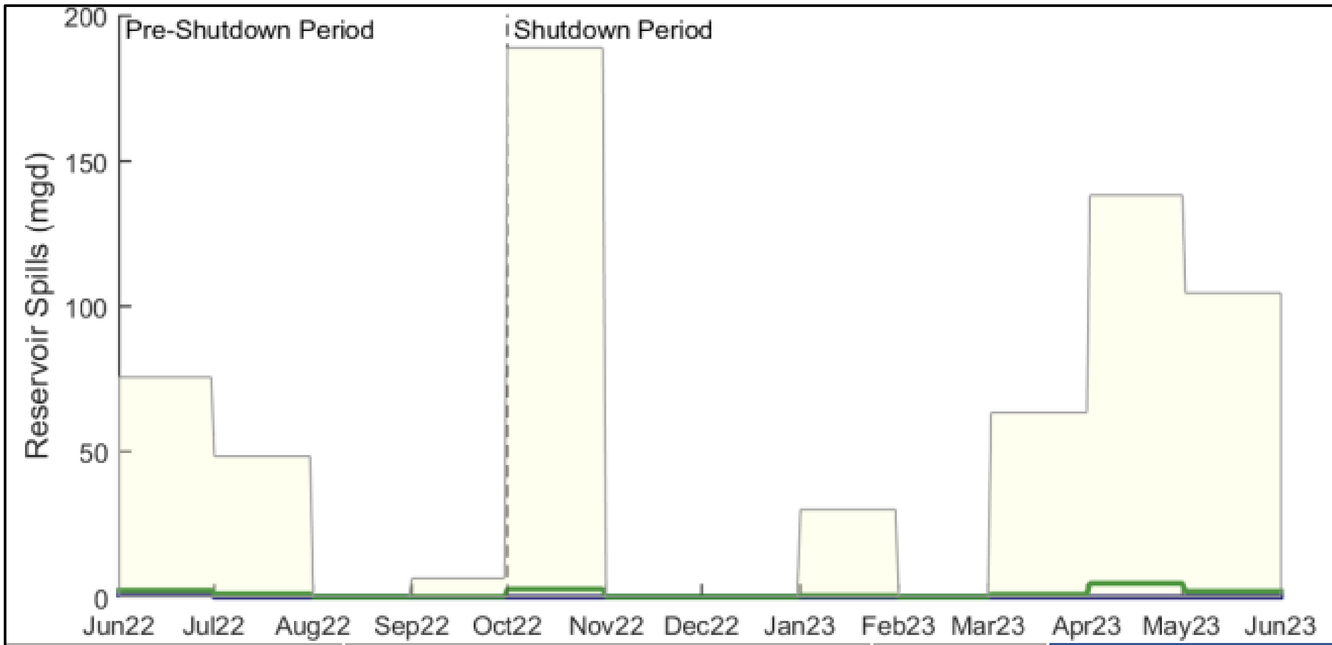
During the pre-shutdown period, monthly average daily releases into Rondout Creek would be unchanged from typical operations (see **Figure 10.3-31**). During this period, monthly average daily spills into Rondout Creek would be marginally lower than typical conditions by up to 1 mgd (see **Figure 10.3-32**). During the temporary shutdown of the RWBT, monthly average daily releases into Rondout Creek would be substantially higher than typical conditions by up to approximately 200 mgd due to operation of the temporary siphons (see **Figure 10.3-31**). During this period, monthly average daily spills into Rondout Creek would be marginally lower than typical conditions by up to approximately 4 mgd (see **Figure 10.3-32**). Flow differences for



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	15	12	15	15	0
	July	15	14	15	15	0
	August	15	11	15	15	0
	September	15	15	15	15	0
Shutdown Period	October	15	13	15	21	6
	November	10	2	10	32	22
	December	10	0	10	53	43
	January	10	0	10	81	71
	February	9	0	10	94	85
	March	9	0	10	139	130
	April	10	0	10	203	193
	May	15	0	15	168	153

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.3-31: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Rondout Creek Downstream of Rondout Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	2	0	76	1	-1
	July	1	0	48	0	-1
	August	0	0	0	0	0
	September	0	0	6	0	0
Shutdown Period	October	3	0	189	0	-3
	November	0	0	0	0	0
	December	0	0	0	0	0
	January	0	0	30	0	0
	February	0	0	0	0	0
	March	1	0	63	0	-1
	April	4	0	138	0	-4
	May	2	0	101	0	-2

Figure 10.3-32: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Rondout Creek Downstream of Rondout Reservoir Study Area

releases exceed the typical range for the duration of the shutdown phase from October through May. Following the end of the shutdown in June, water would again be diverted per typical operations and the siphons would no longer be used. Siphons would be removed upon completion of the temporary shutdown. With the typical operations resumed, releases from the reservoir would also return to typical operating levels

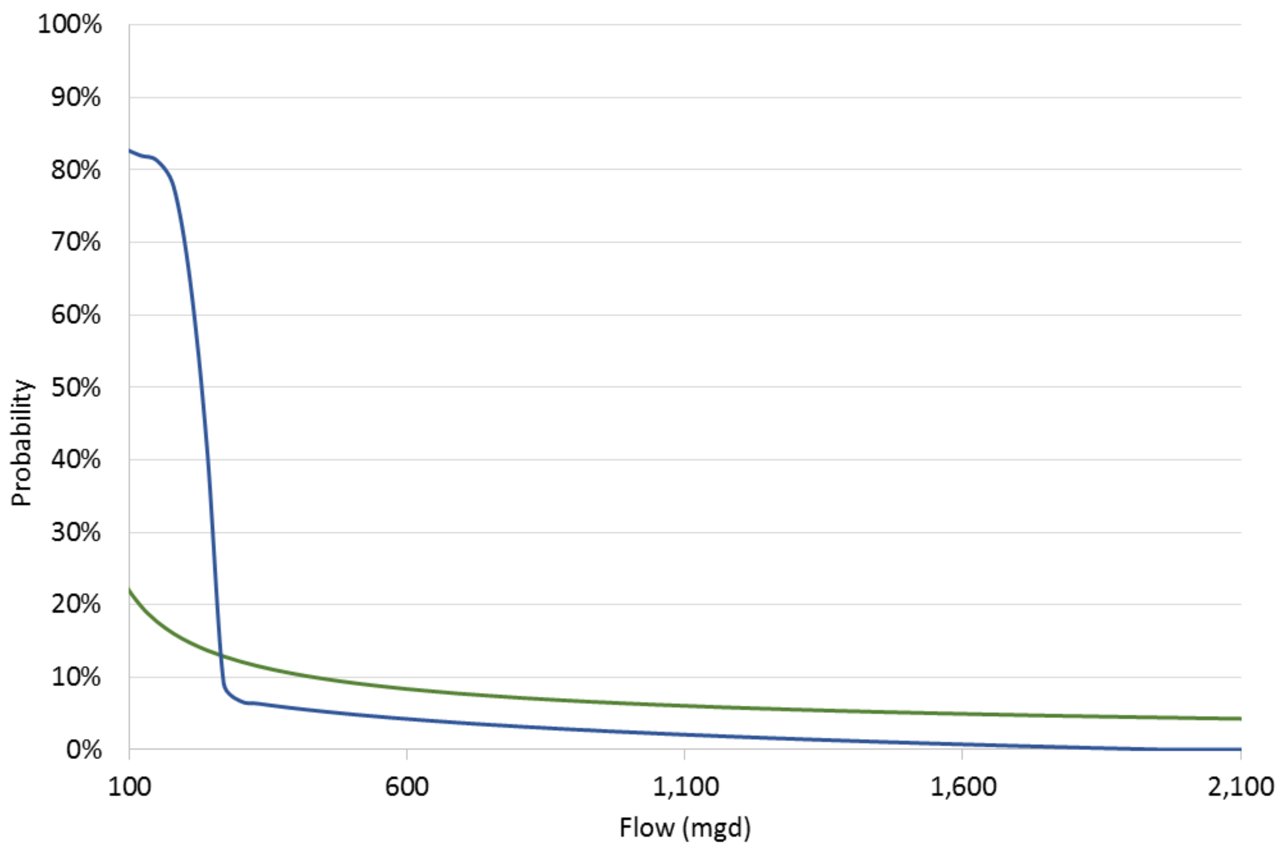
While flows through the siphons could reach approximately 245 mgd during the RWBT temporary shutdown, maximum flow rates to Rondout Creek would not be anticipated to increase because the siphons would maintain a void in the reservoir to capture large inflows from extreme storms under most conditions (see **Figure 10.3-32** and **Figure 10.3-33**).

Further, minimum flows would be maintained per regulations. Monthly average daily flows to Rondout Creek during the shutdown, which could be sustained at approximately 200 mgd on average based on the dataset mean, would represent a departure from the range of typical flows (see **Figure 10.3-31**).

To verify that flows anticipated from the increased releases due to siphons would not result in any direct impacts (e.g., flooding) to surrounding properties or roads, a site visit to the creek was conducted during a spill event. The site visit occurred on June 14, 2013, following storms that resulted in spills reaching approximately 600 mgd the day of the site visit. **Figure 10.3-34** presents photographs of locations along Rondout Creek before, during, and after the June 14, 2013 spill event. Photographs from the site visit on June 14, 2013 document that no properties, roads, or bridges inundated by flows at approximately 600 mgd. Flow rates during the temporary shutdown would be substantially less (maximum flow of approximately 260 mgd); therefore, flows during the temporary shutdown from Rondout Reservoir are not anticipated to result in inundation of property or structures. The photograph locations noted in **Figure 10.3-34** are shown in **Figure 10.3-35**.

Results of the hydrologic evaluation also indicated that, while releases would be higher compared to typical operations downstream of Merriman Dam to Rondout Creek's confluence with Sandburg Creek, the contribution of total flow from Rondout Reservoir would be greatly reduced downstream of the confluence. For example, while the section of Rondout Creek above the confluence with Sandburg Creek has rarely seen sustained flows at 200 mgd, flows downstream of the confluence normally exceed 200 mgd approximately 20 percent of the time.[26] Therefore, the section of Rondout Creek below the confluence with Sandburg Creek would regularly experience flows at or above the anticipated discharge from the siphons during the RWBT temporary shutdown. The proportion of flows in Rondout Creek due to releases during the temporary shutdown would further decrease at locations downstream of the confluence with Sandburg Creek, as other tributaries and baseflow would contribute to the overall flow in the Creek. For example, Rondout Creek at the Rosendale USGS Gauge experiences flow at or above 200 mgd approximately 50 percent of the time.

[26] Flows at the confluence with Sandburg Creek were calculated by scaling the flows at the USGS Rosendale gauge, the only stream gauge on the Rondout Creek.



Note: The first location downstream of Rondout Reservoir with NWS flood stages delineated is the USGS Rosendale Gauge along the Rondout Creek, but the OST does not estimate flows at that location.

Legend
WSSO
Typical

Figure 10.3-33: Annual Probability of High Flows from Spills and Releases – Rondout Creek Downstream of Rondout Reservoir Study Area

Existing Conditions Photograph May 1, 2013	Storm Event Photograph June 14, 2013	Post Storm Event Photograph July 12, 2013
Rondout Creek near XS-35		
		
Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek near XS-20, Bennet Road Bridge		
		

Figure 10.3-34: Photograph Documentation of Spill Event June 14, 2013 – Rondout Creek Downstream of Rondout Reservoir Study Area (arrows used as a reference marker for features in each photograph)

Existing Conditions Photograph May 1, 2013	Storm Event Photograph June 14, 2013	Post Storm Event Photograph July 12, 2013
Rondout Creek near XS-18		
		
Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek near XS-16		
		

Figure 10.3-34: Photograph Documentation of Spill Event June 14, 2013 – Rondout Creek Downstream of Rondout Reservoir Study Area (arrows used as a reference marker for features in each photograph)

Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek near XS-13, State Route 55 Bridge		
		
Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek near XS- 4, State Route 209 Bridge		
		

Figure 10.3-34: Photograph Documentation of Spill Event June 14, 2013 – Rondout Creek Downstream of Rondout Reservoir Study Area (arrows used as a reference marker for features in each photograph)

Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek near XS- 4, State Route 209 Bridge		
		
Existing Conditions Photograph May 1, 2013	**Storm Event Photograph June 14, 2013**	**Post Storm Event Photograph July 12, 2013**
Rondout Creek Downstream of Confluence with Sandburg Creek, Institution Road Bridge		
		

Figure 10.3-34: Photograph Documentation of Spill Event June 14, 2013 – Rondout Creek Downstream of Rondout Reservoir Study Area (arrows used as a reference marker for features in each photograph)

Based on the modeling results that indicate potentially substantial changes in releases from Rondout Reservoir during shutdown operations, an analysis of the potential for impacts from WSSO was warranted for Rondout Creek between Rondout Reservoir and the confluence with Sandburg Creek at Napanoch, New York. An impact analysis is not warranted for Rondout Creek downstream of the confluence with Sandburg Creek based on the modeling results that indicate it is not anticipated that potential significant adverse impacts to Rondout Creek downstream of the confluence with Sandburg Creek from WSSO would occur.

Hydraulic Modeling

To further investigate the potential impacts along Rondout Creek due to releases from Rondout Reservoir during the temporary shutdown, a Hydrologic Engineering Center - River Analysis System (HEC-RAS) model was developed to approximate the hydraulic response of Rondout Creek to the proposed release flows. The hydraulic model is based on a topographic survey conducted along this segment of Rondout Creek between Rondout Reservoir and Napanoch, from November 4, 2013 to November 8, 2013 (see **Figure 10.3-35**). A set of 27 cross sections were selected for topographical survey work to provide sufficient information about channel geometry (bed and bank elevation) throughout this segment of Rondout Creek to ensure the hydraulic model would be capable of producing useful results for water surface elevations and velocities across a range of flows. Surveyed cross sections were selected to capture obstructions (e.g., bridges, beaver dams, natural weirs) and flooding potential associated with proximity to residences located along the creek and or proximity to adjacent roads. Spacing between cross sections was selected to capture slope changes along the stream. Certain cross sections used Light Detecting and Ranging (LiDAR) data to provide elevation information or to supplement data collected in the field where access for topographic surveys was not possible.[27]

The Rondout Creek watershed is varied and quite large. The 10.2 square-mile subwatershed associated with the portion of Rondout Creek just downstream of the Rondout Reservoir is drained mainly by Rondout and Brandy Brooks along with several small tributaries. Rondout Creek runs southeast from the reservoir for approximately 7.5 miles to the confluence with Sandburg Creek. Immediately downstream of Rondout Reservoir, the Rondout Creek bed has an abrupt change in elevation, falling approximately 300 feet in 0.5 mile (approximately 11 percent slope on average). A stretch of milder slopes (approximately 0.3 percent on average) follows for the next 5 miles until the creek reaches Honk Lake, impounded by Honk Falls Dam. After this impoundment, the creek bed elevation drops by 280 feet in the course of 1 mile (approximately 5 percent slope on average) until it reaches the confluence with Sandburg Creek approximately 1 mile upstream of Napanoch, Ulster County, New York.

Model Calibration

Honk Lake is an important controlling feature (i.e. obstruction) of stream flow hydraulics in Rondout Creek upstream of the confluence with Sandburg Creek. Therefore, the lake water surface elevations influence the water surface elevation of Rondout Creek upstream of the dam,

[27] LiDAR is a remote sensing technology that is used to create high resolution mapping over large areas. LiDAR data used for this analysis was provided by Ulster County, New York.

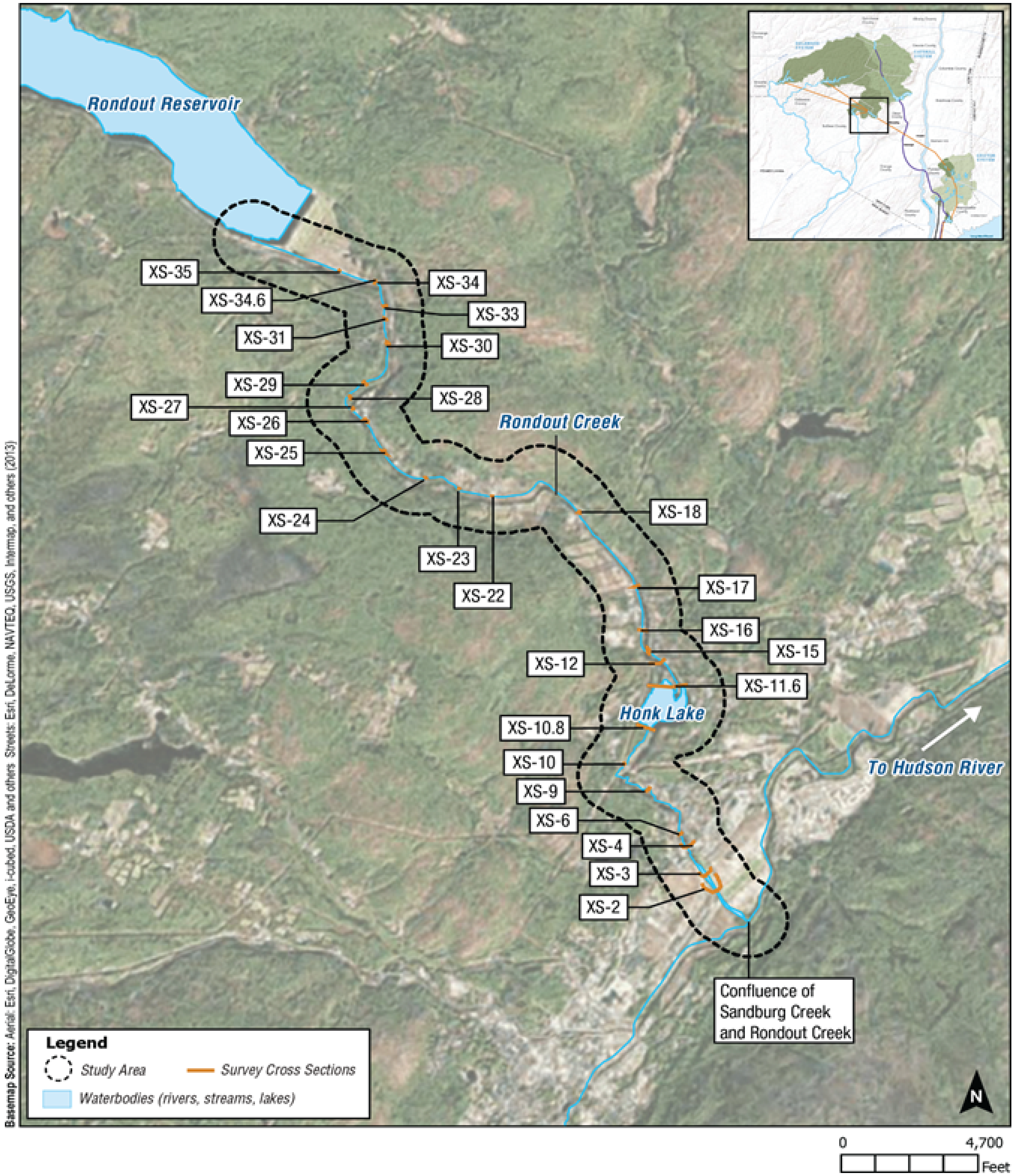


Figure 10.3-35: Topographic Cross Sections – Rondout Creek Downstream of Rondout Reservoir Study Area

and the lake and dam attenuate creek flows downstream of the dam. Because topographic survey data for the dam was not available, LiDAR data was used to capture topography for this feature, initial calibration steps were required to determine the average discrepancy between the topographic survey data, which is quite accurate and tied to established elevation benchmarks, and the LiDAR data set, which is less accurate. Inaccuracies in LiDAR data can arise from the presence of low ground vegetation or free water surfaces that do not reflect the true ground surface.

The difference between ground data and LiDAR elevations for the segment of Rondout Creek upstream of the confluence with Sandburg Creek was on average 0.2 +/-1.3 feet when considering points located in the channel. Overall, LiDAR elevations were found to be slightly higher than topographic survey ground elevations. Because of the relatively close agreement between the topographic survey and LiDAR datasets in most locations, the LiDAR data were determined to be sufficient for areas where topographic surveys were not possible. LiDAR was also used to supplement topographic survey data to extend the surveyed cross sections well into the floodplain.

The hydraulic model was calibrated by slightly modifying the Manning's *n* coefficients, or runoff impedance, at each cross section such that the observed water surface elevation recorded during collection of the field-surveyed cross section data matched the modeled value. Values of Manning's *n* coefficients used in the model, which represent roughness of the floodplain and channel, were preliminarily assigned based on photographs taken at the site, and were modified slightly following the USGS guidelines for natural channels (Schneider and Arcement 1989).

After calibrating the model, other parameters for the model were defined, including the upstream and downstream boundary conditions used in the model, which were based on normal depth corresponding to energy grade line slopes. This simulated the slope of the channel upstream and the confluence with Sandburg Creek downstream. The downstream boundary condition also included backwater affects—the potential for downstream structures or other controlling factors to cause an increase in water surface elevations (or back up of water) at locations upstream—at the confluence of Rondout Creek and Sandburg Creek in Napanoch.

Results

Results of the hydraulic model for releases ranging up to approximately 260 mgd indicate that velocities in Rondout Creek during the RWBT temporary shutdown would generally be below the Natural Resource Conservation Service estimate of erosive velocities (approximately 6 feet per second) for substrate found in Rondout Creek (USDA NRCS 2008). Geology and Soils in Section 10.3.9.3, "Natural Resources" describes the stream geomorphologic assessment of Rondout Creek. Some localized creek sections with velocities higher than the identified thresholds are located in high-sloped areas that are lined with bedrock, heavy boulders, and/or riprap. Therefore, while flows may be high enough to move fine grained substrate, widespread erosion is not anticipated given the solid or large substrate in these localized locations. Thus, increased flows would not be expected to affect the stability of the channel.

Increases in water surface elevation over the base flow water surface elevation resulting from release flows would be on average approximately 2 feet over typical and would remain within the overall channel banks throughout the creek segment evaluated. Further, water surface elevation and inundation extents would remain below the level of inundation resulting from the effective discharge rate of approximately 442 mgd under typical conditions (see Geology and Soils in Section 10.3.9.3, "Natural Resources").[28] There are locations of low-lying floodplain shelves created by encroachment of vegetation into the legacy channel that would be expected to be inundated during releases. Flow over these low-lying shelves during releases would not be of an erosive nature as flow velocity slows as it spreads out over floodplain areas and vegetation in these areas is healthy (see Ecological Communities in Section 10.3.9.3, "Natural Resources"). Mapping of the inundation extents indicated that no properties or structures would be impacted by release from Rondout Reservoir during the RWBT temporary shutdown (see Geology and Soils in Section 10.3.9.3, "Natural Resources" and Ecological Communities in Section 10.3.9.3, "Natural Resources").

The results of the modeling indicate limited potential for effects from flooding or erosion from flows anticipated during the RWBT temporary shutdown. Additional field evaluations of geomorphology and low-lying vegetation were conducted to identify if prolonged flows anticipated during the temporary shutdown could result in impacts to the stream channel. As discussed in the following sections, it was determined that increased flows over the temporary shutdown would not be anticipated to affect Rondout Creek.

Ice Modeling and Ice Jam Flooding

Ice jams can occur along Rondout Creek, some of which can result in flood damage. The US Army Corps of Engineers has records of 13 ice jams since 1927, three of which resulted in reports of flooding. The NWS for the Albany Hydrologic Service Area has reported that ice jams along Rondout Creek near Accord and Kerhonkson have resulted in flooding of U.S. Route 209 in these areas.[29] Ulster County indicated that ice jams have occurred in the vicinity of Rosendale, New York.

An ice jam can occur any time from early winter to late spring, depending upon changes in temperatures that cause alternate freezing and melting of water surfaces. Ice jams are caused by pieces of floating ice that accumulate at an obstruction to the stream flow, such as river bends, mouths of tributaries, slope decreases, and upstream of bridges.

Because the RWBT temporary shutdown and siphon flows would occur between the fall and the following spring, the effects of ice were also considered in the study area evaluation of hydrology and hydraulics. Stream channel ice cover can reduce the channel cross section area and result in increased water surface elevations and flow velocities. There is limited historical data on ice cover conditions in Rondout Creek, therefore, model parameters for ice cover thickness and roughness were established based on published literature and historical air temperature data. The results of modeling ice conditions in Rondout Creek between Merriman

[28] The effective discharge is often considered an index that describes the streamflow responsible for carrying the most sediment over time and forming the geometry of the channel.

[29] Kerhonkson, New York is approximately five miles downstream of the confluence with Sandberg Creek. Accord, New York is approximately 9 miles downstream of the confluence with Sandberg Creek.

Dam and Sandburg Creek under the maximum Rondout Reservoir releases with the siphons in operation indicated that ice would not result in flooding along the creek or create substantially higher velocities.

For Rondout Creek below the confluence of Sandburg Creek in the areas of Kerhonkson and Accord, which is outside the area of the detailed HEC-RAS model, a second, extended HEC-RAS model was developed using existing models from FEMA and an existing HEC-RAS model from a DEP dam break analysis for Rondout Reservoir. In order to assess the potential for the siphon flows to contribute to flooding at these locations, the bankfull flows at each location were calculated and routed through the extended HEC-RAS model with and without the contribution of maximum siphon flows from Rondout Reservoir.[30] The increased water surface elevation with the addition of siphon releases at Accord and Kerhonkson is 0.4 feet at both locations, which corresponds to a 3 percent and 5 percent increase in flow depth, respectively. Therefore, the contribution of the siphons to water surface elevations at these locations is relatively small and would not be expected to exacerbate flooding in the event of an ice jam.

Honk Lake

Honk Lake is on Rondout Creek, formed by Honk Lake Dam, and located within the study area approximately 1.5 miles upstream of the confluence with Sandburg Creek. Honk Falls Dam has been classified as a Class C, high-hazard dam, and NYSDEC has noted a number of deficiencies in the dam that will need to be addressed to meet dam safety standards. Any plans regarding the dam would be independent of WSSO and subject to separate permitting and environmental review in accordance with the New York State Environmental Quality Review Act. For the purposes of this DEIS, it is assumed that Honk Falls Dam would either be rehabilitated or decommissioned (i.e., breached or removed) prior to the RWBT temporary shutdown. The future conditions in Rondout Creek, with and without the dam, were estimated based on information available to be able to evaluate the potential environmental effects downstream of the dam site as a result of the increased releases from Merriman Dam during the RWBT temporary shutdown.

Rehabilitation or decommissioning Honk Lake Dam is not part of this DEIS. For this DEIS, under the dam decommissioning scenario, the lake bed is assumed to be restored with sediment behind the dam having been stabilized or removed. Under a dam rehabilitation scenario, it is assumed the dam would be rebuilt based on current design standards that include the ability to pass half the probable maximum flood without failure. Half of the probable maximum flood would be substantially higher than flows that would occur in the creek from operation of the siphons. Where warranted, potential impacts from WSSO on the Honk Lake Dam decommissioned and rehabilitated conditions are described for individual impact assessments in the following sections.

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[30] The bankfull flow is defined as the flow that just fills the natural channel to the top of its banks and at a point where the water begins to overflow onto the active floodplain. Bankfull flow is also statistically associated with a mean recurrence interval of 1.5 years.

10.3.9.3 Natural Resources

The potential for impacts to natural resources from WSSO within the Rondout Creek Downstream of Rondout Reservoir Study Area is discussed below.

Geology and Soils

The bedrock geology of Rondout Creek area is associated with the Appalachian Plateaus, Rondout-Esopus Valley, Shawangunk Mountain, Wallkill Valley, and Marlboro Mountain geologic regions. These formations are made up of near horizontal bedded Devonian sandstones, siltstones, and shales; Devonian and Silurian limestone, shales, and sandstones; Silurian quartz pebble conglomerate and sandstone; and Ordovician sandstones, siltstones, and shales (USDA 1979).

Evaluation of the Rondout Creek geomorphology confirmed the assessment from the hydraulic modeling analysis that flow velocities would not be high enough to result in widespread erosion. In most areas of the stream, the channel geometry is sufficiently large to carry flows anticipated from the temporary siphons. Further, occasional spill events have removed fine sediment, leaving larger, denser substrate that is not susceptible to erosion at the anticipated flows. Lastly, vegetation along the creek is healthy and would not be adversely impacted during short duration high flows anticipated during the temporary shutdown.

The original Rondout Creek stream channel was formed prior to the construction of Merriman Dam in 1954 when the creek experienced substantial natural flow variation. The limited release capacity and strict operations of Rondout Reservoir has led to a stable flow regime into Rondout Creek that is lower than pre-dam conditions and experiences little variation. Additionally, the reservoir effectively impounds upstream sediment that would otherwise wash into the downstream reaches of the Creek below the dam. This has changed the substrate in Rondout Creek to a bouldery substrate with many crevices among the boulders that were formerly filled with sand. This "armoring" of the streambed extends throughout the creek from Merriman Dam to Sandburg Creek. In addition, there are a number of bedrock outcroppings in the streambed throughout the Rondout Creek Downstream of Rondout Reservoir Study Area. Because the controlled flows are substantially lower than natural flows, vegetation has encroached into the historical streambed and has become established on numerous, rocky mid-channel bars along the stream (see **Figure 10.3-36**). Additionally, the upper portion of the study area contains a series of beaver dams. Due to occasional spill events that occur frequently enough to maintain the channel geometry and a larger hydraulic capacity, the effective discharge remains between approximately 442 mgd and approximately 518 mgd for reaches above Honk Lake based on hydrologic analyses, features within the creek, and creek substrate size.[31] The effective discharge drops to approximately 69 mgd for the reach below Honk Lake, indicating that Honk Lake further controls flow downstream of the lake. While some fine sediment is expected to be mobilized in the reach below Honk Lake during the temporary shutdown, much of the streambed below

[31] The effective discharge is often considered an index that describes the streamflow responsible for carrying the most sediment over time and forming the geometry of the channel.

Rondout Creek near XS- 31, State Route 55 Bridge, taken July 12, 2013

Rondout Creek near XS- 20, Bennet Road Bridge, taken June 25, 2015

Rondout Creek near XS- 16, taken July 12, 2013

Figure 10.3-36: Example Vegetation Encroachment – Rondout Creek Downstream of Rondout Reservoir Study Area

Honk Lake is controlled by boulder and bedrock or is composed of large diameter substrate and would be unaffected by flows anticipated during the temporary shutdown.

In the future without WSSO, Rondout Creek would continue flowing under its typical conditions. There would be no expected changes to geology or soils from these continued flows.

As previously mentioned, the maximum sustained release rate anticipated from Rondout Reservoir would be approximately 200 mgd (see **Figure 10.3-31**) with short duration flows reaching 260 mgd, both of which are well below the effective discharge rate for the majority of the study area (see **Table 10.3-9**). However, per **Figure 10.3-31,** flows will only be marginally higher than typical in October of the temporary shutdown, gradually increasing through the winter and spring. Therefore, for the duration of the shutdown, flows are anticipated to be well below the maximum discharge rate for the siphons.

Particle size analysis along Rondout Creek further indicates that the potential for widespread erosion is low because the streambed material is generally larger than the predicted moveable particle size based on the maximum flows during the RWBT temporary shutdown. The following text provides a detailed discussion of the geomorphology assessments conducted along Rondout Creek to identify the potential for erosion due to increased releases from Rondout Reservoir.

Seven evaluation reaches (see **Figure 10.3-37**) were surveyed between Merriman Dam and Sandburg Creek. The surveys included the locations of the longitudinal profile start/end points, the surveyed cross sections, pebble count locations, bar/pavement/sub-pavement sample locations, BANCS/Pfankuch assessment locations, and beaver dam locations (see **Figure 10.3-38**). For each reach, the Rosgen stream classification, effective discharge cross section and profile parameters, and effective discharge (Q_{ED}) were determined (see **Table 10.3-9**). No data for historical releases from Honk Lake was available, so the estimated effective discharge for this area was based on surveyed field indicators.

Table 10.3-10 includes the results of the calculated shear stress for the effective discharge as determined by the field survey, the predicted largest moveable particle size from the Shields and Rosgen curves, particle sizes for the riffle pebble count, and bar samples. Additional results from pavement/sub-pavement samples at select reaches are shown in **Table 10.3-11**.[32] A comparison of the effective discharge for each reach to the maximum and sustained Rondout Reservoir release discharge during the temporary shutdown is shown in **Table 10.3-12**. For reaches upstream of Honk Lake, the maximum reservoir release would range from 49 to 58 percent of estimated effective discharge. For the area downstream of Honk Lake, the maximum reservoir release would be approximately 377 percent of the estimated effective discharge, which is indicative of the flow attenuation provided by the existing Honk Lake. Hydrologic modeling indicates releases would range between 20 and 200 mgd on average for most of the shutdown (see **Figure 10.3-31**), substantially less than the 260 mgd maximum. Further, a rehabilitated Honk Lake would continue to attenuate flows, but the ultimate attenuation would depend on the

[32] It is not always feasible to sample pavement and subpavement material in streams due to depth and size of overlying material. For some reaches in Rondout Creek these samples were able to be taken and are included in the analysis.

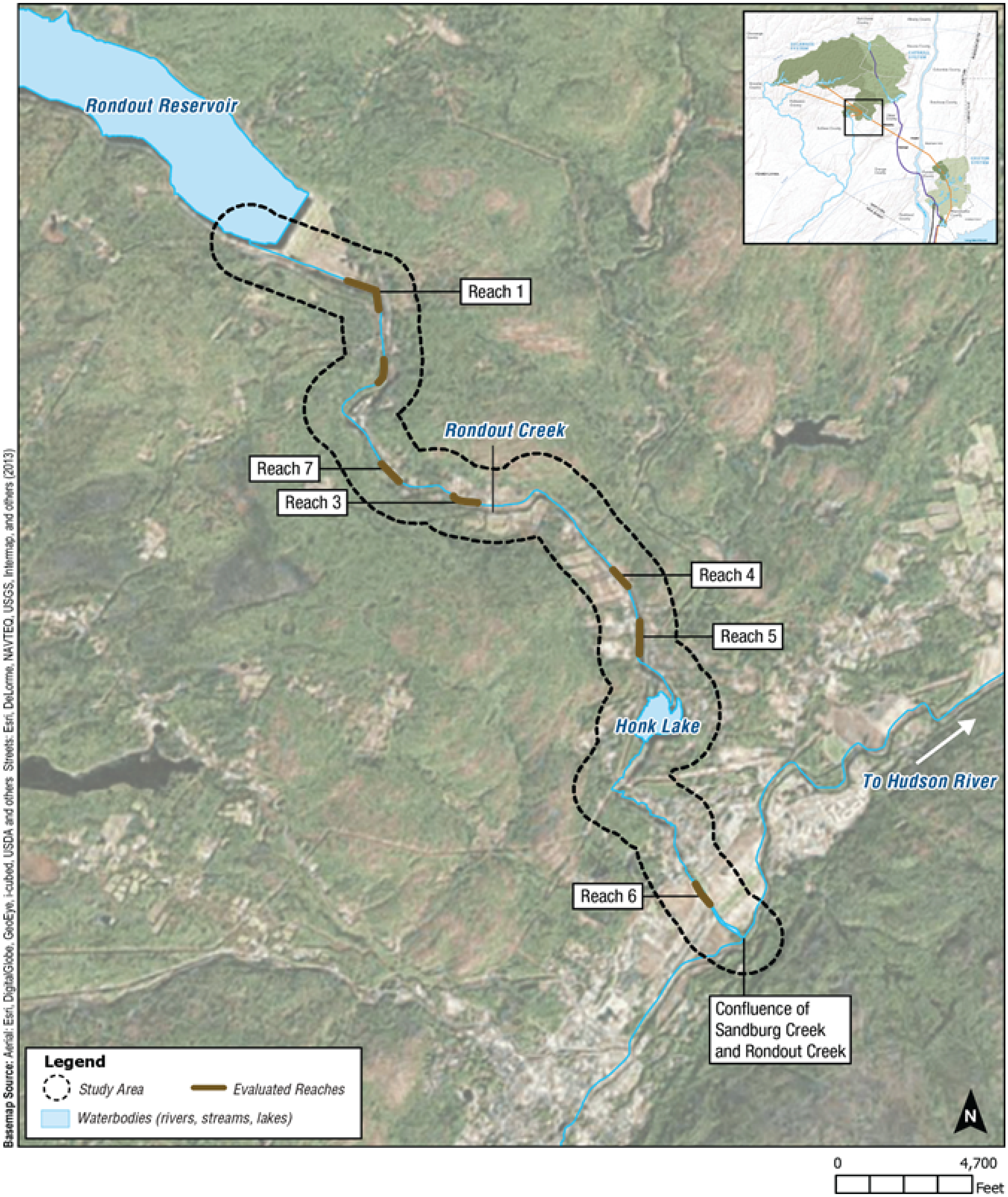
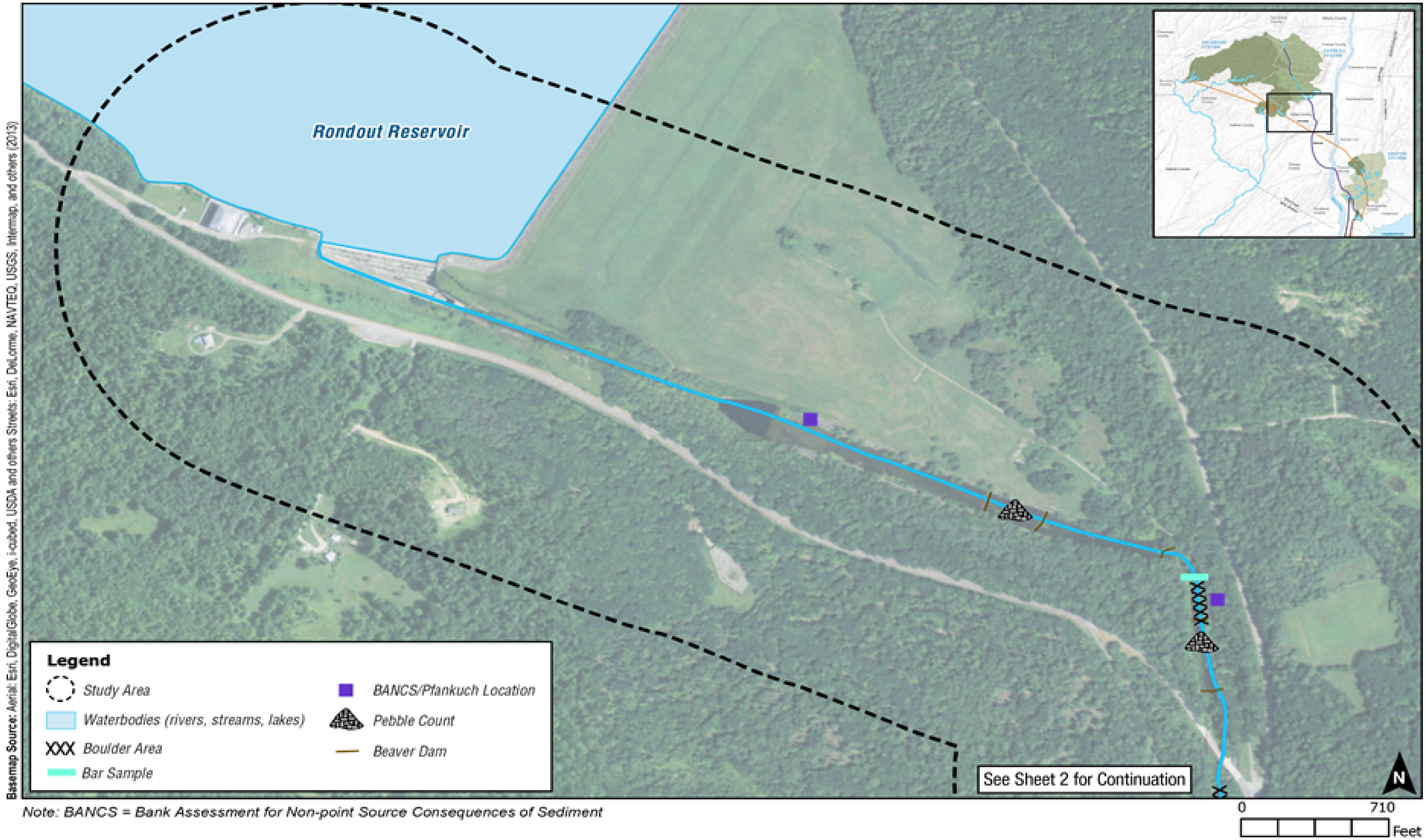


Figure 10.3-37: Geomorphology Survey Reaches – Rondout Creek Downstream of Rondout Reservoir Study Area



Note: BANCS = Bank Assessment for Non-point Source Consequences of Sediment

Figure 10.3-38: Geomorphology Survey – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 1)

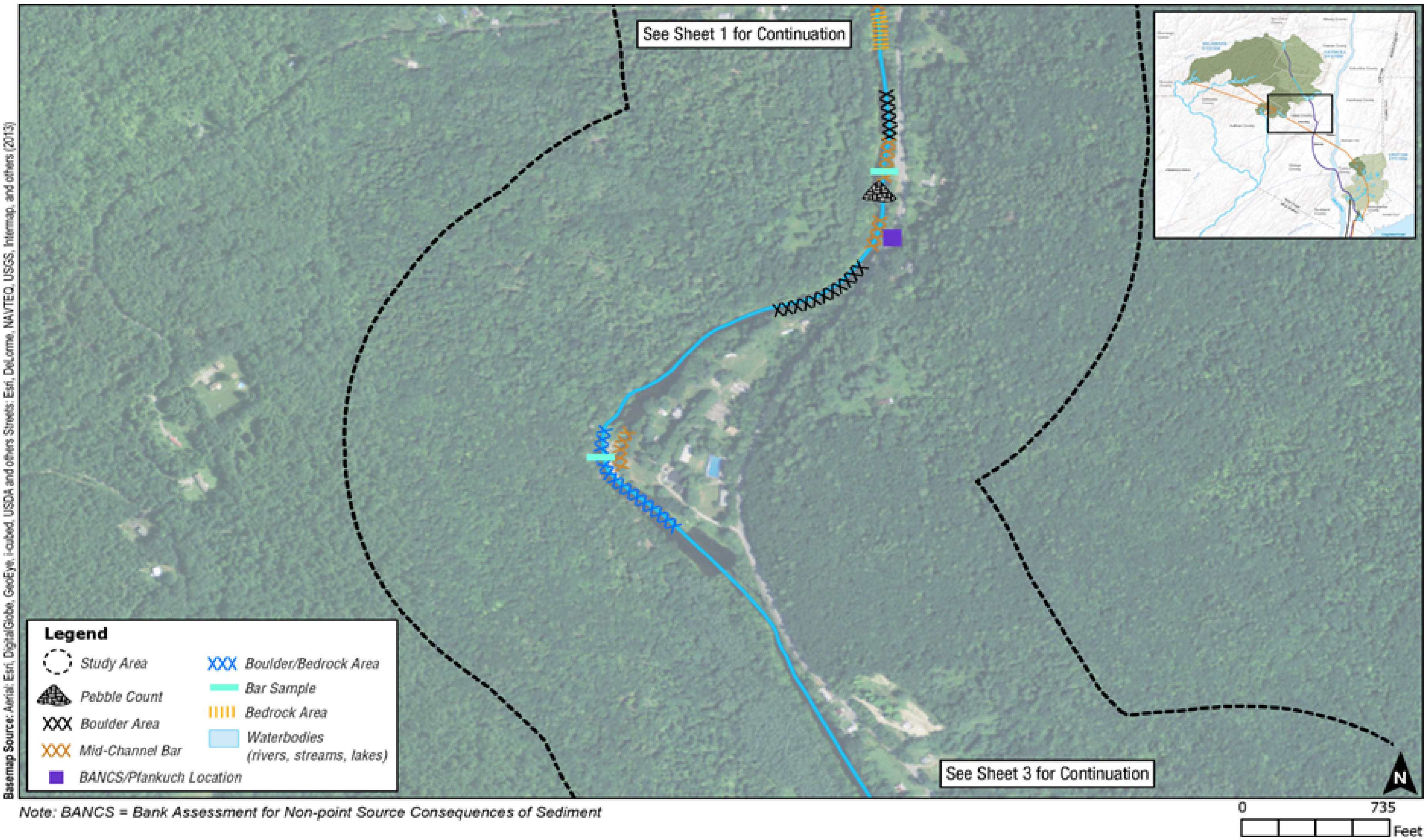


Figure 10.3-38: Geomorphology Survey – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 2)

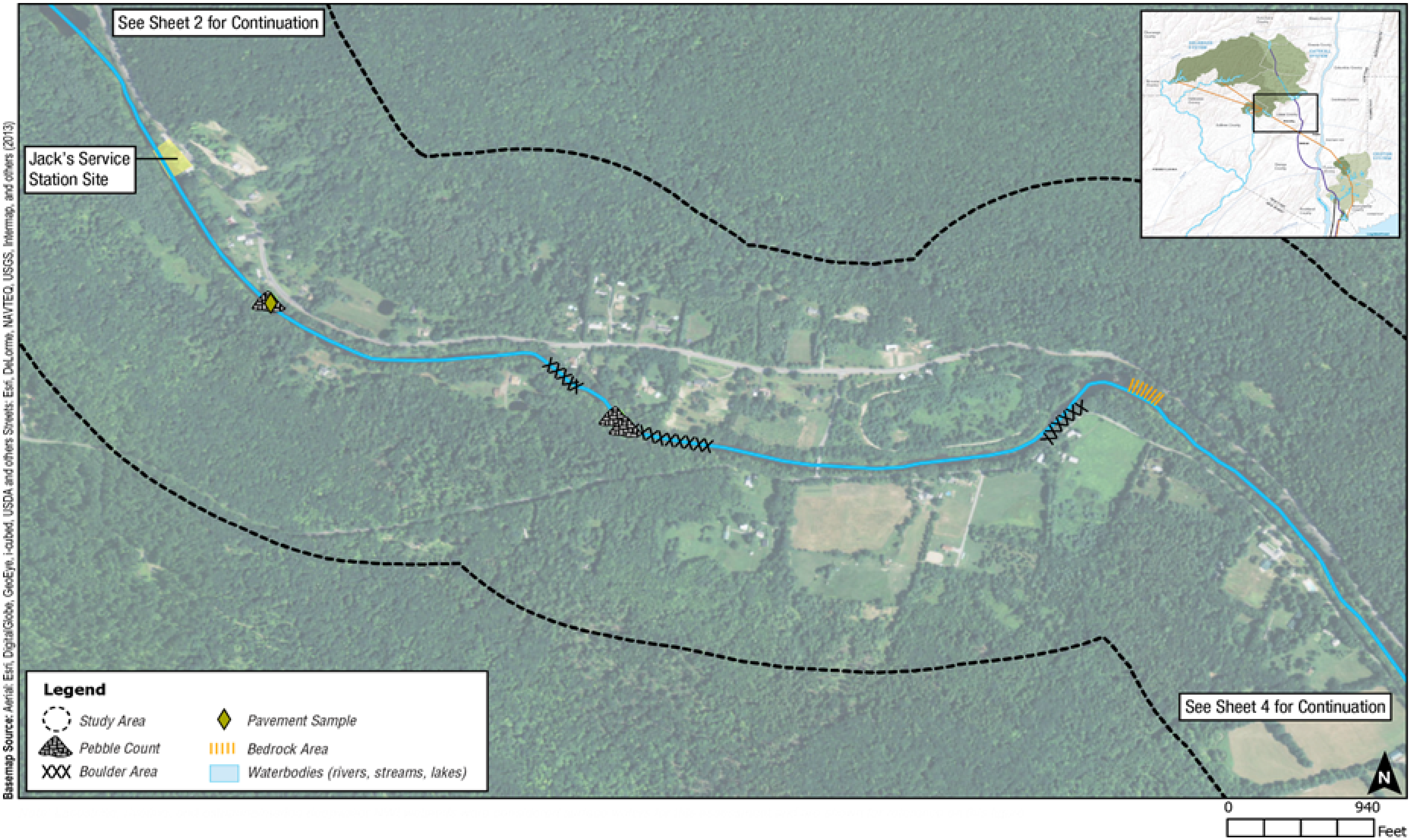


Figure 10.3-38: Geomorphology Survey – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 3)

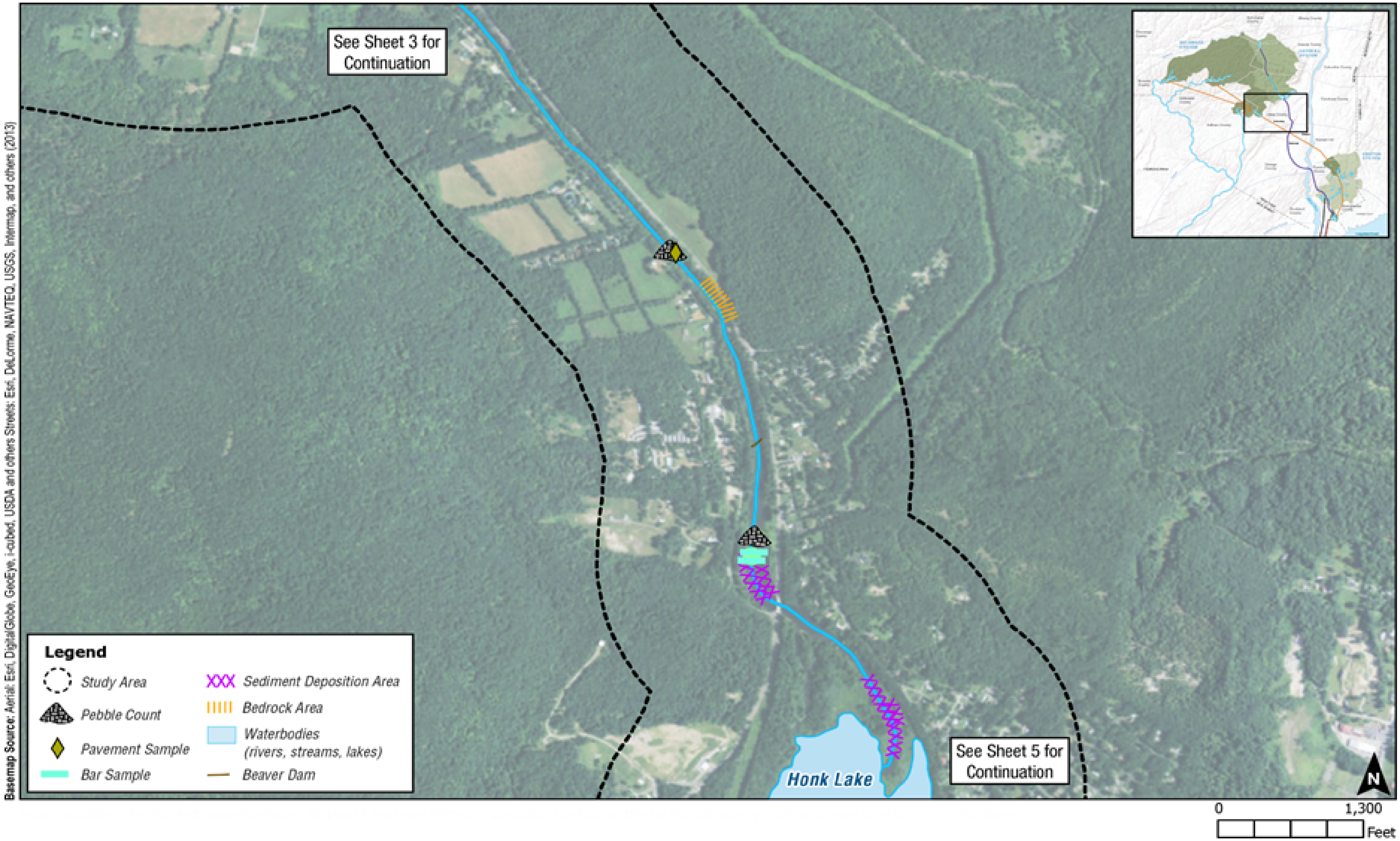
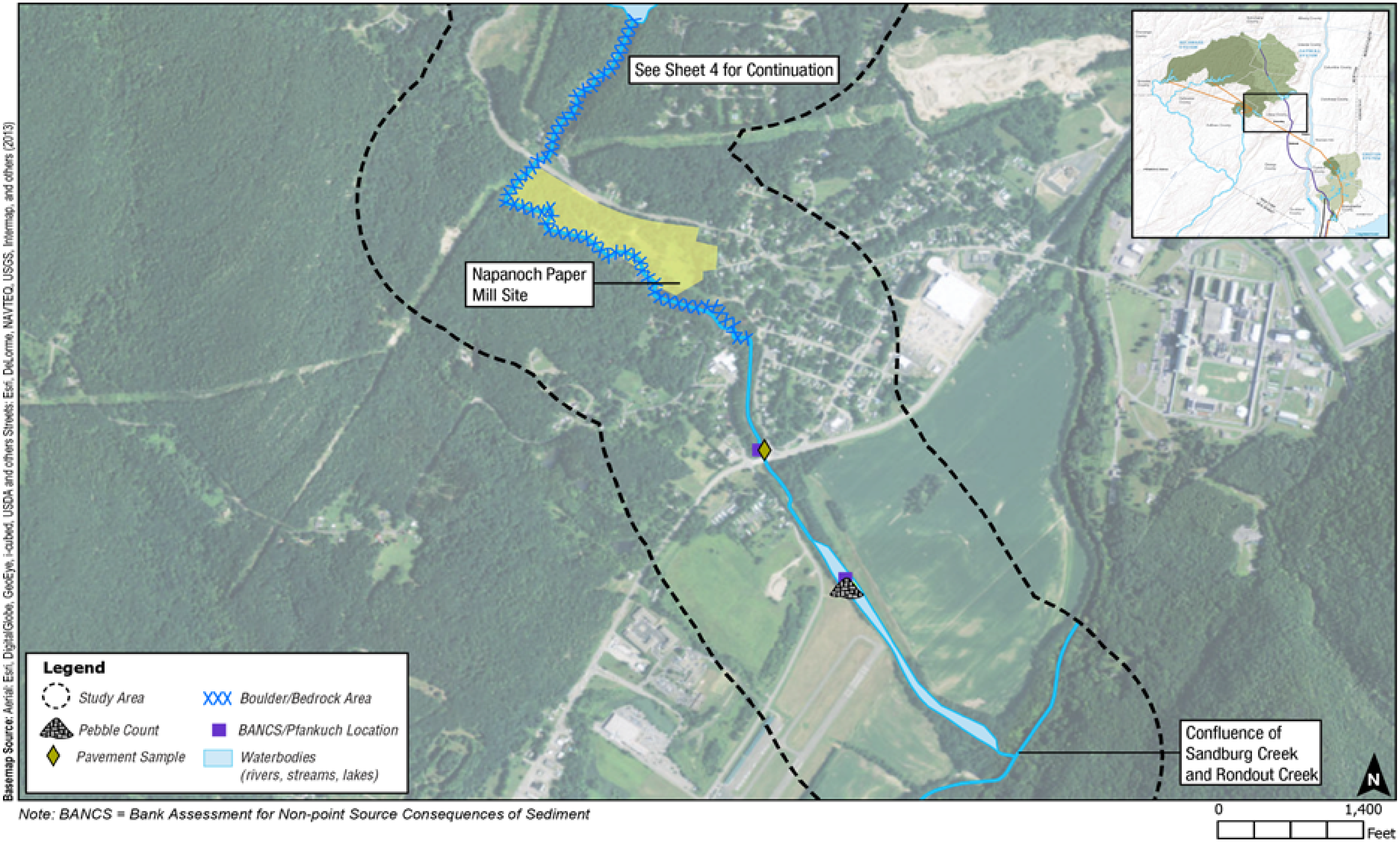


Figure 10.3-38: Geomorphology Survey – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 4)



Note: BANCS = Bank Assessment for Non-point Source Consequences of Sediment

Figure 10.3-38: Geomorphology Survey – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 5)

Table 10.3-9: Geomorphic Parameters and Estimated Effective Discharge for Rondout Creek Reaches, Surveyed April 28 to May 1, 2015

Reach ID	Rosgen Stream Class	Effective Discharge Cross Section Area (Square Feet)	Effective Discharge Width (Feet)	Effective Discharge Mean Depth (Feet)	Effective Discharge Max Depth (Feet)	Effective Discharge Water Surface Slope (Feet/Feet)	$Velocity_{ED}$ (Feet Per Second)	$Flow_{ED}$ (Cubic Feet Per Second)	$Flow_{ED}$ (mgd)
Reaches between Rondout Reservoir and Honk Lake									
Reach 1	F3	308.92	119.2	2.6	3.5	0.0016	2.4	727.8	470.4
Reach 1	F3	282.54	114.0	2.5	4.0	0.0025	2.6	728.1	470.6
Reach 2	F3	223.55	101.9	2.2	2.9	0.0031	3.3	730.8	472.3
Reach 7	B3c	180.77	84.6	2.1	3.7	0.0059	3.8	683.1	441.5
Reach 3	B3c	172.12	91.1	1.9	3.5	0.0075	4.2	728.2	470.7
Reach 4	F3	220.78	96.8	2.3	2.7	0.0040	3.5	781.3	505.0
Reach Upstream of Honk Lake Affected by Lake Storage									
Reach 5	D3	301.09	167.5	1.8	3.1	0.0025	2.663	801.8	518.2
Reach below Honk Lake									
Reach 6	C3	48.97	32.2	1.5	2.1	0.0042	2.19	107.2	69.3

Note:
ED = Effective Discharge
Rosgen stream classification as defined in Applied River Morphology (Rosgen 1996).

Table 10.3-10: Effective Discharge Shear Stress, Predicted Largest Moveable Particle Sizes, and Particle Sizes for Riffle Pebble Count, Bar Sample, for Rondout Creek Reaches, Surveyed April 28 to May 1, 2015

Reach ID	ED Shear Stress (lbs/ square feet)	Predicted Largest Moveable Particle - Rosgen (mm)	Predicted Largest Moveable Particle - Shields (mm)	Riffle D50 (mm)	Riffle D84 (mm)	Riffle D100 (mm)	Bar D50 (mm)	Bar D100 (mm)
Reaches between Rondout Reservoir and Honk Lake								
Reach 1	0.30	56	19	77	216	1024	33	76
Reach 1	0.39	77	29	106	225	1024	33	76
Reach 2	0.40	81	32	83	146	256	37	180
							59	90
Reach 7	0.79	128	61	76	271	1024	NA	NA
Reach 3	0.90	139	69	102	170	362	NA	NA
				117	219	512	NA	NA
Reach 4	0.56	100	43	101	178	362	NA	NA
Reach Upstream of Honk Lake Affected by Lake Storage								
Reach 5	0.30	60	21	74	119	362	46	132
							46	168
Reach below Honk Lake								
Reach 6	0.39	77	30	139	237	512	NA	NA

Notes:
NA indicates stream reach was a straight riffle section or a meander with no bar present
mm = millimeters

Table 10.3-11: Pavement and Sub-pavement Sample Results, Rondout Creek Reaches, Surveyed April 28 to May 1, 2015

Reach ID	Pavement D50 (mm)	Pavement D100 (mm)	Sub-pavement D50 (mm)	Sub-pavement D100 (mm)
Reaches between Rondout Reservoir and Honk Lake				
Reach 7	144	240	10	74
Reach 4	130	192	26	83
Reach below Honk Lake				
Reach 6	142	160	4	60

Notes:
mm = millimeters

Table 10.3-12: Maximum and Sustained Releases as a Percentage of Estimated Effective Discharge for Each Stream Reach

Reach	Estimated Effective Discharge (EED)	Maximum Release[1] as Percentage of EED	Maximum Sustained Release[2] as Percentage of EED
Reaches between Rondout Reservoir and Honk Lake			
1	470 mgd	54%	43%
2	472 mgd	54%	42%
7	442 mgd	58%	45%
3	470 mgd	54%	43%
4	505 mgd	50%	40%
Reach Upstream of Honk Lake Affected by Lake Storage			
5	518 mgd	49%	39%
Reach below Honk Lake			
6	69 mgd[3]	377%	290%

Notes:
[1] Percent = 260 mgd divided by estimated effective discharge.
[2] Percent = 200 mgd divided by estimated effective discharge.
[3] The effective discharge at this reach is affected by the storage within Honk Lake with the existing dam in place. A rehabilitated dam would continue to attenuate flows. If the dam were breached or removed, the downstream section of Rondout Creek would return to conditions similar to the upstream portion, which has a substantially larger effective discharge.

resulting spillway design of the rehabilitated Honk Lake Dam. For the evaluation with the dam decommissioned (breached or removed), it is assumed that the stream channel would return to the condition before the dam was constructed, which would have similar properties as the sections of Rondout Creek upstream of Honk Lake where the reservoir release would be approximately 50 percent of effective discharge.

As indicated in **Table 10.3-13** below, both the estimates of effective discharge entrainment (442 to 518 mgd above Honk Lake and 69 mgd below Honk Lake at Reach 6), and the HEC-RAS discharge (260 mgd) entrainment estimates show that the maximum release discharge would not entrain the existing 84th percentile particle diameter for material within the Creek. The 84th percentile particle diameter (D84) is the typical size particle that would be mobilized during the bankfull flow for gravel and cobble bed streams.[33] Therefore, the effective discharges are not anticipated to mobilize a substantial portion of the existing bed material in Rondout Creek, and the planned temporary Rondout Reservoir release flow would not be anticipated to degrade the existing streambed.

Table 10.3-13: Predicted Sediment Entrainment for Rondout Creek Effective Discharge and Planned Rondout Reservoir Release Flow, Compared to Riffle Substrate D84 Observed during 2015 Geomorphic Survey

Reach	Observed D84 (mm)	Effective Discharge	Diameter of Particles Entrained by the Effective Discharge (mm)	Maximum Release Discharge	Largest Particle Movement Prediction from HEC-RAS based on Release Discharge (Rosgen Values)
Reaches between Rondout Reservoir and Honk Lake					
1	216	470 mgd	57	260 mgd	70
2	146	472 mgd	81	260 mgd	81
7	271	442 mgd	128	260 mgd	104
3	170-219	470 mgd	139	260 mgd	117
4	178	505 mgd	100	260 mgd	94
Reach upstream of Honk Lake Affected by Lake Storage					
5	118	518 mgd	60	260 mgd	45
Reach below Honk Lake					
6	237	69 mgd	77	260 mgd	84
Note: mm = millimeters					

In conclusion, seven reaches of Rondout Creek were evaluated during a geomorphic survey completed from April 28 to May 1, 2015, which included Rosgen class F3, B3c, D3, and C3 streams (Rosgen 1996). When compared to historical Rondout Reservoir discharge data, the effective discharge for the reaches above Honk Lake have an approximately four-year return interval. The estimated effective discharges for the reaches upstream of Honk Lake exceed the maximum temporary shutdown release flow of 260 mgd, indicating that these reaches have historically experienced discharges greater than 260 mgd, which has maintained the channel capacity.

The maximum predicted moveable particle size for effective discharge estimated from the geomorphic survey was in general agreement with the particle sizes predicted by the HEC-RAS

[33] Entrainment in this context refers to the ability of the flow of water to move or transport particles downstream.

model. The predicted moveable particles were all smaller than the measured D84 of the surveyed representative riffles, suggesting that riffle degradation (i.e., erosion) is not likely with the maximum temporary shutdown release flow of 260 mgd, although localized transport of smaller bed material may occur.

The largest particles measured in the bar and sub-pavement samples were smaller than the 84^{th} percentile particle diameter of the representative riffle for six of the seven reaches. This indicates that the bars are building in these reaches and the riffles are not degrading. At Reach 5 above Honk Lake, however, where two bar samples were collected downstream of the active riffle, the largest particles on the bars exceed the 84th percentile particle diameter of the local riffles, indicating that the riffles could be degrading and the bars are unstable. It should be noted that at Reach 5, recent conditions may not have been representative of historical conditions, as it was difficult to distinguish between recent and historical deposition due to the current change in Honk Lake water surface elevations. The results suggest that the effective discharge for Reach 5 could be actively degrading the riffle, which matched field observations of observed scour pools that were actively forming in the mid-riffle at the time of the survey. These areas would be stabilized, however, once final action on Honk Lake Dam has been implemented and either the normal pool elevation or the legacy stream channel restored.

The following two scenarios were assessed for Honk Lake in the future with the temporary shutdown: (1) the dam would be repaired and water surface elevations would return to historical levels, or (2) the dam would be removed and the stream geomorphology would adjust to the new base condition, which is independent of the temporary shutdown. Under the first scenario, the dam would provide attenuation of flows anticipated during the temporary shutdown, which would depend on final spillway design. Under the dam removal or breach scenario, the stream would adjust to be more similar to the upstream reaches with respect to effective discharge, which is higher than the anticipated flows during the temporary shutdown.

While some localized bank erosion could occur as a result of the temporary shutdown release flow, large-scale erosion would not be expected to occur. Field surveys indicated the banks were stable with large sections of rock and boulders. Where the banks were dominated by vegetation, the vegetation survey indicated that the riparian areas consisted of healthy vegetation with a robust root stock and that aerial cover of vegetation was 100 percent in most locations surveyed. Because the shutdown would predominantly occur over the dormant season, there is little risk to established vegetation. Ecological Communities in Section 10.3.9.3, “Natural Resources,” provides more detail on the vegetation surveys.

Multiple beaver dams were identified along the creek from field visits. The temporary shutdown release flow would increase the stresses on these features and increase the chance for failure. This could result in a release of sediment and coarse woody debris to downstream reaches. Prior to the temporary shutdown, DEP would develop a plan to remove the debris that has the potential to transport downstream and create blockages or unforeseen localized issues.

Based on this analysis, WSSO would not result in significant adverse impacts to geology and soils in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

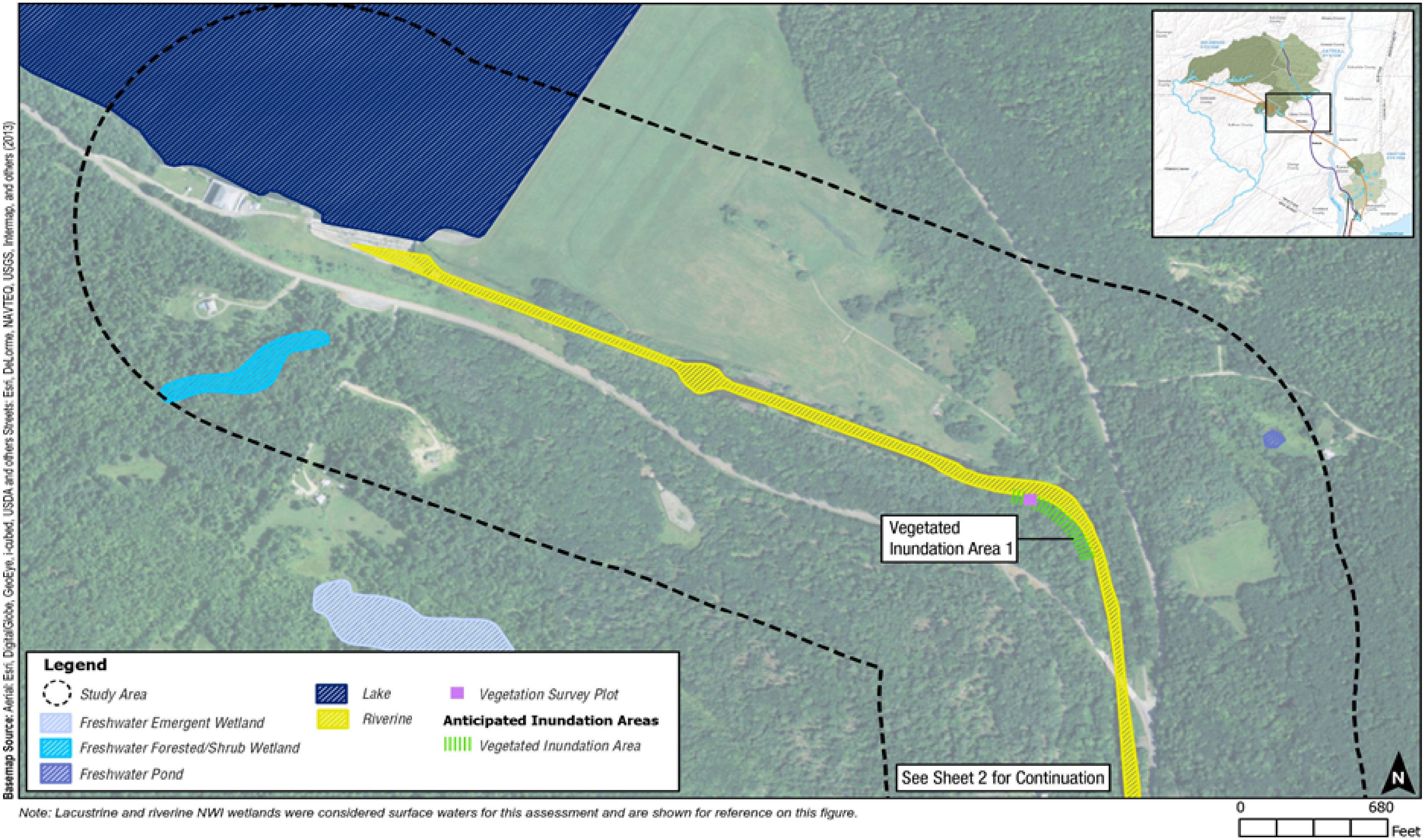
Terrestrial Resources

Ecological Communities

A determination of the baseline ecological communities of the Rondout Creek Downstream of Rondout Reservoir Study Area was conducted to assess the potential for impacts to ecological communities that would result from increased releases in Rondout Creek during WSSO. NYNHP database results showed that one significant natural community, a chestnut oak forest, occurs in the southern portion of the study area at the foot of the Shawangunk Ridge. Vegetation studies were conducted in the Rondout Creek Downstream of Rondout Reservoir Study Area during the week of June 22, 2015. Ecological communities were identified according to Edinger et al. 2014. Vegetation studies were conducted at 10 potential vegetated inundation areas and at the only vegetated mid-channel bar (see **Figure 10.3-39**) within the study area. Vegetation studies consisted of identifying plant coverage using a randomly selected 10-foot by 10-foot plot, and timed meander surveys throughout the inundation area to inventory the vegetative communities at each site. Rondout Creek between Merriman Dam and Sandberg Creek occurs in a confined valley, has high water clarity, few meanders, a moderate to steep gradient, a mostly cobble bottom, shaded banks, and abundant freshwater macroinvertebrates. These attributes for this section of Rondout Creek are consistent with a rocky headwater stream.

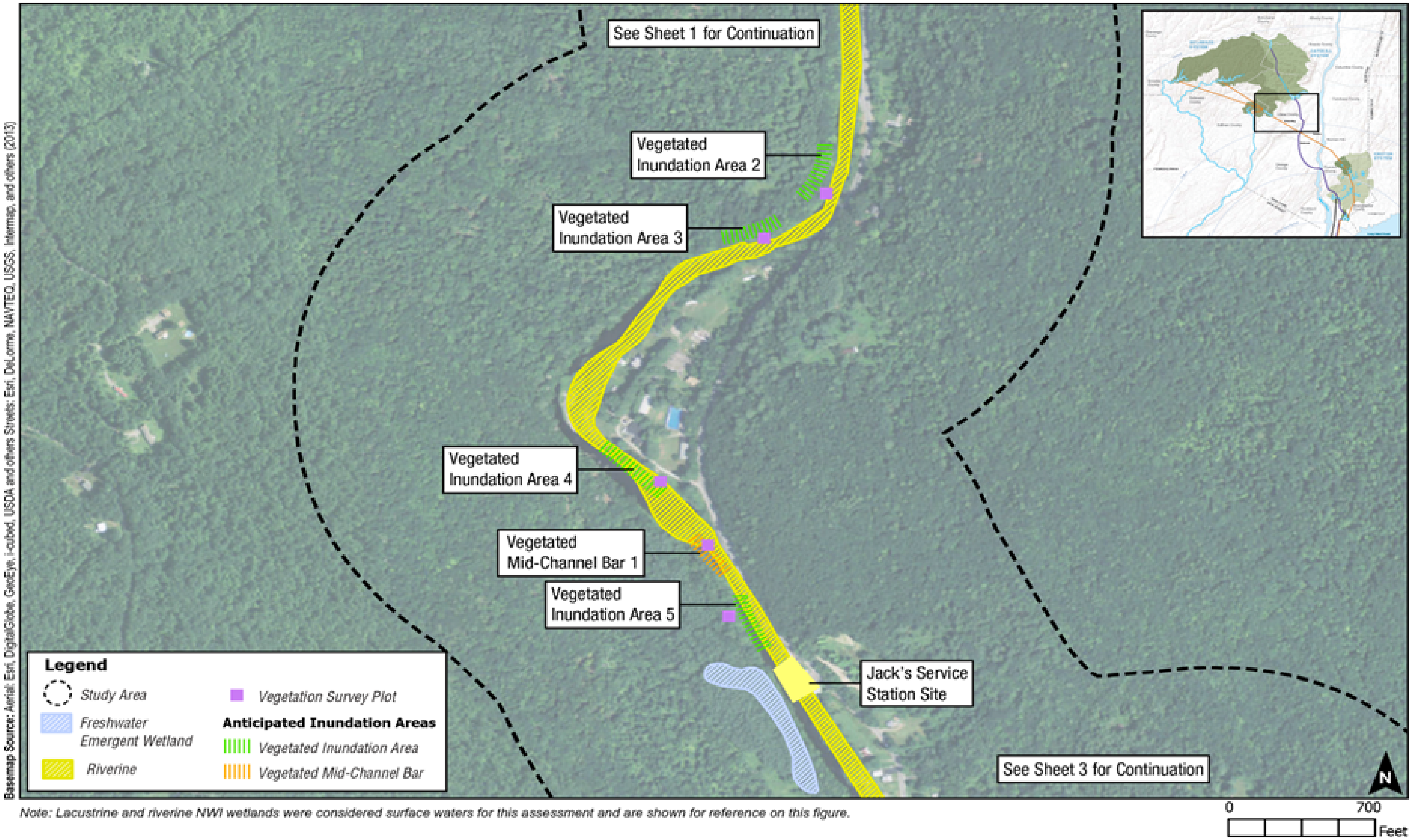
Rondout Creek has isolated locations of larger deep pools, soft edges, and gradually sloping banks that contain riparian vegetation. These areas would be classified as shallow emergent marshes. Vegetation that was common in these areas included arrowleaf tearthumb (*Persicaria sagittata*), bedstraw (*Galium* spp.), bluets (*Houstonia caerulea*), common boneset (*Eupatorium perfoliatum*), broadleaf cattail (*Typha latifolia*), American bur-reed (*Sparganium americanum*), clearweed (*Pilea pumila*), fringed sedge (*Carex crinita*), duckweed (*Lemna* spp.), American hogpeanut (*Amphicarpaea bracteata*), hop sedge (*Carex lupulina*), spotted touch-me-not (*Impatiens capensis*), joe pye weed (*Eutrochium maculatum*), narrowleaf cattail (*Typha angustifolia*), bay forget-me-not (*Myosotis laxa*), sensitive fern (*Onoclea sensibilis*), common rush (*Juncus effusus*), yellow loosestrife (*Lysimachia vulgaris*), and others. The one vegetated mid-channel bar observed at Rondout Creek shared many of the herbaceous species observed along the riparian edges but also contained a scattered but robust shrub layer that included stunted American sycamore (*Platanus occidentalis*), American witchhazel (*Hamamelis virginiana*), black willow (*Salix nigra*), and red-osier dogwood (*Cornus sericea*). Other locations along the creek were observed to have terraces that support floodplain forests composed primarily of a mature canopy of red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), hickories (*Carya cordiformis, C. ovata, C. laciniosa*), and American sycamore. White pine (*Pinus strobus*) was an uncommon associate in the floodplain areas but was common in the canopy in the upland forested areas of the study area.

Floodplain areas had scant shrub layers and abundant and diverse herbaceous layers typical of floodplain and broadleaf deciduous forest in the Catskills region. Upland forest that occurs along the banks of Rondout Creek consisted of Appalachian oak-hickory forest and Appalachian oak-pine forest. Although not a defined ecological community by Edinger, some of the northern and eastern facing shaded, steep banks to Rondout Creek contained large stands of great laurel (*Rhododendron maximum*) with a scant herbaceous community. One terrestrial cultural



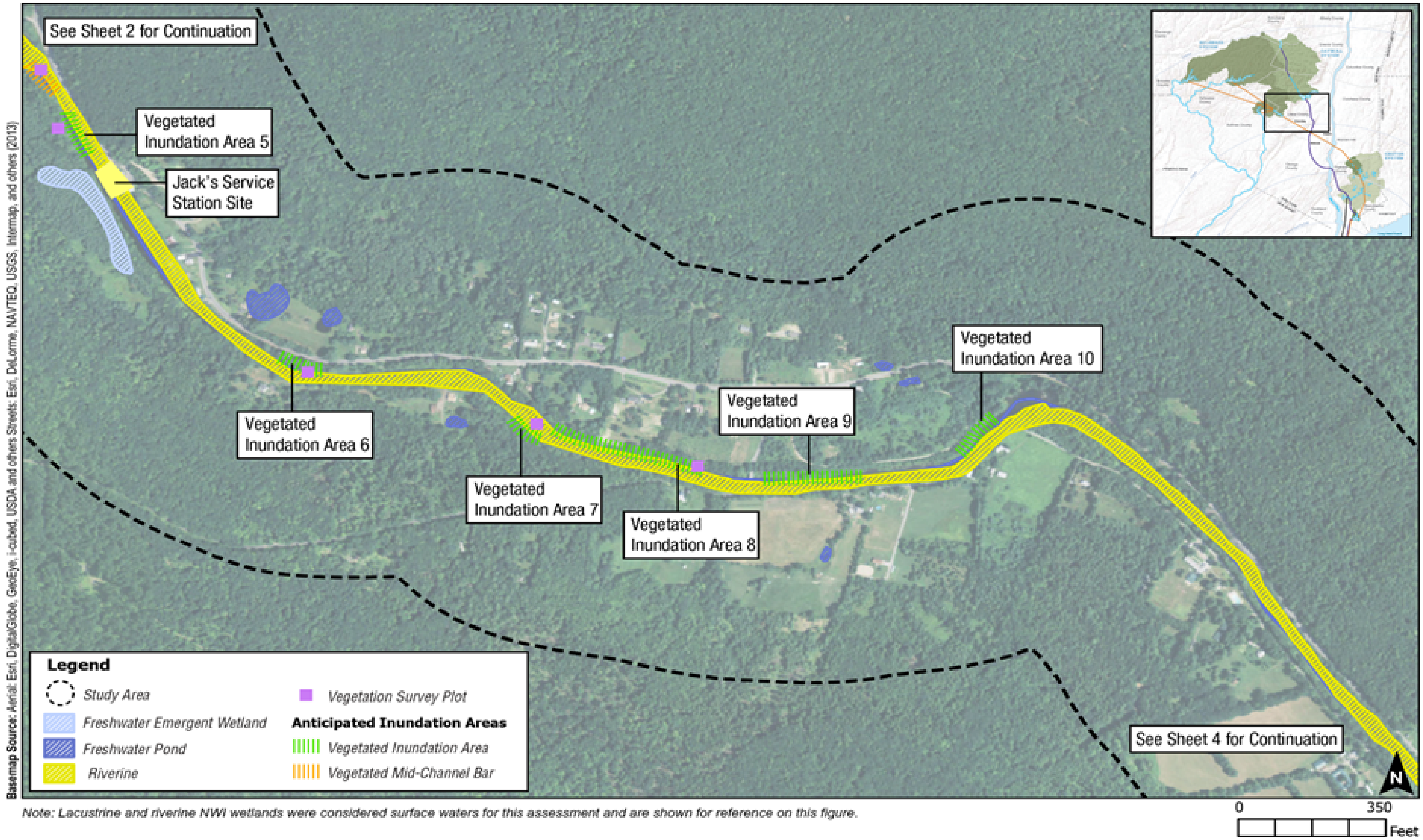
Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.

Figure 10.3-39: Vegetation Survey and Wetlands – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 1)



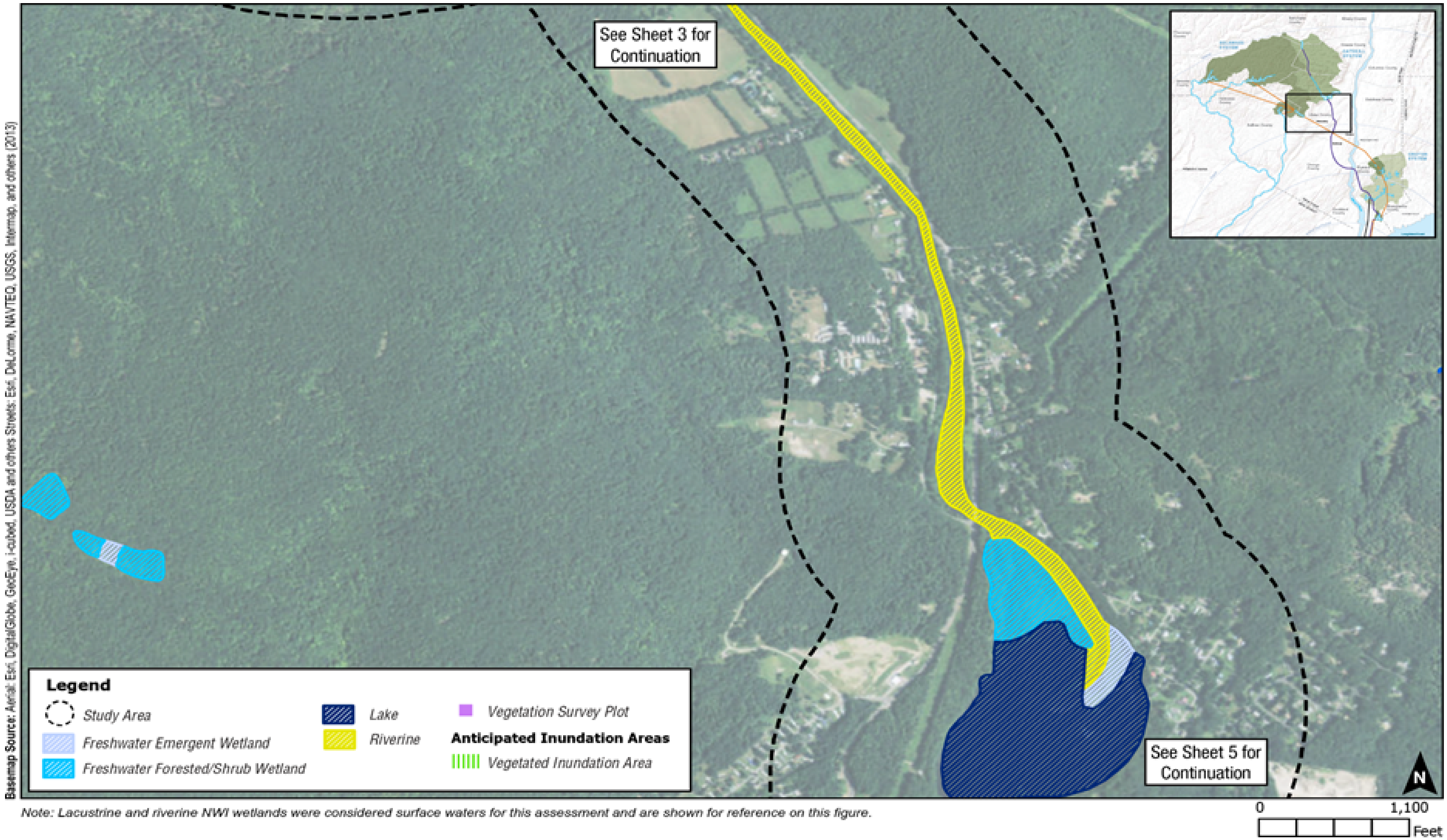
Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.

Figure 10.3-39: Vegetation Survey and Wetlands – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 2)



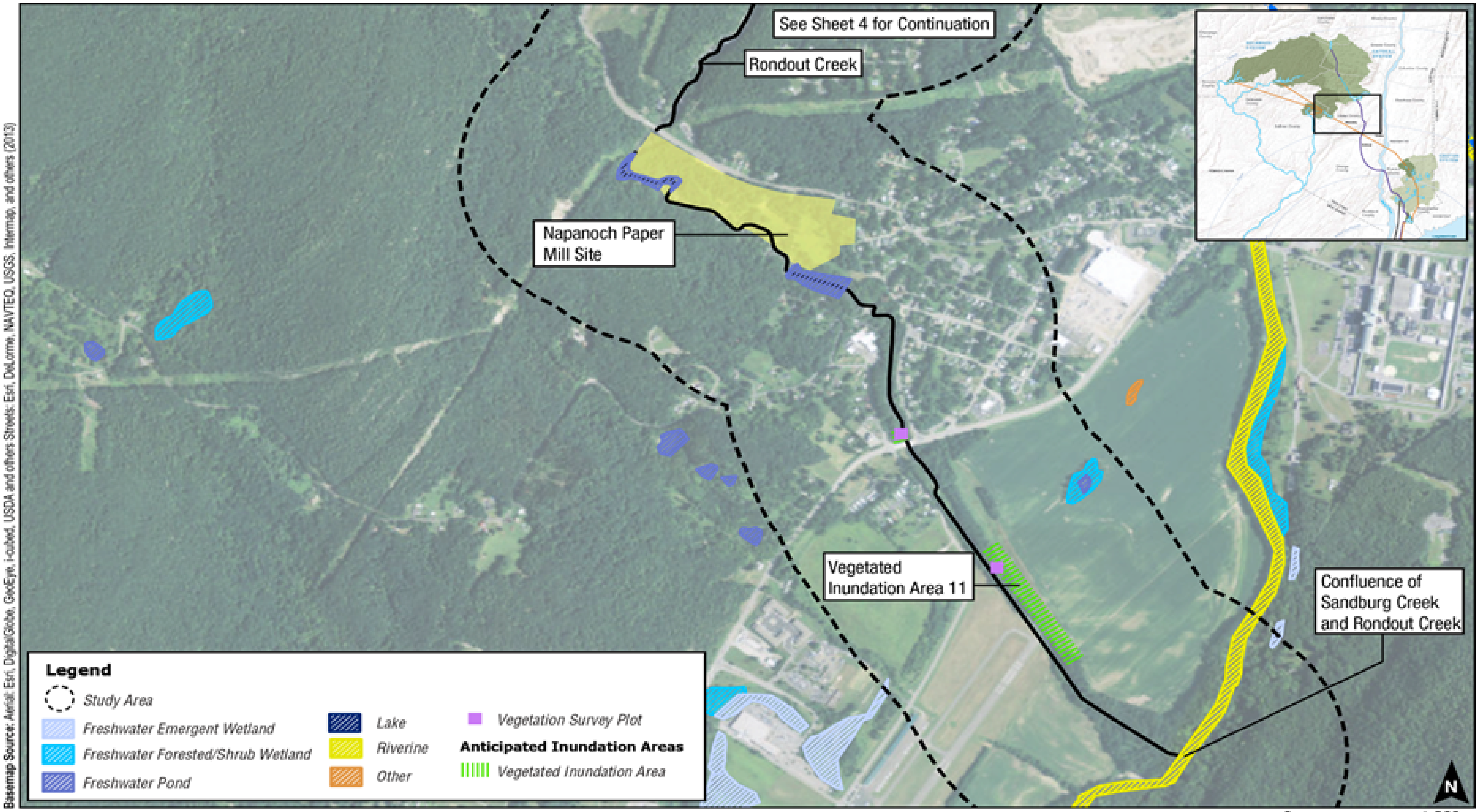
Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.

Figure 10.3-39: Vegetation Survey and Wetlands – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 3)



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.

Figure 10.3-39: Vegetation Survey and Wetlands – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 4)



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.

0 1,200 Feet

Figure 10.3-39: Vegetation Survey and Wetlands – Rondout Creek Downstream of Rondout Reservoir Study Area (Sheet 5)

NYC Environmental Protection

ecological community, a riprap/erosion control roadside, is present on a steep bank along Rondout Creek adjacent to State Route 55. As vegetation surveys progressed downstream, the occurrences of invasive species increased. Japanese barberry (*Berberis thunbergii*), Japanese stiltgrass (*Microstegium vimineum*), and multiflora rose (*Rosa multiflora*) were found in most vegetation survey areas and Japanese knotweed (*Polygonum cuspidatum*) and oriental bittersweet (*Celastrus orbiculatus*) were found more commonly at the lower reaches of Rondout Creek closer to the State Route 209 bridge.

In the future without WSSO, it is assumed that ecological communities within the study area, including the chestnut oak forest identified by NYNHP, would largely be the same as baseline conditions, with the exception of possible changes in habitat due to natural vegetative succession. In the future without WSSO, Honk Lake Dam would be rehabilitated or decommissioned. If rehabilitated, ecological communities would remain unchanged without WSSO. If the dam were decommissioned, the former lake bed would be a different ecological community. For purposes of this assessment, it is assumed that the ecological community would be a mix of upland and wetlands habitats similar to other areas of Rondout Creek. Specific ecological communities would depend on topography, soils, length of time, and whether the lake bed is replanted or allowed to evolve naturally.

Based on the results of the vegetation and geomorphologic analyses, there would be minor and temporary effects to the fringe vegetation of the floodplain forests, shallow emergent marshes, and vegetated mid-channel bar as a result of increases in releases and consequent minor rise in water level of Rondout Creek from WSSO. Because the temporary shutdown would predominantly occur over the dormant season, there is little mortality risk to established vegetation. If high flows persist through May, emergence of some vegetation could be delayed and growth stunted until flows return to typical levels at the end of the shutdown in June. The areas surveyed during the vegetation studies that would most likely experience these effects are the Vegetated Mid-Channel Bar 1 (see **Figure 10.3-39**) and the shallow emergent marsh in Vegetated Inundation Area 4 (see **Figure 10.3-39**). The root stock in these areas is mature and stable and would minimize scour that could be generated by the increased flows. All ecological communities along Rondout Creek are anticipated to completely recover in the growing season following the RWBT temporary shutdown. Therefore, there would be no potential significant adverse impacts to ecological communities within the Rondout Creek Downstream of Rondout Reservoir Study Area. These findings would apply to the Honk Lake area regardless of whether the Honk Lake Dam is rehabilitated or decommissioned prior to the temporary shutdown. There would be no effects to the NYNHP identified chestnut oak forest. This forest abuts Rondout Creek downstream of its confluence with Sandburg Creek. At this location in the Rondout Creek drainage area, increased flows as a result of WSSO would not result in changes to the geomorphology of the creek. Therefore, WSSO would not result in significant adverse impacts to significant natural communities at Rondout Creek in the Rondout Creek Downstream of Rondout Reservoir Study Area.

Wildlife

During site investigations at Rondout Creek, ample wildlife was observed utilizing the banks of Rondout Creek as well as the surrounding forested area. Birds observed included American

Crow (*Corvus brachyrhynchos*), American Goldfinch (*Spinus tristis*), Bald Eagle (*Haliaeetus leucocephalus*), Barn Swallow (*Hirundo rustica*), Belted Kingfisher (*Megaceryle alcyon*), American Black Duck (*Anas rubripes*), Black-capped Chickadee (*Poecile atricapillus*), Blue Jay (*Cyanocitta cristata*), Chimney Swift (*Chaetura pelagica*), Common Grackle (*Quiscalus quiscula*), Common Raven (*Covus corax*), Dark-eyed Junco (*Junco hyemalis*), Downy Woodpecker (*Picoides pubescens*), Mallard (*Anas platyrhynchos*), Northern Cardinal (*Cardinalis cardinalis*), Pileated Woodpecker (*Dryocopus pileatus*), Red-tailed Hawk (*Buteo jamaicensis*), White-breasted Nuthatch (*Sitta carolinensis*), Wood Thrush (*Hylocichla mustelina*), and Yellow Warbler (*Setophaga petechia*). Mammals observed included red squirrel (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), eastern gray squirrel (*Sciurus carolinensis*), American beaver (*Castor canadensis*), white-footed mouse (*Peromyscus leucopus*), and white-tailed deer (*Odocoileus virginianus*). Amphibians and reptiles observed included American toad (*Anaxyrus americanus*), common garter snake (*Thamnophis sirtalis*), red-spotted newt (*Notophthalmus viridescens*), green frog (*Lithobates clamitans*), northern two-lined salamander (*Eurycea bislineata*), and wood frog (*Lithobates sylvaticus*). Invertebrates such as damselflies, dragonflies, and spiders were abundant in the study area.

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions, with the exception of possible changes in habitat due to natural vegetative succession. In the future without WSSO, Honk Lake Dam could be rehabilitated or decommissioned. If rehabilitated, wildlife would remain unchanged without WSSO. If the dam were decommissioned, the former lake bed that would be exposed would become a different ecological community that supports terrestrial wildlife. The ecological community resulting from draining Honk Lake is uncertain and would depend on topography, soils, length of time elapsed, and whether the lake bed is replanted or allowed to evolve naturally. For purposes of this assessment, it is assumed that the resulting habitat would support a mix of upland and wetlands species similar to other areas of Rondout Creek.

The temporary shutdown would not result in significant changes to critical wildlife habitat, wildlife movement, or wildlife prey species that occur within the Rondout Creek Downstream of Rondout Reservoir Study Area. Temporary inundation of low-lying areas of the Rondout Creek shoreline from increased releases could temporarily cause small mammals such as mice and voles that use the current shoreline as habitat to move to higher elevations. Amphibians and reptiles that use the shoreline in these areas would adapt to higher water levels, particularly because flows would be increased gradually. Most of the bird species anticipated to occur in the study area are upland, canopy dependent species and, therefore, would not be affected by WSSO. Birds of prey that utilize the creek for foraging would not be affected.

Therefore, any changes that would be experienced by wildlife as a result of WSSO would be temporary and minor and would occur primarily during winter when many wildlife species are dormant. Therefore, there would be no significant adverse impacts to wildlife within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Rondout Creek Downstream of Rondout Reservoir Study Area were identified based on consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Rondout Creek Downstream of Rondout Reservoir Study Area include the following: Blocks 5363C, 5363D, 5463C, 5362B, 5462A, 5462B, 5462C, and 5462D. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the Rondout Creek Downstream of Rondout Reservoir Study Area include the Rondout Reservoir, Ellenville, Kerhonkson, and Napanoch Quadrangles. In total, these sources identified species with the potential to occur in the Rondout Creek Downstream of Rondout Reservoir Study Area. Field surveys were conducted to assess the potential habitat for these species. Baseline ecological information and assessments for the species in the Rondout Creek Downstream of Rondout Reservoir Study Area is shown in **Table 10.3-14.**

Following the initial analysis, two species were identified as having the potential to be affected by increased flows in Rondout Creek that would occur as a result of WSSO. Therefore, impact analyses for these species, the wood turtle (*Glyptemys insculpta*) and button-bush dodder (*Cuscuta cephalanthi*), are presented below.

Wood Turtle (Glyptemys insculpta)

The wood turtle (*Glyptemys insculpta*) was not identified in the Rondout Creek Downstream of Rondout Reservoir Study Area during the June 2015 vegetation surveys, but was identified as potentially occurring in the vicinity of the Rondout Creek Downstream of Rondout Reservoir Study Area by the NYSDEC Herp Atlas. Wood turtles inhabit a variety of forested habitats that are near watercourses. Watercourses are used by wood turtles for hibernation, resting, mating, and foraging. Wood turtles hibernate fully submerged at the edges of streams, in shallow pools, and often utilize features in the banks or substrate such as root wads or muskrat or other mammal burrows. In the future without WSSO, Rondout Creek would continue flowing under its typical conditions.

In the future with increased flows from WSSO, wood turtles would continue to be able to use Rondout Creek. The RWBT temporary shutdown would begin in October while wood turtles are still active and any changes to the water level in Rondout Creek would be gradual, allowing wood turtles to adjust accordingly. By November, when wood turtles have returned to streams to hibernate, the water level in Rondout Creek would be higher than under typical operations. Wood turtles hibernate below the water surface where the cold water of the stream sinks and regulates itself (Arvisais et al. 2002). The increase in flow velocity could affect how wood turtles select hibernacula, and could limit suitable locations to underwater sites that are somewhat protected from direct flow. Any increase in height of the water would not likely result in adverse effects to hibernating wood turtles in Rondout Creek because they would already be submerged. If flows were to decrease during the temporary shutdown while wood turtles are hibernating, it could cause wood turtles to expend energy and adjust to a deeper location in the stream.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Reptiles and Amphibians				
Blue-spotted salamander (*Ambystoma laterale*)	None	Special Concern	Blue-spotted salamanders inhabit damp deciduous and deciduous/coniferous forests containing temporary ponds at a variety of elevations (Gibbs et al. 2007). They are often found where soils have high sand or loam content and in certain instances can tolerate disturbance in suburban areas. The blue-spotted salamander breeds in March and April and spends most of its lifecycle underground. Blue-spotted salamander does not inhabit streams.	Any forested areas in the Rondout Creek Downstream of Rondout Reservoir Study Area that contain suitable soils, moisture, and ephemeral pools for blue-spotted salamander would not be affected by the increased flows. Therefore, no effects to blue-spotted salamanders are anticipated in this study area and no further analysis for blue-spotted salamanders is warranted for this study area.
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Suitable bog turtle habitat includes fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and “mucky.” Vegetation commonly includes calciphile species. Suitable bog turtle habitat is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require streams for any part of their natural history.	Surveys of the Rondout Creek Downstream of Rondout Reservoir Study Area found no wetlands that are suitable habitat for bog turtle. During field investigations, the only wetlands that were found in areas that would be affected by WSSO were shallow emergent marshes on the stream edge. These wetlands did not have the shallow pools, mucky substrates, tussocky vegetation, or rivulets preferred by bog turtle. NYNHP did not identify bog turtle occurrences in the study area and the banks of Rondout Creek in the study area are steep and use of Rondout Creek as a migration pathway is unlikely. Therefore, no effects to bog turtle habitat are anticipated as a result of WSSO. No further analysis for bog turtles is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats including forests with sandy, well-drained soils; dry open uplands such as meadows, pastures, open fields, and utility right-of-ways; and, moist lowlands and wetlands. Eastern box turtles are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtle does not require streams for any part of their natural history.	Eastern box turtles could potentially utilize the floodplain forests or forested areas upland of Rondout Creek. However, only the low- lying areas of these habitats (i.e., adjacent to the creek) would be affected by WSSO. Eastern box turtles are mobile species that use a variety of habitats and avoid open water. Therefore, no effects to eastern box turtles are anticipated as a result of the increase in flows in Rondout Creek and no further analysis for eastern box turtles is warranted for this study area.
Eastern Hognose Snake (*Heterodon platyrhinos*)	None	Special Concern	Eastern hognose snake prefers open canopy woodlands, brushy fields, and high floodplains of large streams containing sandy substrates. Species also utilizes sand plains, pine plantations, and pin-oak forests (Gibbs et al. 2007; Hudsonia 2008). Eastern hognose snake does not require streams for any part of their natural history.	Eastern hognose snakes could potentially utilize the floodplain forests or upland forested areas adjacent to Rondout Creek. However, only the low-lying areas of these habitats (i.e., adjacent to the creek) would be affected by WSSO. Eastern hognose snake would have ample suitable habitat in the forested areas upland of the creek that would be unaffected by WSSO. Therefore, no effects to eastern hognose snakes are anticipated as a result of the increase in flows to Rondout Creek and no further analysis for eastern hognose snakes is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Jefferson Salamander (*Ambystoma jeffersonianum*)	None	Special Concern	Jefferson salamanders inhabit large tracts of upland deciduous and mixed deciduous/coniferous forest with abundant stumps and logs, but also occur in bottomland forests that border agricultural or otherwise disturbed areas. The Jefferson salamander spends the majority of its lifecycle underground and relies on the tunnels created by burrowing small mammals. Jefferson salamanders breed early in the year in March and April. They are broadly distributed in south-central New York. Jefferson salamander does not require streams for any part of their natural history.	Any forested areas in the Rondout Creek Downstream of Rondout Reservoir Study Area that contain suitable soils, moisture, and ephemeral pools would not be affected by the increased flows and no Jefferson salamander habitat would be affected as a result of increased flows. Therefore, no effects to Jefferson salamanders are anticipated and no further analysis for Jefferson salamanders is warranted for this study area.
Spotted turtle (*Clemmys guttata*)	None	Special Concern	Spotted turtle habitat consists of vernal pools in the spring, upland forest for part of summer after pools dry out, and wet meadows, forested swamps, or sphagnum bogs for overwintering. They are strongly associated with pools that are shallow, have clear water, and have a muddy or mucky substrate. In winter, spotted turtles could inhabit abandoned mammal lodges or burrows or under the roots of flooded shrubs and trees, and could congregate with bog turtles or snapping turtles during this time (Gibbs et al. 2007). Spotted turtle could be found in small slow flowing streams but would not use moderate to large, fast flowing streams such as Rondout Creek.	During field investigations, the only wetlands that were found in areas that would be affected by WSSO were shallow emergent marshes on the stream edge. These wetlands did not have the shallow pools or muddy/mucky substrate preferred by spotted turtle. Rondout Creek itself is a larger stream than spotted turtles would utilize. No spotted turtle habitat would therefore be affected by WSSO. Therefore, no effects to spotted turtles are anticipated and no further analysis for spotted turtles is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Timber Rattlesnake (*Crotalus horridus*)	None	Threatened	Timber rattlesnakes primarily inhabit deciduous forests in mountainous terrain; however, in summer they can be found in lower elevation coniferous forests, mixed forests, old fields, and near wetlands. Timber rattlesnakes find dens to overwinter in that are located on mountain slopes with southern exposure, where canopy coverage is less than complete, and where there is access to subterranean environments. The timber rattlesnake is found in the Hudson Highlands, with concentrations in the Catskill and Shawangunk Mountains (Gibbs et al. 2007). Timber rattlesnakes do not require streams for any part of their natural history.	During the summer, timber rattlesnakes could be found at lower elevations including Rondout Creek. However, the increased flows at Rondout Creek would occur in fall, winter, and spring when timber rattlesnakes are in upland terrain. The timber rattlesnake habitat would be unaffected and there would remain ample suitable habitat in the areas upland of the creek that would be unaffected by WSSO. Therefore, no effects to timber rattlesnakes are anticipated and no further analysis for timber rattlesnakes is warranted for this study area.
Wood turtle (*Glyptemys insculpta*)	None	Special Concern	Wood turtles have large home ranges and typically inhabit riverside or streamside environments bordered by woodlands or meadows and utilize open sites with low canopy cover. Individuals bask along stream banks and hibernate in creeks (Gibbs et al. 2007). Wood turtles require streams for some stage in their natural history.	Wood turtle habitat occurs in the study area and wood turtles have the potential to utilize the study area. Therefore, potential impacts to wood turtles were assessed for this study area.
Birds				
Cooper's Hawk (*Accipiter cooperii*)	Protected - MBTA	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests. They are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. Cooper's Hawks forage primarily on other birds. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require streams for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Increased flows in Rondout Creek would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Golden-winged Warbler (*Vermivora chrysoptera*)	Protected - MBTA	Special Concern	Golden-winged Warblers primarily inhabit patchy shrublands with a forest edge but also utilize old farm fields in various stages of succession. The Golden-winged Warbler will inhabit a wider variety of successional habitat in other regions of its range outside of New York. Golden-winged Warbler is insectivorous (Confer 2008).Golden-winged Warblers do not require streams for any part of their natural history.	Based on the review of ecological communities and aerial imagery, Golden-winged Warbler habitat does not occur in any WSSO affected area in this study area. Therefore, no effects to Golden-winged Warblers are anticipated and no further analysis for Golden-winged Warblers is warranted for this study area.
Grasshopper Sparrow (*Ammodramus savannarum*)	Protected - MBTA	Special Concern	Grasshopper Sparrow uses open grasslands with patches of bare ground and usually avoids areas with extensive shrub cover. In New York, the species is also known for breeding in forested areas (Smith 2008). Grasshopper Sparrows do not require streams for any part of their natural history.	Grasshopper Sparrows have the potential to occur in the forested areas upland of Rondout Creek. Increased flows in Rondout Creek would not affect Grasshopper Sparrow habitat, breeding, or foraging. Therefore, no effects to Grasshopper Sparrows are anticipated and no further analysis for Grasshopper Sparrows is warranted for this study area.
Northern Goshawk (*Accipiter gentilis*)	Protected - MBTA	Special Concern	Northern Goshawks' habitat in New York consists of mature deciduous, coniferous, and mixed deciduous-coniferous forests with a relatively open understory. It is also found nesting in mature conifer plantations. Northern Goshawks prey primarily on mature birds and small mammals, but is also an opportunistic feeder and will take insects and fledglings depending on prey availability (Crocoll 2008). Northern Goshawk do not require streams for any part of their natural history.	Northern Goshawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Increased flows in Rondout Creek would not affect Northern Goshawk habitat, breeding, or foraging. Therefore, no effects to Northern Goshawks are anticipated and no further analysis for Northern Goshawks is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Osprey (*Pandion haliaetus*)	Protected - MBTA	Special Concern	Osprey habitat is found along coastal and inland waterways that contain abundant fish populations. Osprey forage on fish, primarily in shallow waters. Osprey is an adaptable breeder, usually nesting in trees and dead snags, but also uses a variety of man-made structures for nesting and will nest on the ground (Nye 2008a). Osprey require water, which can include streams, for some stage in their natural history.	Suitable Osprey habitat occurs in the study area at Honk Lake and along Rondout Creek. Osprey breeding, nesting behaviors, and nesting habitat are not dependent on stream flow and increased flows in Rondout Creek would not affect breeding Osprey nesting behaviors or nesting habitat. Osprey forage on fish and increased flows are not anticipated to have negative effects to the fisheries present in Rondout Creek (see Aquatic Resources). Therefore, no effects to Ospreys are anticipated and no further analysis for Ospreys is warranted for this study area.
Peregrine Falcon (*Falco peregrinus*)	Protected - MBTA	Endangered	Peregrine Falcons traditionally nest on cliff ledges. Peregrine Falcons generally prefer open landscapes, including over open water, particularly for foraging during the nesting and non-nesting periods. However, in the Hudson Valley they also commonly nest on man-made structures such as bridges and buildings, and often use nest boxes provided by NYSDEC that are intended to reduce egg loss and increase nest success (Loucks 2008). Peregrine Falcons do not require streams for any part of their natural history.	Peregrine Falcon was identified by NYNHP as occurring in the Rondout Creek Downstream of Rondout Reservoir Study Area. Peregrine Falcon habitat occurs on the cliffs of the Shawangunk Ridge. There are no suitable cliffs, tall buildings, or large bridges suitable for Peregrine Falcon in the WSSO affected area. Additionally Peregrine Falcon does not rely on streams for any essential natural history. Therefore, no effects to Peregrine Falcons are anticipated and no further analysis for Peregrine Falcons is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-shouldered Hawk (*Buteo lineatus*)	Protected - MBTA	Special Concern	In New York, Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas or flooded swamps/wetlands for foraging and nesting. Red-shouldered Hawks occasionally nest in suburban areas where forest cover is less contiguous. Red-shouldered Hawks forage primarily on small woodland mammals but could also eat herpetiles. Migration and wintering habitats are similar to the species' breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Crocoll 2008). Red-shouldered Hawks do not require streams for any part of their natural history.	Red-shouldered Hawks could occur in forested areas adjacent to streams such as Rondout Creek. Red-shouldered Hawk could occur in wetlands or other wet habitats. There are several small riparian emergent marsh wetlands that occur on the stream edge; however, these are not large enough to support Red-shouldered Hawk breeding or foraging. Increased flows in Rondout Creek would not affect Red-shouldered Hawk habitat, breeding, or foraging. Therefore, no effects to Red-shouldered Hawks are anticipated and no further analysis for Red-shouldered Hawks is warranted for this study area.
Sharp-shinned Hawk (*Accipiter striatus*)	Protected - MBTA	Special Concern	Sharp-shinned Hawks nest in mixed, coniferous, and deciduous forests, but nest sites are most frequently in wooded areas with a dense canopy cover, small-diameter trees, and high tree density (Hames and Lowe 2008). Sharp-shinned Hawks do not require streams for any part of their natural history.	Sharp-shinned Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Increased flows in Rondout Creek would not affect Sharp-shinned Hawk habitat, breeding, or foraging. Therefore, no effects to Sharp-shinned Hawks are anticipated and no further analysis for Sharp-shinned Hawks is warranted for this study area.
Whip-poor-will (*Antrostomus vociferus*)	Protected - MBTA	Special Concern	Whip-poor-will are ground nesting birds and nest in several habitats, all which provide open areas for aerial foraging and shaded areas for nesting and roosting. Whip-poor-will is most abundant in New York in barrens communities and fields, quarries, power-line cuts, and other openings (Medler 2008). Whip-poor-will do not require streams for any part of their natural history.	Whip-poor-will could occur in the upland forests adjacent to Rondout Creek. Increased flows in Rondout Creek would not affect Whip-poor-will habitat, breeding, or foraging. Therefore, no effects to Whip-poor-wills are anticipated and no further analysis for Whip-poor-wills is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	Indiana bats form maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernate in caves and could migrate moderately long distances between hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize streams for foraging and migrating when they are available.	Indiana bats have the potential to utilize the Rondout Creek corridor and air above Rondout Creek for migration and foraging purposes. Increased flows in Rondout Creek could temporarily affect fringe herbaceous vegetation in the low-lying areas adjacent to Rondout Creek are not anticipated to affect trees, including potential Indiana bat roost habitat. In addition, increased flows in Rondout Creek would not affect migration or foraging behaviors. These effects would occur primarily during the winter when Indiana bat are hibernating. No tree clearing would occur as a result of WSSO in this study area. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees of varying sizes. These bats are opportunistic, roosting in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize streams for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize the Rondout Creek corridor and air above Rondout Creek for migration and foraging purposes. Increased flows in Rondout Creek could temporarily affect fringe herbaceous vegetation in the lowest lying areas adjacent to Rondout Creek but are not anticipated to affect trees and therefore, would not affect potential suitable summer roosting habitat or utilization of the Rondout Creek corridor or air space. These effects would occur primarily during the winter when Northern long-eared bat are hibernating. No tree clearing would occur as a result of WSSO in this study area. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Benthic Macroinvertebrates - Mussels				
Dwarf Wedgemussel (*Alasmidonta heterodon*)	Endangered	Endangered	In New York, dwarf wedgemussel populations are only known to occur in reaches of the Delaware and Neversink Rivers. The Neversink River population of dwarf wedgemussel is the largest across its range. The dwarf wedgemussel lives in cool, shallow freshwater streams and rivers with a moderate current and fine sediments. Dwarf wedgemussel uses a variety of substrates; however, large cobble is not known to support dwarf wedgemussel. The dwarf wedgemussel has a complex life history that includes external fertilization, egg development in the female, and release of larvae/glochidia which need to contact a host fish within a few days or they die. The attached glochidium develop on the host fish and undergo metamorphosis into a juvenile mussel and then they release from the host and drift and settle on the bottom in habitat frequented by the host fish. The location they land in could or could not be suitable habitat. Pollution, erosion, sedimentation, invasive species, and hydrologic alterations are all primary drivers behind their decline across their range. Known host fish for the dwarf wedgemussel include tessellated darter (*Etheostoma olmstedi*), Johnny darter (*Etheostoma nigrum*), mottled sculpin (*Cottus bairdi*) (USFWS 1993; Michaelson and Neves 1995; NYNHP 2013).	Rondout Creek consists mostly of a cobble substrate with few areas containing fine sediments. Rondout Creek could contain flow characteristics and water quality preferred by dwarf wedgemussel; however, there are multiple impoundments on Rondout Creek that greatly limit the viable host fish population and interrupt the natural sedimentation process within the stream. None of the five host fish known for dwarf wedgemussel in New York are known to occur abundantly in Rondout Creek. These are the tessellated and Johnny darter (*Etheostoma olmstedi* and *E. nigrum*), slimy and mottled sculpin (*Cottus congatus* and *C. bairdi*), and juvenile and parr of the Atlantic salmon (*Salmo salar*) (Michaelson and Neves 1995; McLain and Ross 2005). Due to the slope of Rondout Creek, storm events lead to high flow events that scour and transport downstream any non-cobble substrate. The presence of the impoundments cause any fine materials washed downstream from these storms to be deposited at the base of the impoundment, resulting in uniform substrate of cobble and boulders throughout most reaches. Neither of these substrates are known to support dwarf wedgemussel in the absence of other fine substrate materials. Therefore, it is unlikely that suitable dwarf wedgemussel habitat or a population of dwarf wedgemussel occurs in Rondout Creek and no effects to dwarf wedgemussels are anticipated. Therefore, no further analysis for dwarf wedgemussesl is warranted for this study area.

Table 10.3-14: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Rondout Creek Downstream of Rondout Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Plants				
Button-bush Dodder (*Cuscuta cephalanthi*)	None	Endangered	Button-bush dodder is a parasitic annual plant whose host species in New York include willows, asters, goldenrods, button-bush, horsetails, mints, and water-willow. All habitats in which this species has been found are wetland types including stream shores, wet meadows, marshes, shrub swamps, and blueberry bogs. Mature button-bush dodders lack roots and leaves and consist only of yellow or orange stems attached to the host plant via haustoria and small white flowers (NYNHP 2013).	NYNHP identified a historical occurrence of button-bush dodder in the Rondout Creek Downstream of Rondout Reservoir Study Area. Field surveys conducted at Rondout Creek identified a species of dodder growing on a small mid-channel bar. This individual was using goldenrod (*Solidago* spp.) and silky dogwood (*Cornus amomum*) at the water's edge. Mid-channel bars have the potential to be inundated as a result of WSSO at Rondout Creek. Therefore, potential impacts to button-bush dodder as a result of WSSO are analyzed for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act
MBTA: Migratory Bird Treaty Act

This would leave wood turtles more susceptible to freezing or predation until they find more suitable hibernating habitat. Any possible reduction in flows during the temporary shutdown would not result in flows lower than the current release rate of 15 mgd. Therefore, there could be minor, indirect, and temporary impacts to hibernating wood turtles as a result of WSSO. WSSO may affect, but is not likely to adversely affect, wood turtles.

Button-bush Dodder (Cuscuta cephalanthi)

Button-bush dodder (*Cuscuta cephalanthi*) was identified as historically occurring in the Rondout Creek Downstream of Rondout Reservoir Study Area by NYNHP database consultation. During field investigations in June 2015, a species of dodder that has similar morphological features as the button-bush dodder was located in a vegetated mid-channel bar in an upper reach of Rondout Creek. Button-bush dodder typically flowers between August and mid-September. During the June survey, the observed dodder's flowers were not completely developed, thus, a follow-up survey was conducted on August 12, 2015, when the flowers were in bloom. The mature flowers also shared morphological characteristics with button-bush dodder. However, this identification was unable to be confirmed by a NYNHP botanist. For the purposes of this analysis, it is assumed that the dodder species located at the vegetated mid-channel bar is the button-bush dodder.

Button-bush dodder is an annual species that usually dies at the end of each growing season but could also rarely overwinter on a host plant if suitable conditions are present. Thus, the primary means of reproduction of this species is through seed dispersal. Button-bush dodder goes to seed in the fall at the end of the growing season and once it senesces (deteriorates with age) during the winter, relies on its previous years' seed to germinate and find new host plants. Because of this natural history, populations of button-bush dodder are ephemeral and unpredictable. Little is known about short-term and long-term population trends of button-bush dodder in New York due to its difficulty to identify, its short-lived populations, unknown habitat preferences, and unknown seed dispersal and seed bank behavior.

In the future without WSSO, Rondout Creek would continue flowing under typical conditions. The mid-channel bar where the dodder species were found would continue to function as habitat for wetland plants. Other mid-channel bars are present at Rondout Creek and they would continue to support the same habitat as baseline conditions. Similar riparian habitat as is found on the mid-channel bars is also found at locations along the banks of Rondout Creek.

In the future with WSSO, the dodder species that was located in Rondout Creek would be anticipated to be found in Rondout Creek in habitat similar to the mid-channel bar habitat and could continue to be present elsewhere in Rondout Creek. In the future, due to the annual nature of the dodder, it is unlikely it would be present in the same location where it was currently assumed to be identified. Higher flows due to WSSO could potentially result in minor scour or inundation of mid-channel bars such as those on which the dodder species was found. However, the root stock of these mid-channel bars is robust and would remain in place following the RWBT temporary shutdown, and all vegetation would return the following growing season. Similarly, no potential button-bush dodder habitat is anticipated to be affected with a rehabilitated Honk Lake Dam or if the dam were decommissioned prior to the RWBT temporary shutdown. Therefore, WSSO may affect, but is not likely to adversely affect, button-bush dodder in the Rondout Creek Downstream of Rondout Reservoir Study Area.

WSSO would not result in significant adverse impacts to federal /State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Aquatic and Benthic Resources

The flow in Rondout Creek above Napanoch (in the reach from Merriman Dam to its confluence with Sandburg Creek) is controlled by releases and spills from Rondout Reservoir. There are no tributaries in this reach that significantly influence flow levels. As noted previously, construction of the dam and operation of Rondout Reservoir has modified the annual hydrology, water temperature regime, sediment dynamics, and flood dynamics of the creek over time. In turn, these changes have had a major influence on the aquatic habitat of the creek. The release of cold water, particularly during the summer, has favored a coldwater, aquatic life community. The year-round controlled flows from the reservoir have reduced the channel width of the historical streambed, permitted vegetation to encroach into the channel and establish on numerous, rocky mid-channel bars along the stream. Additionally, the reservoir effectively impounds upstream sediment that would otherwise wash into the downstream reaches. This has changed the substrate in Rondout Creek to a bouldery substrate with many crevices among the boulders that were formerly filled with sand. This effect extends downstream past Honk Lake to Sandburg Creek. There are also bedrock outcroppings that create a series of waterfalls within this lower reach.

The aquatic life community in Rondout Creek reflects the long-term changes in stream habitat resulting from reservoir operations, and represents the baseline conditions for the impact analysis. In the future without WSSO, typical reservoir operations would continue, and it is assumed that aquatic resources would remain consistent with baseline conditions. Rondout Creek substrate would be favorable to species that prefer rocky surfaces and a minimum of fine-grain material. Increased flows would be within the historical range for the creek, therefore no substantial changes to the benthic community are anticipated.

Based on review of the NYSDEC's 2015 fisheries database, the fish community in Rondout Creek below Merriman Dam includes both warmwater and coldwater species. These species include trout, an important game fish in the creek. Brown trout (*Salmo trutta*) are present as a result of stocking, with some wild trout likely also present. Stream habitat appears to be conducive to trout spawning and juvenile survival. There is limited potential spawning substrate, but some reproduction is possible.

The presence of largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and pumpkinseed (*Lepomis gibbosus*) in the database is not believed to reflect the current creek fish community.[34] For example, fish samples from just below Merriman Dam could have included fish that originated in and washed out from the reservoir upstream. Similarly,

[34] Per Smith (1985), the typical habitats for these species are ponds, lakes and large, slow moving rivers; whereas Rondout Creek is a shallow, swift headwaters stream.

samples taken in Honk Lake, a small impoundment on the creek, are not considered representative of the creek's overall fish community.

Since Rondout Reservoir has been in place, the fine-grain material in the streambed between Merriman Dam and Honk Lake has been transported downstream by infrequent small to moderate floods and has accumulated in the upstream portion of Honk Lake. Rondout Reservoir continues to be a sediment impoundment so that little, if any, sand or other fine-grain material enters the stream between Merriman Dam and the upstream portion of Honk Lake. The presence of sand in the substrate in Honk Lake has had a limited effect on the benthic habitat of Honk Lake.

Under WSSO, the existing modified stream channel in Rondout Creek and its aquatic life communities would not be adversely affected by the increased flows because they are within the range of flows that can be accommodated by aquatic species that inhabit Rondout Creek. Water quality of the releases would not result in changes to the stream (e.g., temperature, turbidity, or other water quality parameter), because Rondout Reservoir is a high quality, unimpaired waterbody. Water temperatures in particular would be unaffected because releases would be highest in the winter and early spring. Siphon flow would cease in late May or beginning of June, prior to higher temperature water reaching the siphon intake due to reservoir stratification.[35] At the confluence of Rondout Creek and the Hudson River, where herring and other fish species seek warmer water to spawn in the spring, additional flows via siphons would be minor with respect to total Rondout Creek and Hudson River flows, and would not be expected to influence water temperatures in that section of the creek.

Natural trout spawning is relatively limited in Rondout Creek and the population is maintained by stocking. Trout spawning that does occur in the creek would be in the fall, before flows are substantially higher than typical conditions. Additionally, most fish species in the creek would be adapted to using rocky substrates along the creek bottom for eggs and would not likely use soil and vegetation in the inundated overbank areas, which could become dry following the end of the temporary shutdown when stream flows return to typical. Streams with natural hydrological conditions often have high flows in fall and spring, which does not cause a problem for fish spawning. Therefore, fish spawning in the creek would not anticipated to be impacted by siphon flows.

An assessment of the potential impacts from WSSO to aquatic organisms in the Rondout Creek Downstream of Rondout Reservoir Study Area with Honk Lake Dam (and with a surface elevation equal to the elevation before the impoundment was drawn down in the fall of 2014), and without Honk Lake Dam is presented below.

Honk Lake Dam Rehabilitated

The inlet area of Honk Lake includes a large area of sand and sediment most likely deposited prior to Rondout Reservoir being built. This sand covers the substrate from the upstream portion

[35] Large inflows that could raise water surface elevations and trigger siphon operation in October at the beginning of the temporary shutdown when the reservoir is potentially still stratified would mix the water column, reducing water temperatures in the withdrawal zone of the siphons.

of Honk Lake (upstream of the State Route 55 Bridge) to a delta located near its center. Unconsolidated sand is a poor substrate for benthic macroinvertebrates, which are a food source for fish. Increased flows in Rondout Creek during the temporary shutdown would not have an adverse effect on aquatic habitat in Honk Lake. The flows estimated during the temporary shutdown, up to a maximum of approximately 260 mgd, would be an order of magnitude less than maximum flows that have occurred under typical conditions. Some continued redistribution of sediments and minor changes in water depth could occur. However, the habitat in Honk Lake would not be adversely impacted by these flow levels.

Honk Lake Dam Decommissioned

If Honk Lake Dam were removed, it is assumed that the controlling streambed elevation would be the original bedrock crest of Honk Falls, approximately 500 feet downstream of the existing Honk Lake Dam. Under this scenario, the habitat above Honk Falls would be a riverine condition and would be relatively high quality stream habitat similar to other sections of Rondout Creek. The stream channel would provide habitat for trout similar to the habitat between Merriman Dam and the existing Honk Lake, and could be stocked by the State, similar to other portions of Rondout Creek. The substrate is assumed to be similar to the substrate upstream of Honk Lake and would likely support a benthic community capable of supporting common stream fisheries. Therefore, increased stream flows from WSSO would not result in significant adverse impacts to aquatic resources if Honk Lake Dam were decommissioned.

Therefore, WSSO would not result in significant adverse impacts to aquatic and benthic resources in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.3.9.2, “Study Area Evaluation”), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the Rondout Creek Downstream of Rondout Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the Rondout Creek Downstream of Rondout Reservoir Study Area. Higher than typical flow rates that would occur with siphon operation would be below the maximum flow rates typically experienced in the stream, and would be below the ordinary high water of the stream. Additionally, erosion that could result in changes to the floodplain is not anticipated (see Geology and Soils in Section 10.3.9.3, “Natural Resources”). Therefore, WSSO would not result in significant adverse impacts to floodplains in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Groundwater

While stream flows would be higher than typical for a longer duration, the flow would remain within established banks and below the ordinary high water mark. Increased flows could result in minor increases in the surficial aquifer immediately adjacent to the stream, but short-term increased flows are not anticipated to appreciably change groundwater elevations in the vicinity of Rondout Creek.[36] Therefore, WSSO would not result in significant adverse impacts to groundwater in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the Rondout Creek Downstream of Rondout Reservoir Study Area (see **Figure 10.3-39**). The study area extends 0.25 mile around the stream and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on Rondout Creek. There are no NYSDEC-mapped wetlands within or intersecting the study area. There are 17 USFWS NWI-mapped wetlands within or intersecting the study area. The 17 USFWS NWI wetlands cover approximately 28 acres and consist of 4 emergent wetlands, 3 scrub/shrub or forested wetlands, and 10 ponds. Only four of these NWI wetlands occur on the fringe of Rondout Creek and none of these NWI wetlands overlap with areas identified during the stream geomorphology investigations as subject to inundation. Two of the four NWI wetlands that abut Rondout Creek are located at Honk Lake. Fringe wetlands identified during stream geomorphological investigations (see Geology and Soils in Section 10.3.9.3, “Natural Resources”) were not represented on NWI maps.

In the future without WSSO, there would be no change from typical operations and management of Rondout Reservoir or its releases. The releases and spills to Rondout Creek would be expected to be within the typical range. Adjacent and nearby wetlands would not be affected in the future without the project. Therefore, wetlands within the Rondout Creek Downstream of Rondout Reservoir Study Area in the future without WSSO are assumed to be the same as baseline conditions.

Temporary, minor effects to fringe wetlands along Rondout Creek would occur due to the modified releases from Merriman Dam as a result of WSSO. The increased flows would occur beginning in October of the shutdown and would be maintained throughout the duration of the shutdown, returning to typical flows by June following the shutdown. Releases into Rondout Creek would vary greatly during the shutdown, ranging from a typical release rate between 0 and 15 mgd up to 260 mgd.

The vegetation survey along Rondout Creek indicated that the riparian areas consisted of healthy vegetation with a robust root stock, and that areal cover of vegetation was 100 percent in most locations surveyed. Therefore, impacts to fringe wetlands would be expected to be temporary and minor. The effects are likely to involve a modified hydrologic regime, stressed vegetation

[36] A surficial aquifer is an unconfined aquifer that is very near the land surface, with a water surface that fluctuates with precipitation, evapotranspiration, well withdrawals, and other local hydrology.

with potential loss of sensitive species, and possible soil erosion or deposition. The hydrologic regime would return to typical conditions after the temporary shutdown and return of Merriman Dam to typical operations. Vegetation would rebound naturally from the temporary effects occurring during a portion of one growing season.

Two NWI-mapped wetlands along Rondout Creek that could be affected by the flow modifications are adjacent to and abutting Honk Lake. The two wetlands include one forested and one emergent wetland, which cover a total of approximately 14 acres. These two wetlands were not investigated during stream geomorphology field surveys. If Honk Lake Dam were rehabilitated, increased flows along Rondout Creek could result in slight increases to water surface elevations at Honk Lake during the shutdown. The potential for impacts to the wetlands could include modified hydrologic regime, vegetative stress, and soil erosion. Additionally, deposition of suspended sediments in the adjacent wetlands could occur as high flows in Rondout Creek decrease in velocity behind Honk Lake Dam. The potential for these impacts are described above and would be expected to be temporary and minor.

If the dam impounding Honk Lake were removed, portions of the lake bed could maintain sufficient hydrology to develop into wetland areas surrounding the stream channel that would establish upon draining of Honk Lake, thereby changing the wetland area in the Rondout Creek Downstream of Rondout Reservoir Study Area. Once fully established, effects to potential future wetlands within the currently inundated area of Honk Lake would be expected to be similar to the effects described for the wetlands located along Rondout Creek.

Impacts to wetlands along Rondout Creek would be temporary and minor. Therefore, WSSO would not result in significant adverse impacts to wetlands in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.4 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Variations in flows would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Increased flows in Rondout Creek from siphon operation would not result in erosion or flooding (see Geology and Soils in Section 10.3.9.3, “Natural Resources”). Furthermore, WSSO activities would not require a change in, or alter existing zoning within the surrounding area. For these reasons, and because variations in flows would be temporary and would not be anticipated to result in flooding or erosion of stream banks, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

The consistency of increased flows as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in receiving waterbody flows. Therefore, WSSO would not result in significant adverse impacts to public policy within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.5 Socioeconomic Conditions

Increased flows in Rondout Creek from siphon operation would not result in erosion or flooding (see Geology and Soils in Section 10.3.9.3, "Natural Resources"). Potential changes in releases from Rondout Reservoir during the temporary shutdown would not cause indirect or direct effects to factors that influence the socioeconomic character of the surrounding study areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.6 Community Facilities and Services

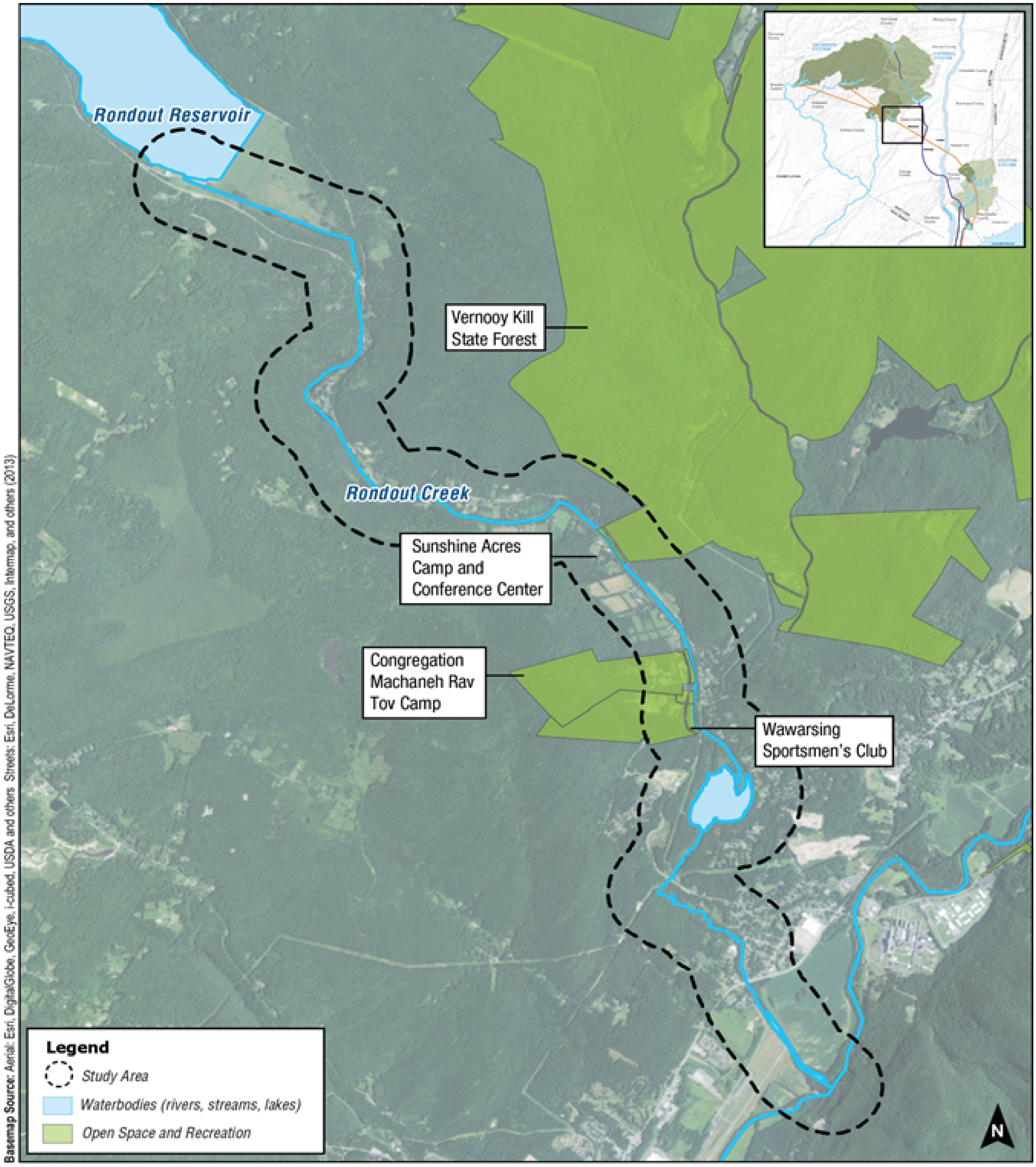
There would be no development or other construction associated with WSSO in this study area. Increased flows in Rondout Creek from siphon operation would not result in erosion or flooding (see Geology and Soils in Section 10.3.9.3, "Natural Resources"). Increased flows would not physically impact or otherwise impair the use of existing community facilities and services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.7 Open Space and Recreation

Open space and recreational resources within the study area include Rondout Creek and open space and recreational resources that intersect the waterbody along Rondout Creek beginning at the Rondout Reservoir and ending at Napanoch, New York (see **Table 10.3-15** and **Figure 10.3-40**).

Table 10.3-15: Rondout Creek Open Space and Recreation Resources

Map Key	Name	Address	Resource Opportunities	Area/Watercourse Length (if Applicable)
DEL-29	Rondout Creek	Wawarsing New York 12489	Fishing	5 miles
DEL-31	Wawarsing Sportsmen's Club	25 Sportsman Road, Wawarsing New York 12489	Hunting and Fishing Club	92 acres
DEL-30	Congregation Machaneh Rav Tov Camp	45 Sportsman Road, Wawarsing New York 12489	Summer Camp	115 acres
DEL-32	Vernooy Kill State Forest	Lundy Road, Wawarsing New York 12489	Public Recreational Area	3,600 acres
DEL-33	Sunshine Acres Camp and Conference Center	165 Sportsman Road, Wawarsing New York 12489	Summer Camp	40 acres



Note: Only Open spaces that immediately abut waterbodies were analyzed.

0 4,700 Feet

Figure 10.3-40: Open Space and Recreation Resources – Rondout Creek Downstream of Rondout Reservoir Study Area

Rondout Creek provides recreational fishing and is stocked with trout by NYSDEC (see Aquatic and Benthic Resources in Section 10.3.9.3, "Natural Resources"). There are no NYSDEC parking areas or Public Fishing Rights locations located in the Rondout Creek Downstream of Rondout Reservoir Study Area.[37] However, additional fishing opportunities exist for those who own property along Rondout Creek, via public open space properties including parks or private clubs and camps or enter the creek at unmarked or DEP access locations.

Open spaces along Rondout Creek include Wawarsing Sportsmen's Club, Congregation Machaneh Rav Tov Camp, Sunshine Acres Camp and Conference Center, and Vernooy Kill State Forest. Located along the east bank of the Rondout Creek, Vernooy Kill State Forest is a NYSDEC managed property and part of the larger Sundown Wild Forest. Vernooy Kill State Forest encompasses approximately 3,600 acres of natural landscapes such as mountains, waterfalls, and rivers. Recreational opportunities in Vernooy Kill State Forest include hunting, fishing, hiking, and camping. There are approximately 1,000 feet of Vernooy Kill State Forest located along the north side of Rondout Creek. However, there are no roads, trails, or parking areas to facilitate creek access.

Sunshine Acres Camp and Conference Center is a 40-acre religious summer camp and conference center located along the west bank of the Rondout Creek, across from Vernooy Kill State Forest. Sunshine Acres Camp and Conference Center has a summer camp for children, which operates from July through August. Additionally, the camp remains active through the duration of the year for religious retreats in the Lee Shank Lodge.

The Congregation Machaneh Rav Tov Camp and Wawarsing Sportsmen's Club are located adjacent to one another along the western bank of the Rondout Creek. The Congregation Machaneh Rav Tov Camp is an approximately 115-acre religious summer camp. The property contains bungalows, fields, and other areas available for outdoor recreation. The Wawarsing Sportsman's club is a private hunting and fishing club located on approximately 92 acres of forested land. Directly across from the Wawarsing Sportmen's Club property is a path that leads down to the Rondout Creek. Collectively, Congregation Machaneh Rav Tov Camp and Wawarsing Sportsmen's Club are located along 500 feet of the Rondout Creek. The portions that abut the creek are separated from the larger part of the properties by Sportsmen's Road.

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the Rondout Creek Downstream of Rondout Reservoir Study Area within the timeframe of the impact analysis. Natural processes such as changes in habitat due to natural vegetative succession are anticipated. Use of the identified open spaces would continue. Therefore, in the future without WSSO, it is assumed that open space and recreation within the Rondout Creek Downstream of the Rondout Reservoir Study Area would be the same as baseline conditions.

[37] Public Fishing Rights are permanent easements purchased by NYSDEC from landowners reserved for the purpose of fishing only. Public fishing rights give anglers the right to fish and walk along the bank (usually a 33 foot strip on one or both banks of the stream).

During the RWBT temporary shutdown, flows from Rondout Reservoir to Rondout Creek would increase through the operation of the siphons. Increased flows in Rondout Creek from siphon operation would not result in erosion or flooding (see Geology and Soils in Section 10.3.9.3, "Natural Resources"). As described previously, recreational areas within the study area are focused on upland activities, thus temporarily increased flows would not impact the adjacent recreational areas.

Increased flows in Rondout Creek would not be anticipated to impact fisheries (see Aquatic and Benthic Resources in Section 10.3.9.3, "Natural Resources"). Most of the temporary shutdown would occur over the winter months and no adjustment to NYSDEC fish stocking is anticipated during WSSO. However, angling opportunities, particularly in the spring, could be temporarily inhibited by high flows, which could make wading difficult and some areas of the stream unapproachable. Effects to recreational opportunities along the creek would be minor and temporary. Therefore, WSSO would not result in significant adverse impacts to recreation and open space within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.8 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.9 Historic and Cultural Resources

There would be no construction associated with WSSO in the Rondout Creek Downstream of Rondout Reservoir Study Area. The potential mechanism for potential historic or cultural resources impacts from WSSO is through erosion. While flows to Rondout Creek would be higher during the temporary shutdown than typical operations, a geomorphic analysis indicated large-scale erosion is not likely (see Geology and Soils in Section 10.3.9.3, "Natural Resources").

Further, because of the substantial reduction in natural flows following dam construction, the streambed has filled in as vegetation has encroached into the legacy streambed. The temporary increase in flows could potentially erode some of this recently accumulated sediment as the stream begins to re-establish its legacy channel, but this change would not impact any historical, archeological, or cultural sites that pre-date the construction of the dam.

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no impact to historic and cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.10 Visual Resources

While stream flows would be higher than typical for a longer duration as a result of WSSO, the flow would remain within established banks and the ordinary high water mark. It is not anticipated that there would be any visual contrast in the stream due to turbidity during the operation of the siphons, nor are increased flows anticipated to result in substantial erosion to the streambed or vegetation mortality (see Geology and Soils in Section 10.3.9.3, "Natural Resources"). Therefore, WSSO would not result in significant adverse impacts to visual resources within the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. The potential mechanism for disturbing potentially existing hazardous materials within the Rondout Creek Downstream of Rondout Reservoir Study Area would be through excessive erosion. While stream flows would be higher than typical, the results of the geomorphic analysis indicated low potential for widespread erosion (see Geology and Soils in Section 10.3.9.3, "Natural Resources").

Two legacy contamination sites were identified adjacent to Rondout Creek in the study area, the former Napanoch Paper Mill site, approximately 1 mile upstream of the confluence with Sandburg Creek, and a former service station located approximately 1 mile downstream of Merriman Dam (see **Figure 10.3-38**). The former Napanoch Paper Mill was contaminated with polychlorinated biphenyls and metals and is currently being remediated under the direction of NYSDEC. The service station has a leaking underground fuel storage tank and no information is available on remediation. Stream banks were observed at both sites during geomorphic surveys and were determined to have a low potential for erosion due to stable stream banks, substantial bedrock, and mature vegetation. Further both properties are approximately 10 to 20 feet above the creek and would be unaffected by higher flows during the shutdown.

Based on the low potential for erosion along Rondout Creek, WSSO would not result in significant adverse impacts to hazardous materials in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls along Rondout Creek within the study area. While flows to Rondout Creek would be higher than typical during the temporary shutdown, the flow would remain within established banks and the ordinary high water mark. Properly constructed and maintained private wells and septic systems with appropriate separation distances from the ordinary high water mark for the creek would be unaffected by the higher flows during the shutdown, which would be lower than the maximum flow experienced under typical conditions. Further, WSSO would not include any construction in the Rondout Creek Downstream of Rondout Reservoir Study Area that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.13 Energy

Increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during WSSO would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.14 Transportation

Increased flows in Rondout Creek from siphon operation would not result in erosion or flooding within the Rondout Creek Downstream of Rondout Reservoir Study Area (see Geology and Soils in Section 10.3.9.3, "Natural Resources"). Increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during the temporary shutdown would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.15 Air Quality

Increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during the temporary shutdown would have no effect on air quality in the vicinity of the creek. Therefore, WSSO would not result in significant adverse impacts to air quality in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.16 Noise

Increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during the temporary shutdown would have no effect on noise levels in the vicinity of the creek. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.17 Neighborhood Character

The character of the Rondout Creek Downstream of Rondout Reservoir Study Area is largely defined by public service/utility and vacant land uses, as well as its physical setting within a rural location (see **Figure 10.3-29**). Rondout Creek flows southeast from the Rondout Reservoir within the study area.

DEP has consulted with the Town of Wawarsing and Ulster County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the Rondout Creek Downstream of Rondout Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the study area would be the same as baseline conditions.

As described in Section 10.2.3, “Impact Analysis Methodology,” based on the screening assessment for shadows and urban design, an impact analysis for the Rondout Creek Downstream of Rondout Reservoir Study Area was not warranted. As described in Section 10.3.9.4, “Land Use, Zoning, and Public Policy,” Section 10.3.9.5, “Socioeconomic Conditions,” Section 10.3.9.9, “Historic and Cultural Resources,” Section 10.3.9.10, “Visual Resources,” Section 10.3.9.14, “Transportation,” and Section 10.3.9.16, “Noise,” an impact analysis for the Rondout Creek Downstream of Rondout Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; visual resources; transportation; or noise.

As described in Section 10.3.9.7, “Open Space and Recreation,” there would be no potential for WSSO activities to affect open space and recreation for the Rondout Creek Downstream of Rondout Reservoir Study Area.

Increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.3.9.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from increased flows to the Rondout Creek Downstream of Rondout Reservoir Study Area during the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Rondout Creek Downstream of Rondout Reservoir Study Area and no further analysis is warranted.

10.4 CATSKILL WATER SUPPLY SYSTEM ASSESSMENT AND IMPACT ANALYSIS

Completed in 1928, the Catskill System includes Schoharie Reservoir, the Shandaken Tunnel, and Ashokan Reservoir, and typically provides approximately 40 percent of the City's daily water supply **Figure 10.4-1**. As described in Section 10.1.2.1, "Description of the Surface Water Supply System," the Catskill System reservoirs are located west of the Hudson River in Ulster, Schoharie, Delaware, and Greene counties. Water flows southeast from Schoharie Reservoir via the 18-mile Shandaken Tunnel, emptying into Esopus Creek at Allaben. From there, water continues to flow another 12 miles in Esopus Creek before entering Ashokan Reservoir.

From Ashokan Reservoir, water is diverted at a capacity of up to approximately 590 mgd into the upper Catskill Aqueduct, which carries water approximately 74 miles to Kensico Reservoir in Westchester County.

Centered on Esopus Creek, the Catskill System has extensive recreational opportunities. Esopus Creek upstream of Ashokan Reservoir (referred to in this DEIS as the upper Esopus Creek) has multiple public access points and is home to trout fishing, whitewater kayaking and canoeing, swimming, and tubing opportunities. DEP works to support these recreational activities by closely managing releases from the Shandaken Tunnel to upper Esopus Creek. Diversions from the Shandaken Tunnel are subject to 6 NYCRR Part 670 and a State Pollution Discharge Elimination System permit. These regulations control the flow through the Shandaken Tunnel to limit releases during high flows or water quality events, maintain coldwater flow in the summer, provide flows for recreation, and control ramping rates to prevent sudden changes in flow rates. In addition, special releases are made for whitewater boating on holidays or special events. Reservoir recreation on both Schoharie and Ashokan Reservoirs is limited to DEP-permitted fishing and boating, similar to other DEP reservoirs. Esopus Creek below Ashokan Reservoir (referred to in this DEIS as lower Esopus Creek) is used for boating, fishing, and swimming opportunities. DEP also maintains hydroelectric turbines at the Ashokan Reservoir headworks for hydropower production but, as with the Delaware System hydropower, it is secondary to other objectives of the system.

Schoharie Reservoir has a watershed area of approximately 314 square miles. Downstream of Schoharie Reservoir, Schoharie Creek flows to the Mohawk River. Water that exceeds the spillway elevation of Schoharie Reservoir spills into Schoharie Creek.

Upper Esopus Creek flows into Ashokan Reservoir and has a watershed area of approximately 257 square miles. While typically of high quality, geologic conditions in the Catskill watershed can cause episodic changes to water quality when extreme storm events erode the naturally

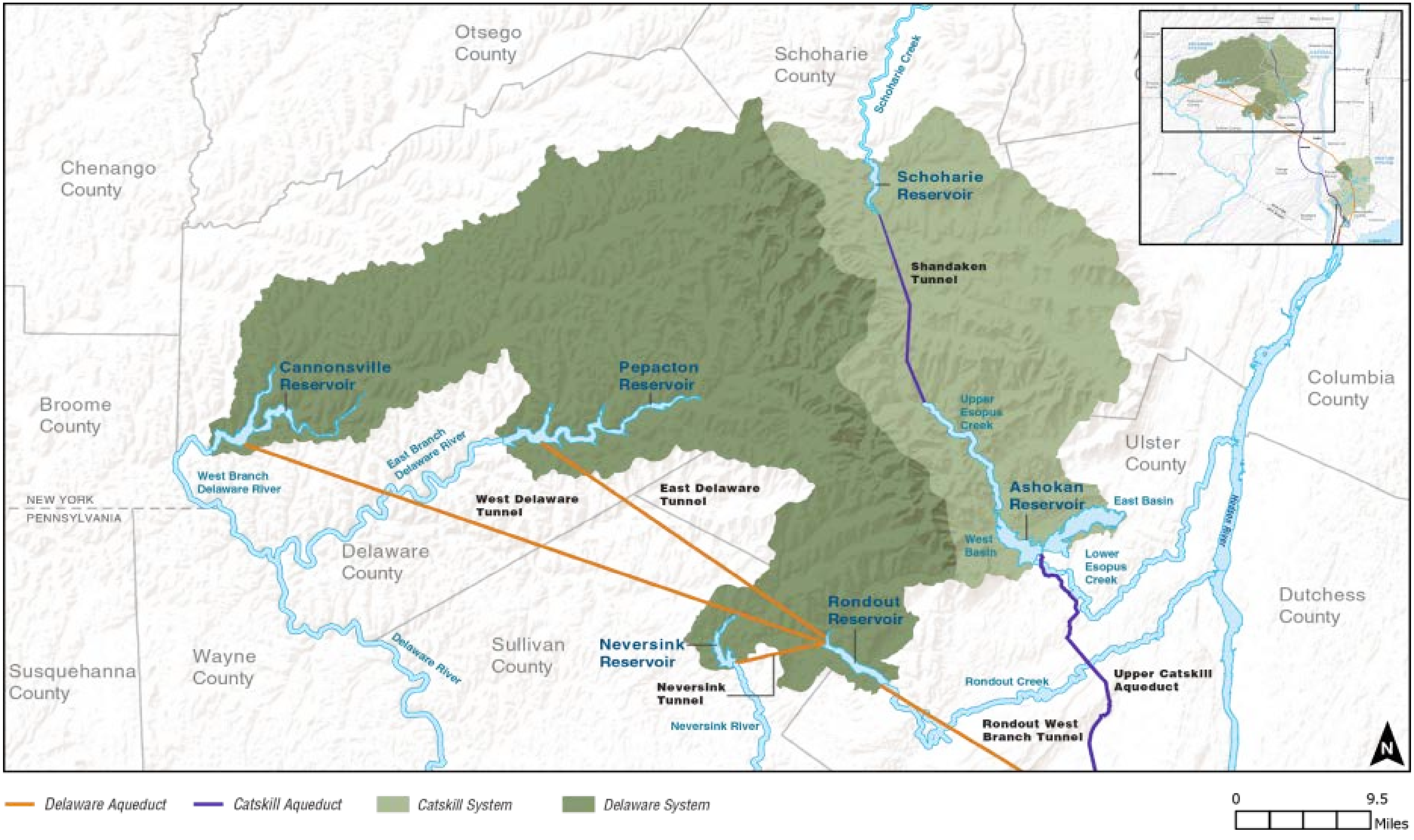


Figure 10.4-1: Catskill and Delaware Water Supply Systems

occurring silt and clay deposits present in the watershed's relatively steep slopes, stream banks, and channels. Such events result in elevated turbidity levels in the water of the Catskill System.[38]

The Catskill System was specifically designed to remove this turbidity prior to it entering the Catskill Aqueduct. Ashokan Reservoir is separated by a dividing weir, forming the East and West Basins. To control turbidity entering the water supply system, water from upper Esopus Creek flows into the West Basin of Ashokan Reservoir first, allowing turbidity to settle out, before flowing into the East Basin for diversion via the upper Catskill Aqueduct. However, heavy rainfall events can lead to increased turbidity and overwhelm the natural settling processes in the reservoirs.

If a storm event results in turbid water near the intake to the upper Catskill Aqueduct, DEP has the option of reducing diversions from Ashokan Reservoir to prevent excess turbidity from entering Kensico Reservoir in order to comply with the regulated level for turbidity set by EPA's Surface Water Treatment Rule. Currently, DEP cannot prevent all diversions from Ashokan Reservoir since approximately 20 upstate communities withdraw water from the upper Catskill Aqueduct through 15 taps. DEP has constructed the Shaft 4 Interconnection between the Catskill and Delaware aqueducts, which would allow DEP to further reduce diversions from the Catskill System during these events by adding Delaware System water to the upper Catskill Aqueduct. However, there is a practical limit to how long DEP can curtail diversions from Ashokan, which must be offset by increased diversions from the Delaware or Croton Systems to meet demand. If a turbidity event lasts too long, DEP would divert turbid water and treat water from Ashokan Reservoir with alum at the Pleasantville Alum Plant located just upstream of Kensico Reservoir. This action is permitted by NYSDEC to facilitate rapid settling of particles in the reservoir. Alum is a common, nontoxic chemical used for drinking water treatment that binds with turbidity-causing particles to increase the speed of the settling process. Alum treatment reduces turbidity to acceptable levels before it is diverted from Kensico Reservoir to the lower Catskill Aqueduct, the City, and other water supply customers. While alum treatment is an option, DEP strives to minimize emergency alum treatment without compromising water quality or reliability. To that end, DEP has conducted an extensive turbidity control program for the Catskill System and is implementing numerous infrastructure and operational improvements in order to minimize alum usage.

More recently, DEP has studied alternatives for further controlling Catskill turbidity, and has expanded use of the Ashokan Release Channel, which routes flow from Ashokan Reservoir to lower Esopus Creek. DEP operates the Ashokan Release Channel in accordance with an Interim Ashokan Release Protocol, pursuant to an October 2013 Consent Order between NYSDEC and DEP. The Interim Ashokan Release Protocol specifies a Conditional Seasonal Storage Objective for Ashokan Reservoir and rules for operations of the Ashokan Release Channel to manage both water quality and flows downstream of the reservoir. The Interim Ashokan Release Protocol is

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[38] Turbidity is an optical property of water influenced by the presence of higher concentrations of suspended particles that make water opaque or cloudy. These particles normally consist of suspended clay, silt, organic and inorganic material, and microscopic organisms. Turbidity is of concern primarily due to its potential impact on public health by making disinfection less effective, as the cloudiness could interfere with chlorine and ultraviolet-light disinfection, and potential contaminants could adhere to or be encapsulated by the suspended particles.

currently being analyzed as part of a separate environmental review to support modification of the City's New York State Pollutant Discharge Elimination System (SPDES) permit for alum treatment at Kensico Reservoir. Releases under the terms of the Interim Ashokan Release Protocol also provide benefits to the environment and recreational use of lower Esopus Creek by setting minimum releases during various times of the year and establishing storage voids within Ashokan Reservoir to capture large storm events, thereby reducing the need to release turbid water to lower Esopus Creek and providing additional flood attenuation to benefit downstream communities.

During WSSO, DEP would rely more heavily on the Catskill System to ensure adequate water supply is available to support the temporary shutdown. During the pre-shutdown phase, diversions from the Catskill System would be minimized to allow the Catskill System reservoirs to be full at the start of the shutdown. During the RWBT temporary shutdown, the City's water supply demands would be met with diversions from the Catskill and Croton systems. All reservoirs within the Catskill System would be managed in accordance with applicable regulations throughout the pre-shutdown and shutdown phases, with the exception of Ashokan Reservoir. As stated in the Interim Ashokan Release Protocol, DEP, with concurrence from NYSDEC, could operate Ashokan Reservoir at a variance from the Interim Ashokan Release Protocol (or its successor) during the temporary shutdown. During the shutdown, DEP anticipates that the Ashokan Reservoir Combined Seasonal Storage Objective would need to be temporarily suspended to meet water supply needs. This would result in the temporary reduction of discharge mitigation releases from the reservoir. DEP would seek to maintain minimum community releases in accordance with the Interim Ashokan Release Protocol (or its successor) for the duration of the pre-shutdown and shutdown phases. DEP would work directly with NYSDEC to establish these variances from typical operations in order to support WSSO during the temporary shutdown. The following sections describe how the overall change in operations for the Catskill System from WSSO would alter operations at individual system reservoirs and associated flows to receiving waterbodies during the temporary shutdown.

10.4.1 SCHOHARIE RESERVOIR STUDY AREA IMPACT ANALYSIS

10.4.1.1 Study Area Location and Description

As discussed, Schoharie Reservoir is one of two reservoirs in the City's Catskill Water Supply System. It was placed into service in 1926. Schoharie Reservoir is located at the intersection of Schoharie, Delaware, and Greene counties, New York, and is formed by impounding Schoharie Creek by Gilboa Dam (see **Figure 10.4-2**). The reservoir consists of one basin, almost 6 miles in length, and holds 17.6 billion gallons at full capacity. Spills and releases (via siphons) discharge into the continuation of the Schoharie Creek, and diversions via the Shandaken Tunnel discharge to upper Esopus Creek which flows to Ashokan Reservoir. Gilboa Dam is currently not equipped with a release structure, although one is currently under construction and would be completed by 2020. Currently, releases are facilitated by the combination of siphons and crest gates. The siphons have a maximum flow rate of approximately 500 mgd. The crest gates can raise or lower the crest of the dam spillway by 5 feet to release water or create a storage void. While Schoharie Reservoir serves the City's customers as part of the larger Catskill System, no local communities draw directly from the reservoir.

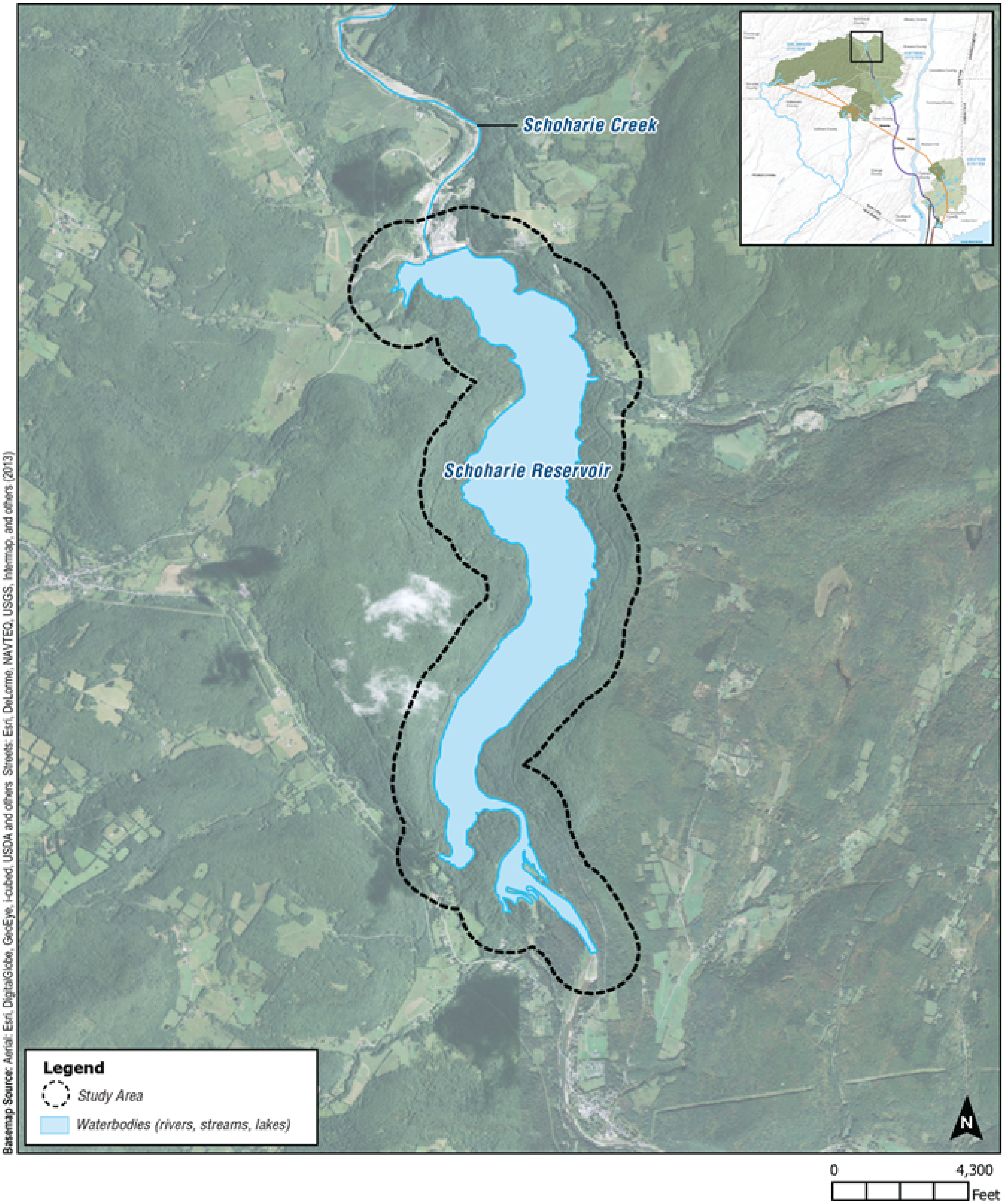

Figure 10.4-2: Schoharie Reservoir Study Area

The Schoharie Reservoir watershed encompasses approximately 316 square miles and includes parts of 15 towns in three counties: Ashland, Cairo, Durham, Halcott, Hunter, Jewett, Lexington, Prattsville, and Windham in Greene County, New York; Broome, Conesville, Gilboa, and Sullivan in Schoharie County, New York; and Roxbury and Stamford in Delaware County, New York. Schoharie Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout and walleye (*Sander vitreus*) annually, making it popular for recreational fishing. Boating for the purposes of fishing and recreation is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is prohibited. The water quality classification for Schoharie Reservoir is Class A(TS) throughout its entire length.

10.4.1.2 Study Area Evaluation

Under typical operations, Schoharie Reservoir fills and spills based on inflows to the reservoir, diversions via the Shandaken Tunnel, siphon operation, and crest gate elevation. Diversions are managed per the Shandaken Tunnel SPDES permit and NYSDEC regulations (6 NYCRR Part 670). A reservoir storage objective is maintained through the winter months using the existing siphons, which would be maintained in the future using the release structure currently under construction.[39] Crest gates are raised to elevation 1,130 feet between April and October and lowered to elevation 1,125 feet from November through March. Reservoir water surface elevations fluctuate seasonally and can be drawn down substantially by up to 50 feet and reach dead storage when conditions are dry, because diversions can exceed inflows (see **Figure 10.4-3**).

Schoharie Reservoir operations would continue to follow the Shandaken Tunnel SPDES permit and NYSDEC regulations during WSSO. During the pre-shutdown period, water surface elevations in Schoharie Reservoir would be higher than typical conditions by up to 6 feet (see **Figure 10.4-3**). During the shutdown, the crest gates would remain at elevation 1,130 feet and the storage objective temporarily suspended to ensure the reservoir is as full as possible for the duration of the RWBT temporary shutdown. Water surface elevations in Schoharie Reservoir would be higher than typical conditions by up to 9 feet (see **Figure 10.4-3**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. Based on these results, there would be no potential significant adverse impacts from WSSO to Schoharie Reservoir. Therefore, no further analysis is warranted for the Schoharie Reservoir Study Area.

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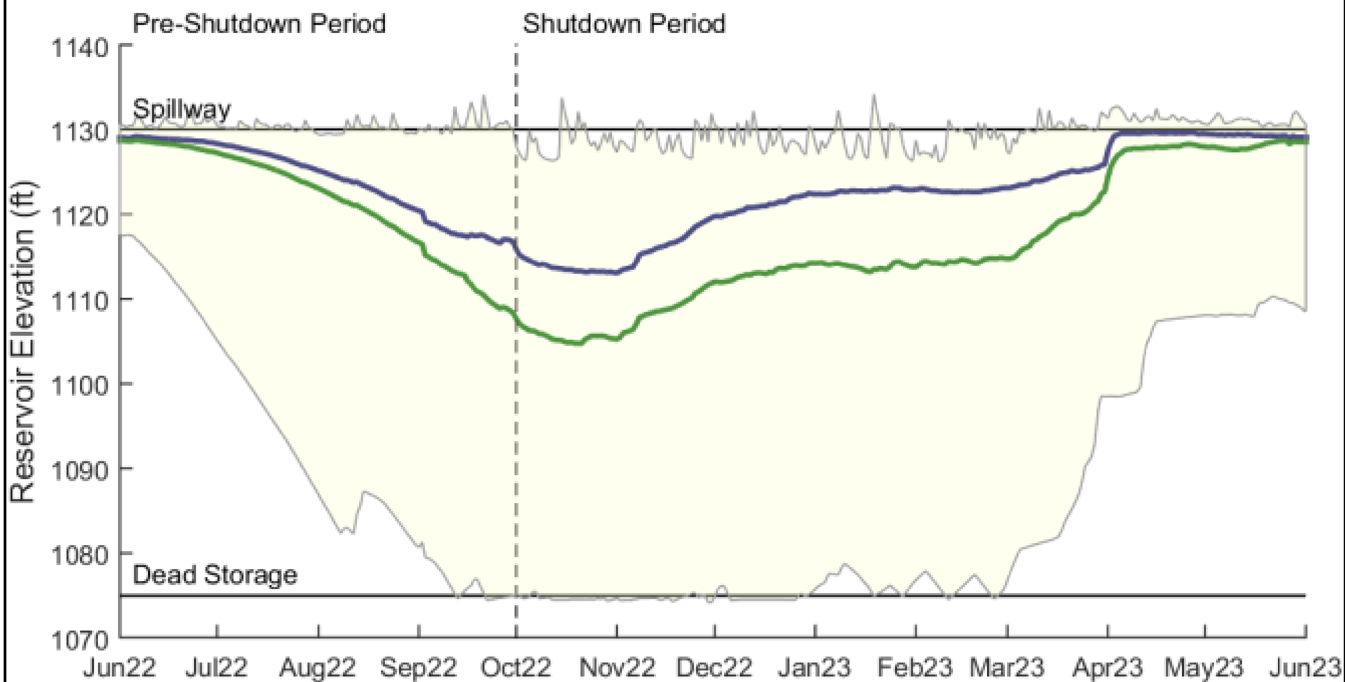
[39] The current storage objective is to release water when the storage void is less than 50 percent of the snow water equivalent in the surrounding watershed. DEP has recently proposed a new policy to release water to maintain a 90 percent conditional seasonal storage objective between October 15 through March 15 of each year, similar to rules in the other Catskill and Delaware System reservoirs. The rules have not been accepted by NYSDEC. More information on the proposed rules can be found at: http://www.nyc.gov/html/dep/html/press_releases/15-014pr.shtml.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	1128	1113	1130	1129	1
	July	1125	1097	1130	1127	2
	August	1120	1084	1129	1123	3
	September	1112	1080	1130	1118	6
Shutdown Period	October	1106	1075	1127	1114	8
	November	1109	1075	1127	1116	7
	December	1113	1076	1127	1121	8
	January	1114	1078	1126	1123	9
	February	1114	1076	1126	1123	9
	March	1118	1085	1127	1124	6
	April	1128	1107	1131	1129	1
	May	1128	1111	1131	1129	1

Note: There are no water utility intakes for drawing water directly from the reservoir.

Figure 10.4-3: Elevation Dataset Mean and Range for Typical Operations and WSSO – Schoharie Reservoir Study Area

10.4.2 SCHOHARIE CREEK DOWNSTREAM OF SCHOHARIE RESERVOIR STUDY AREA IMPACT ANALYSIS

10.4.2.1 Study Area Location and Description

Schoharie Creek downstream of Schoharie Reservoir flows approximately 3.3 miles from the Gilboa Dam to the Lower Blenheim-Gilboa Reservoir through Ulster County (see **Figure 10.4-4).** Schoharie Creek flows north past farm property and forested open space in this short stretch of stream. There is no minimum release requirement for Schoharie Reservoir to Schoharie Creek. Therefore, Schoharie Creek receives intermittent flow from Schoharie Reservoir from spills and siphon releases. The creek supports a warm water fishery and is not stocked with trout. The intermittent flows limit most recreational activities. Schoharie Creek is classified as Class A along its entire length from the Gilboa Dam to Lower Blenheim-Gilboa Reservoir.

10.4.2.2 Study Area Evaluation

Under typical operations, DEP releases water via the siphons to create a void in the reservoir equivalent to 50 percent of the snow water equivalent; however, there is no minimum release requirement. Siphon releases range between 0 mgd up to 500 mgd, the maximum siphon release capacity. Based on modeling analyses, under typical operations, monthly average daily spills can range from 0 mgd to approximately 3,500 mgd and are generally lowest in the summer and fall and highest in the spring (see **Figure 10.4-5**). Daily spills can reach approximately 10,000 mgd. Spills can occur during any month but are more frequent and of larger magnitude during high inflow months (March through May). Alternately, dry years can result in periods of no spills lasting 6 months or more. Crest gate operations consist of raising the spillway elevation to 1,130 feet from April through October and dropping the elevation to 1,125 feet from November through March.

During pre-shutdown and shutdown phases of WSSO, the siphon flow would be set to zero, which would be equivalent to typical conditions during years with minimal snowfall. Because releases are not required and siphon flow is intermittent from year to year, based on snowfall, siphon releases are not assessed as part of the hydrologic evaluation for Schoharie Creek. During the pre-shutdown period, spills into Schoharie Creek downstream of Schoharie Reservoir would be higher than typical conditions by up to approximately 49 mgd (see **Figure 10.4-5**). During the temporary shutdown of the RWBT, spills into Schoharie Creek downstream of Schoharie Reservoir would be at times higher than typical conditions by up to approximately 58 mgd and at times lower than typical conditions by up to approximately 112 mgd (see **Figure 10.4-5**). The dataset mean during WSSO for spills, therefore, would remain within the range of typical operations. Additionally, during the RWBT temporary shutdown, the modeling results indicate that there would be a negligible change (less than or equal to one percentage point) in the probability of high flows downstream of Schoharie Reservoir due to large storm events (see **Figure 10.4-6**). However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would not be the cause of flooding. In fact, the reservoir would reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when the reservoir is full and spilling.

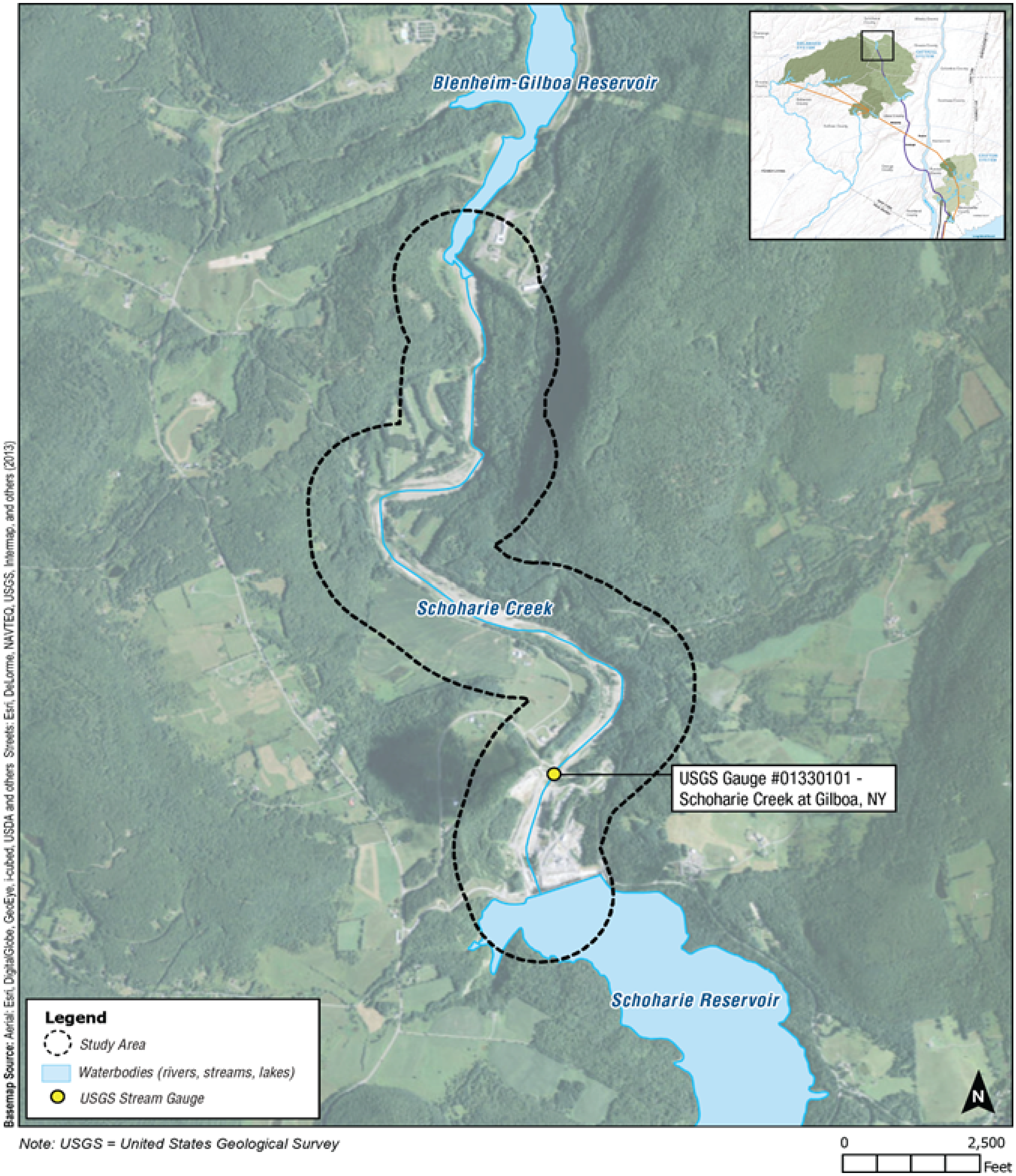
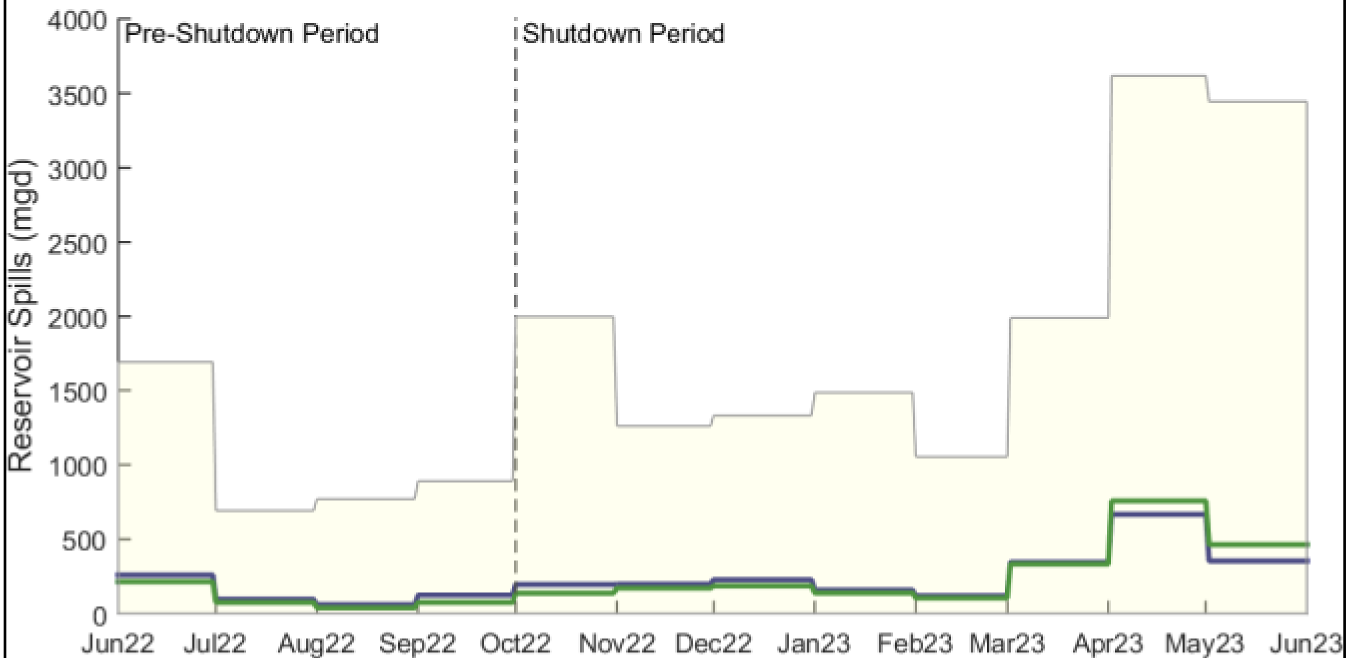
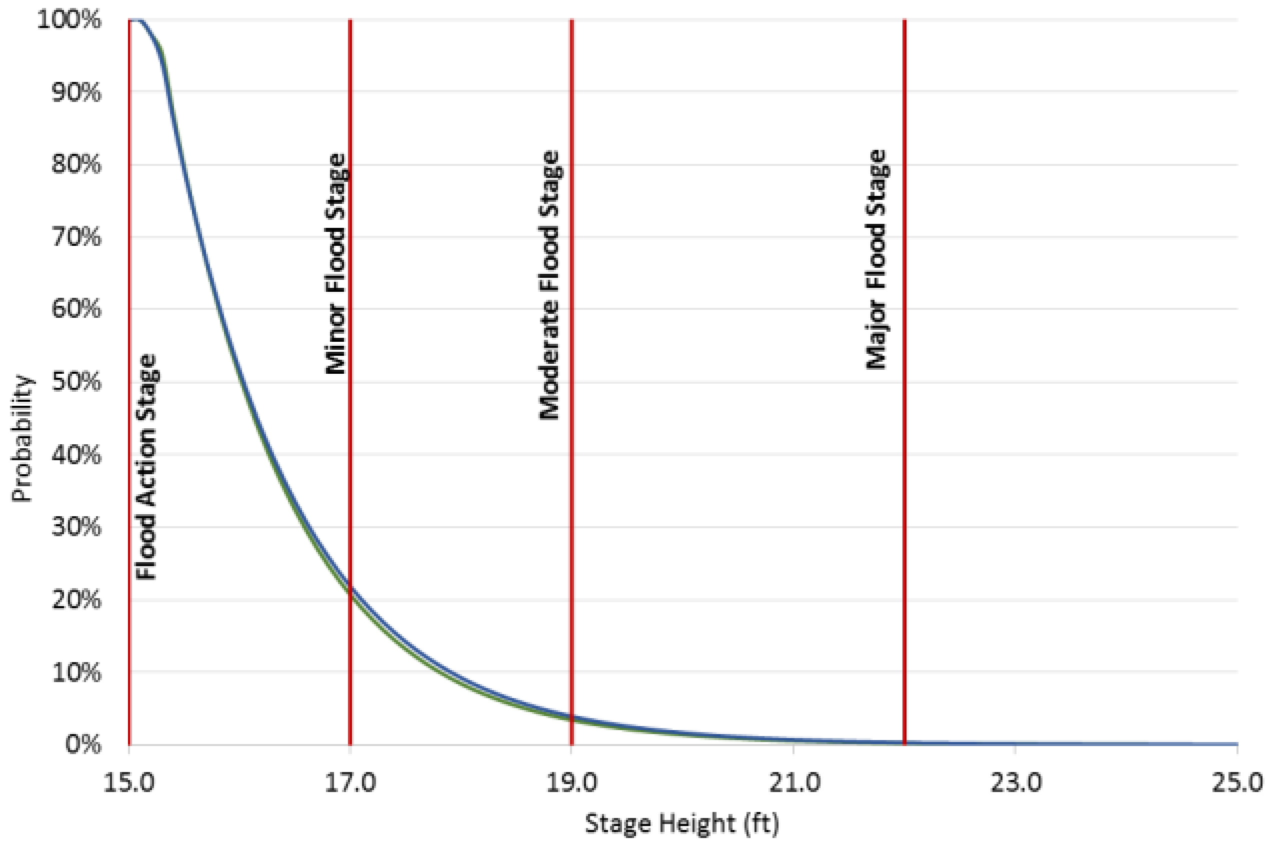


Figure 10.4-4: Schoharie Creek Downstream of Schoharie Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	215	0	1691	259	44
	July	75	0	692	96	21
	August	39	0	770	60	21
	September	75	0	890	124	49
Shutdown Period	October	138	0	1998	196	58
	November	172	0	1261	198	26
	December	187	0	1331	228	41
	January	139	0	1486	158	19
	February	105	0	1069	120	15
	March	329	0	1958	341	12
	April	746	0	3567	658	-88
	May	473	0	3449	361	-112

Figure 10.4-5: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Schoharie Creek Downstream of Schoharie Reservoir Study Area



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	~100%	~100%	NA
Minor Flood Stage	21%	22%	+1%
Moderate Flood Stage	3%	4%	+1%
Major Flood Stage	0%	0%	0%

Legend
WSSO
Typical

Figure 10.4-6: Annual Probability of High Flow Stage at Gilboa USGS Gauge – Schoharie Creek Downstream of Schoharie Reservoir Study Area

Modeling results indicate that the dataset mean for spills would remain within the range observed during typical operations and that there would be negligible change in the ability of Schoharie Reservoir to attenuate large storm events. Therefore, there would be no significant adverse impacts to Schoharie Creek downstream of Schoharie Reservoir from WSSO, and further analysis is not warranted.

10.4.3 ESOPUS CREEK DOWNSTREAM OF SHANDAKEN TUNNEL STUDY AREA IMPACT ANALYSIS

10.4.3.1 Study Area Location and Description

Esopus Creek downstream of the Shandaken Tunnel flows approximately 11 miles through Ulster County where it flows into Ashokan Reservoir (see **Figure 10.4-7**). Esopus Creek flows southeasterly past several villages and hamlets, including Phoenicia, Mount Tremper, and Boiceville. Esopus Creek is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, including wild trout, and is stocked annually, making it popular for recreational fishing. Canoeing, kayaking, and tubing are also popular along Esopus Creek. Esopus Creek is classified as Class A(TS) along its entire length from the Shandaken Tunnel discharge to Ashokan Reservoir.

10.4.3.2 Study Area Evaluation

Diversions via the Shandaken Tunnel are regulated by 6 NYCRR Part 670, Sections 670.1-670.9, which regulates minimum and maximum diversions, and the Shandaken Tunnel SPDES permit number 026 8151, which establishes additional water-quality-based flow limits, as well as variances to the Part 670 flow requirements based on water quality conditions in Esopus Creek and Schoharie Reservoir.

The regulations are designed to balance water supply needs and support the trout fishery in Esopus Creek. Therefore, there is a minimum combined flow for the combination of Shandaken Tunnel discharge and natural Esopus Creek flow of 160 mgd throughout the year. From July 1 through September 15, diversions are set to meet, but not exceed, the 160 mgd minimum combined flow to preserve coldwater storage in the reservoir throughout the summer months. Additionally, from June 1 through October 31, the Shandaken Tunnel cannot contribute flow when natural Esopus Creek flows exceed 300 mgd. Shandaken Tunnel diversions are highest from November through May because of the regulations limiting maximum flow in June through October. Additionally, while not codified, DEP curtails flows from the Shandaken Tunnel to Esopus Creek to prevent flows exceeding the flood action stage at the USGS Coldbrook Gauge approximately 9 miles downstream of the Shandaken Tunnel outlet.

While the minimum combined flow is intended to be met year round, there are a number of conditions in the regulations that provide for variances to the minimum combined flow. These conditions include high turbidity in Schoharie Reservoir, when Ashokan Reservoir is spilling, or when Schoharie Reservoir water surface elevation is below the Shandaken Tunnel intake (i.e., dead storage).

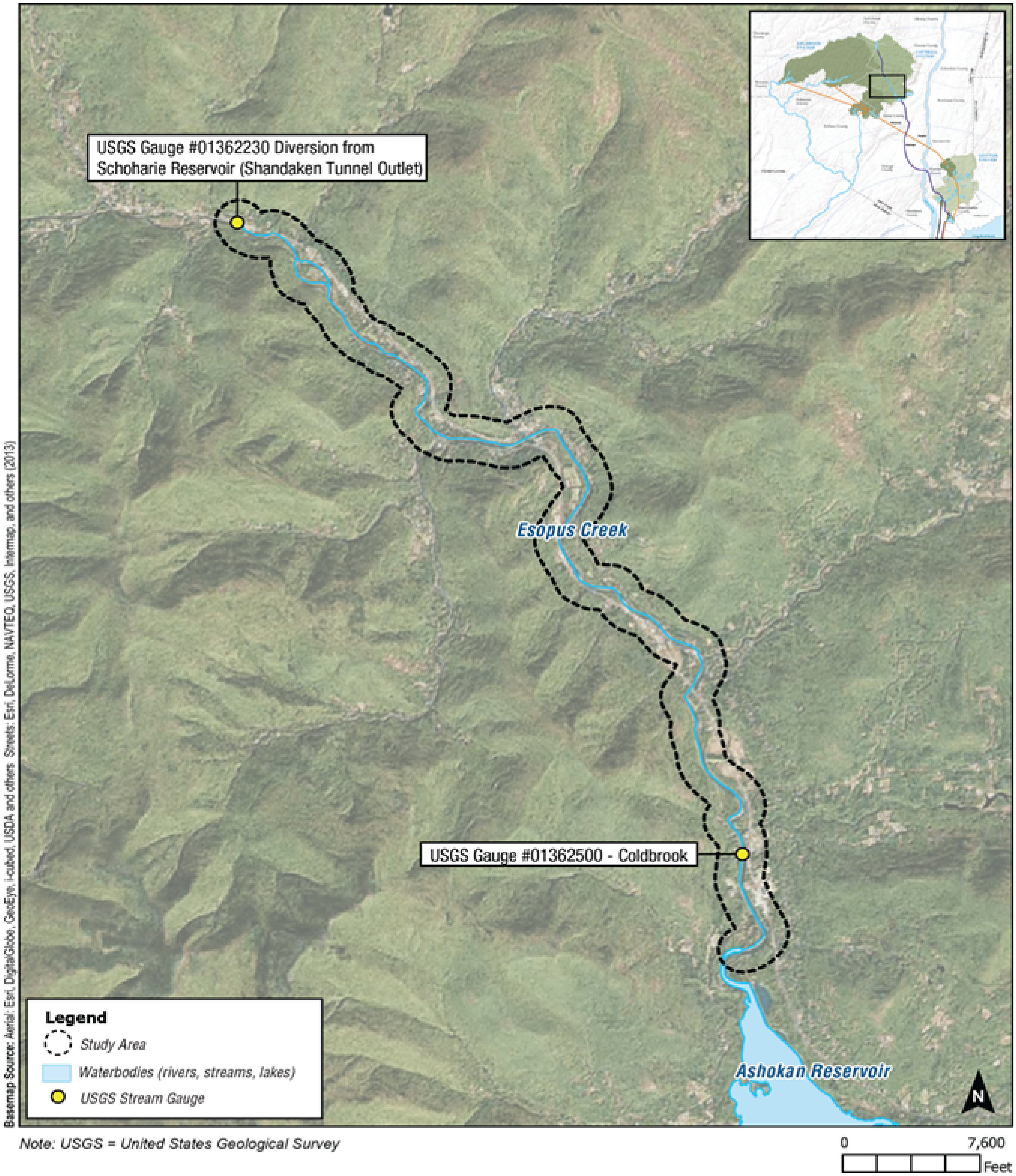


Figure 10.4-7: Esopus Creek Downstream of Shandaken Tunnel Study Area

The turbidity rules limit Shandaken Tunnel discharge such that it does not cause: an increase of more than 15 Nephelometric Turbidity Units (NTU) in Esopus Creek; or, if the Shandaken Tunnel turbidity is greater than 100 NTU, flow is reduced to zero until conditions improve.[40] In addition to the codified variances, NYSDEC could request reductions in the minimum combined flow. For example from July 1 through September 15, 2015, NYSDEC requested a minimum combined flow of approximately 100 mgd. DEP staff and NYSDEC work together to identify appropriate modifications to the minimum combined flow from year to year based on hydrologic conditions.

Under typical operations, DEP diverts water from Schoharie Reservoir to Esopus Creek via the Shandaken Tunnel based on applicable regulations and water supply needs. Based on modeling analyses, under typical operations, monthly average daily diversions could range from approximately 0 mgd up to approximately 615 mgd, the maximum capacity of the tunnel (see **Figure 10.4-8**).[41] While the Shandaken Tunnel flow can represent a large proportion of the combined flow during average conditions (see **Figure 10.4-9**), because of the maximum capacity and flow regulations, Shandaken Tunnel flow represents a small proportion of the flow during high flow events. For example, maximum flows at the USGS Allaben gauge, which is approximately 1 mile upstream, can reach approximately 19,000 mgd, approximately 30 times the maximum capacity of the Shandaken Tunnel.

During WSSO, the Shandaken Tunnel would continue to be operated pursuant to applicable regulations. Diversions via the Shandaken Tunnel during the pre-shutdown period would be lower than typical conditions by up to approximately 58 mgd (see **Figure 10.4-8**). Diversions via the Shandaken Tunnel during the temporary shutdown of the RWBT would be at times lower than typical conditions by up to approximately 24 mgd and at times higher than typical conditions by up to approximately 90 mgd (see **Figure 10.4-8**). The dataset mean during WSSO for both Shandaken Tunnel flows and combined Shandaken Tunnel/Esopus Creek flows would remain within the range of typical operations. During the temporary shutdown, the modeling results indicate that there would be a negligible change (less than or equal to one percentage point) in the probability of high flows downstream of the Shandaken Tunnel discharge at the Coldbrook USGS gauge due to large storm events (see **Figure 10.4-10**).

Modeling results indicate that the dataset mean for Shandaken Tunnel diversions would remain within the range observed during typical operations and that there would be negligible change in the probability of high flow events in Esopus Creek. Therefore, there would be no significant adverse impacts to Esopus Creek downstream of Shandaken Tunnel from WSSO, and no further analysis is warranted.

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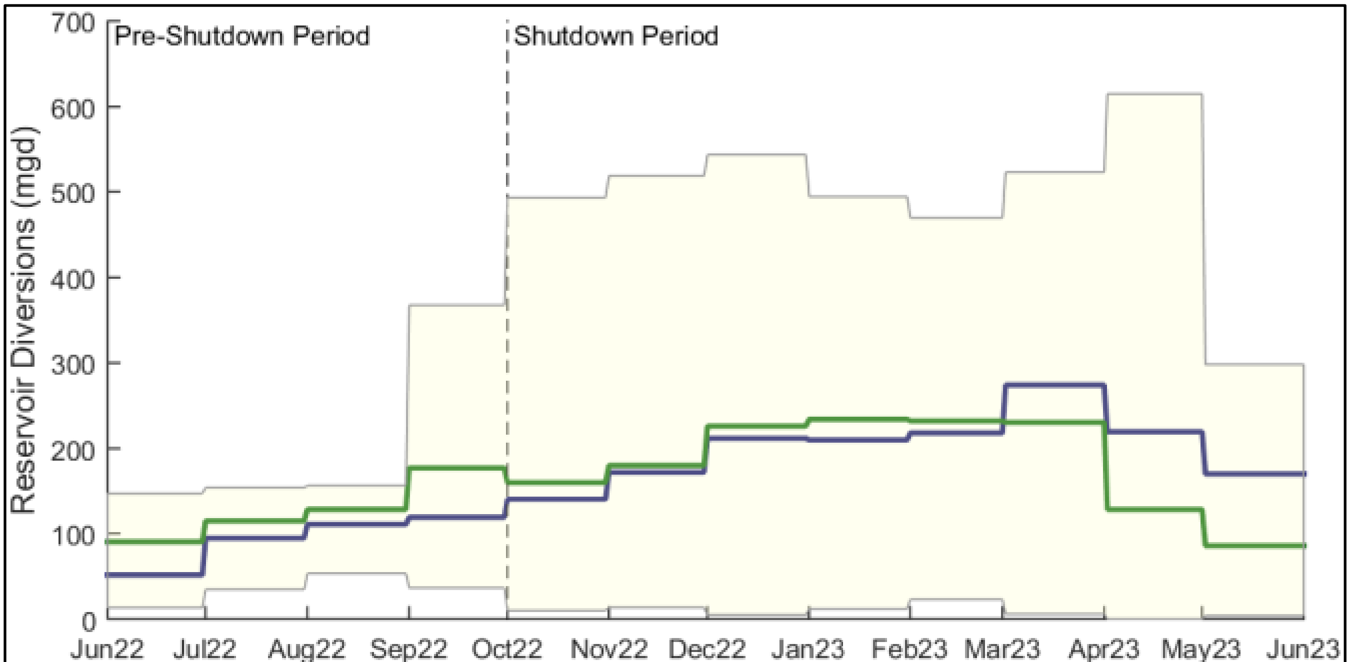
[40] Nephelometric turbidity units are a measure of suspended particulates using light passing through a sample of water.

[41] Note that the OST modeling includes the codified rules for operations of the Shandaken Tunnel, and does not include negotiated flow modifications from year to year.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	90	13	147	52	-38
	July	115	35	154	95	-20
	August	128	53	157	111	-17
	September	177	36	368	119	-58
Shutdown Period	October	160	10	493	140	-20
	November	180	13	519	172	-8
	December	226	5	544	212	-14
	January	234	12	494	210	-24
	February	231	24	464	217	-14
	March	235	6	529	278	43
	April	128	0	615	218	90
	May	87	4	313	173	86

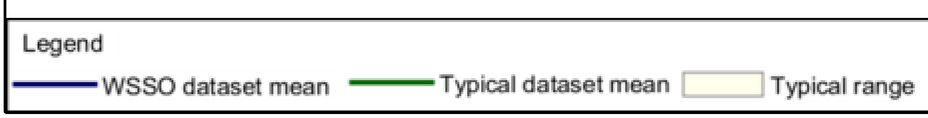
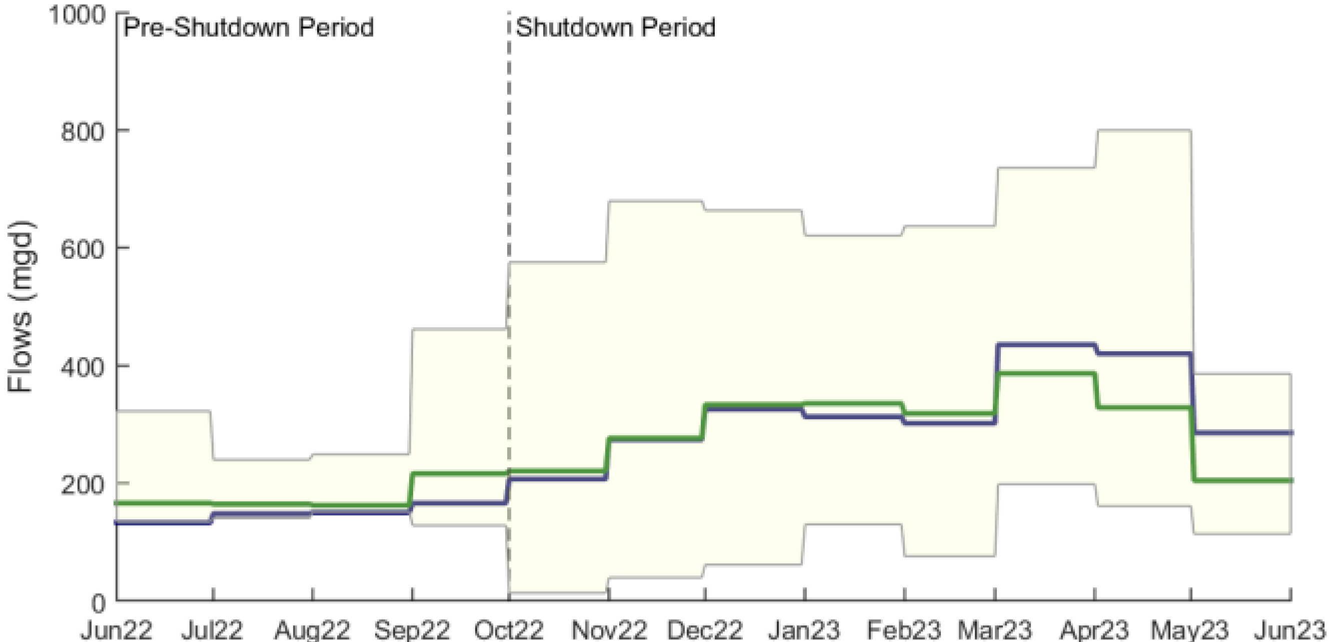


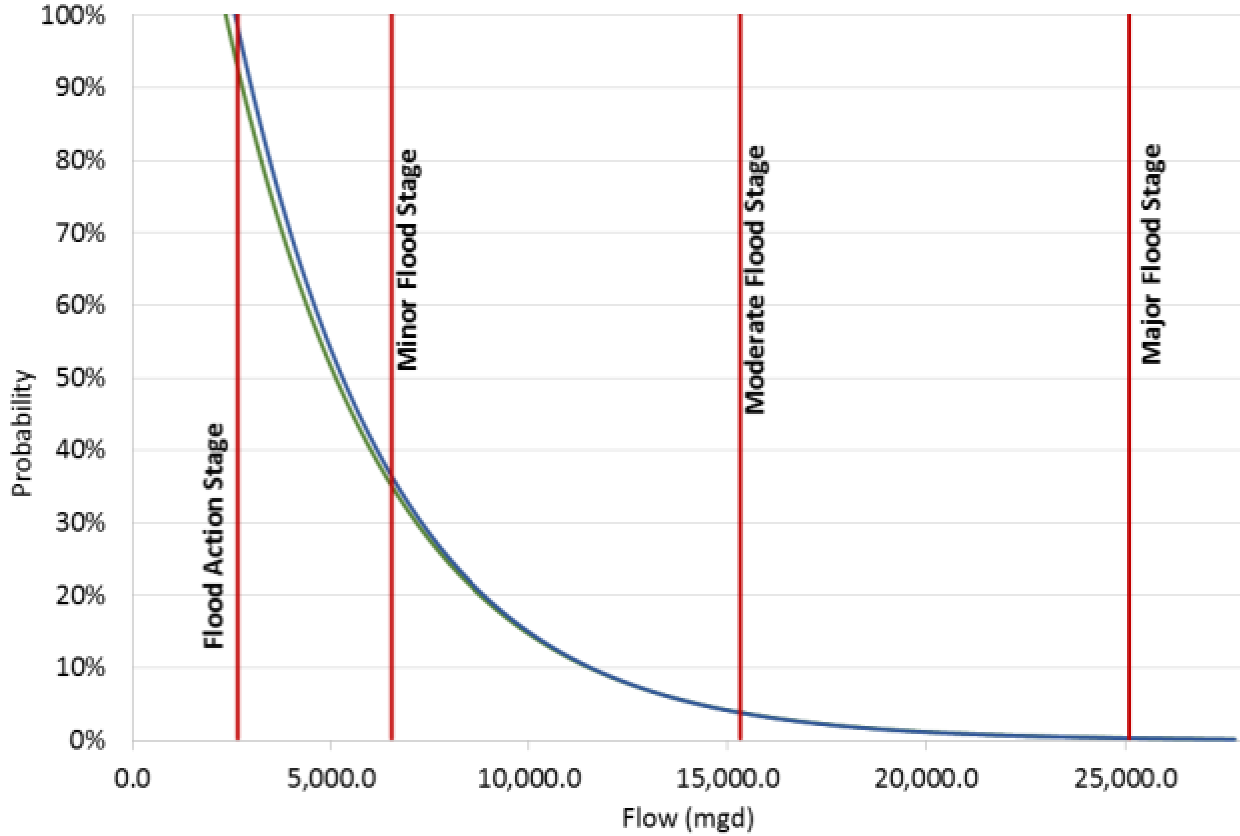
Figure 10.4-8: Diversions Dataset Mean and Range of Diversions Predicted under Typical Operations and WSSO for Shandaken Tunnel Diversions – Esopus Creek Downstream of Shandaken Tunnel Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	166	134	323	134	-32
	July	164	141	240	148	-16
	August	162	151	249	151	-11
	September	216	128	462	165	-51
Shutdown Period	October	221	13	575	196	-25
	November	277	39	680	256	-20
	December	334	61	664	304	-30
	January	336	130	621	307	-29
	February	319	76	637	311	-8
	March	387	198	736	404	17
	April	329	161	800	416	87
	May	205	114	386	277	72

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.4-9: Diversion Dataset Mean and Range of Diversions Predicted under Typical Operations and WSSO for Combined Shandaken Tunnel Diversions and Natural Esopus Creek Flow – Esopus Creek Downstream of Shandaken Tunnel Study Area



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	95%	100%	+5%
Minor Flood Stage	34%	35%	+1%
Moderate Flood Stage	4%	4%	0%
Major Flood Stage	0%	0%	0%

Legend
WSSO Typical

Figure 10.4-10: Annual Probability of High Flows at Coldbrook USGS Gauge – Esopus Creek Downstream of Shandaken Tunnel Study Area

10.4.4 ASHOKAN RESERVOIR STUDY AREA IMPACT ANALYSIS

10.4.4.1 Study Area Location and Description

Ashokan Reservoir is located in Ulster County and is formed by the Olivebridge Dam, which impounds Esopus Creek (see **Figure 10.4-11**).

As described above, Ashokan Reservoir consists of two basins, the East and West Basins, separated by a concrete dividing weir. Water flows into the West Basin from upper Esopus Creek and travels through the dividing weir into the East Basin. Water can be diverted to the Catskill Aqueduct from either basin via a multi-level intake in the Ashokan Upper Gate Chamber. Water can also be released from either basin to the Ashokan Release Channel or, when reservoir elevations are high, water spills from the East Basin. Both releases and spills discharge to lower Esopus Creek, which travels through Ulster County to the Hudson River. Public access at Ashokan Reservoir is limited to DEP-permitted boating and fishing. The water quality classification for Ashokan Reservoir is AA(T) throughout its entire length, which indicates it is a high quality source of drinking water. While Ashokan Reservoir serves the City's customers as part of the larger Catskill System, no local communities draw directly from the reservoir.

10.4.4.2 Study Area Evaluation

Under typical operations, Ashokan Reservoir fills and spills based on inflows to the reservoir, diversions from Schoharie Reservoir, diversions to the Catskill Aqueduct, and releases to Esopus Creek. Releases are governed by the Interim Ashokan Release Protocol, which has a Conditional Seasonal Storage Objective that seeks to maintain a storage void for spill mitigation from July 1 through May 1 each year. During the temporary shutdown, the storage objective would be temporarily suspended to enable the reservoir to be full by the start of the shutdown in October and remain as full as possible for the duration of the shutdown. The Interim Ashokan Release Protocol, which is the subject of a separate environmental review, allows for an exception during the RWBT temporary shutdown.

During the pre-shutdown period, water surface elevations in the Ashokan Reservoir West Basin would be higher than typical conditions by up to 12 feet (see **Figure 10.4-12**), and water surface elevations in the Ashokan Reservoir East Basin would be higher than typical conditions by up to 11 feet (see **Figure 10.4-13**). During the temporary shutdown of the RWBT, water surface elevations in Ashokan Reservoir West Basin would be higher than typical conditions by up to 11 feet (see **Figure 10.4-12**), and in Ashokan Reservoir East Basin would be higher than typical conditions by up to 10 feet (see **Figure 10.4-13**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project for both basins.

As part of Upstate Water Supply Resiliency, repair and rehabilitation of the Catskill Aqueduct (see Chapter 9, "The Proposed Catskill Aqueduct Repair and Rehabilitation") would increase the capacity of the Catskill Aqueduct. Higher maximum flows through the Catskill Aqueduct would be necessary for short duration during the Catskill Aqueduct Repair and Rehabilitation.

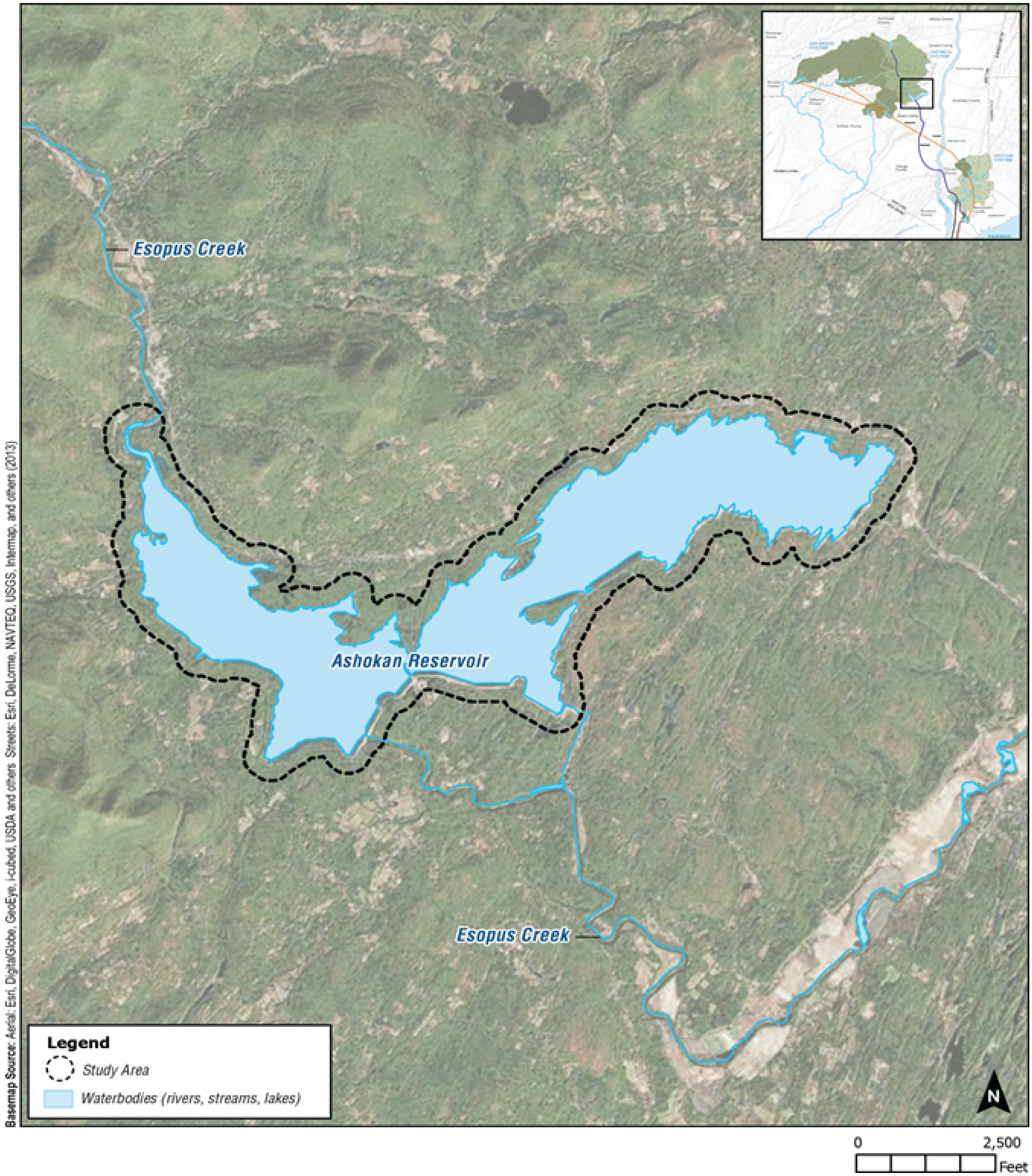
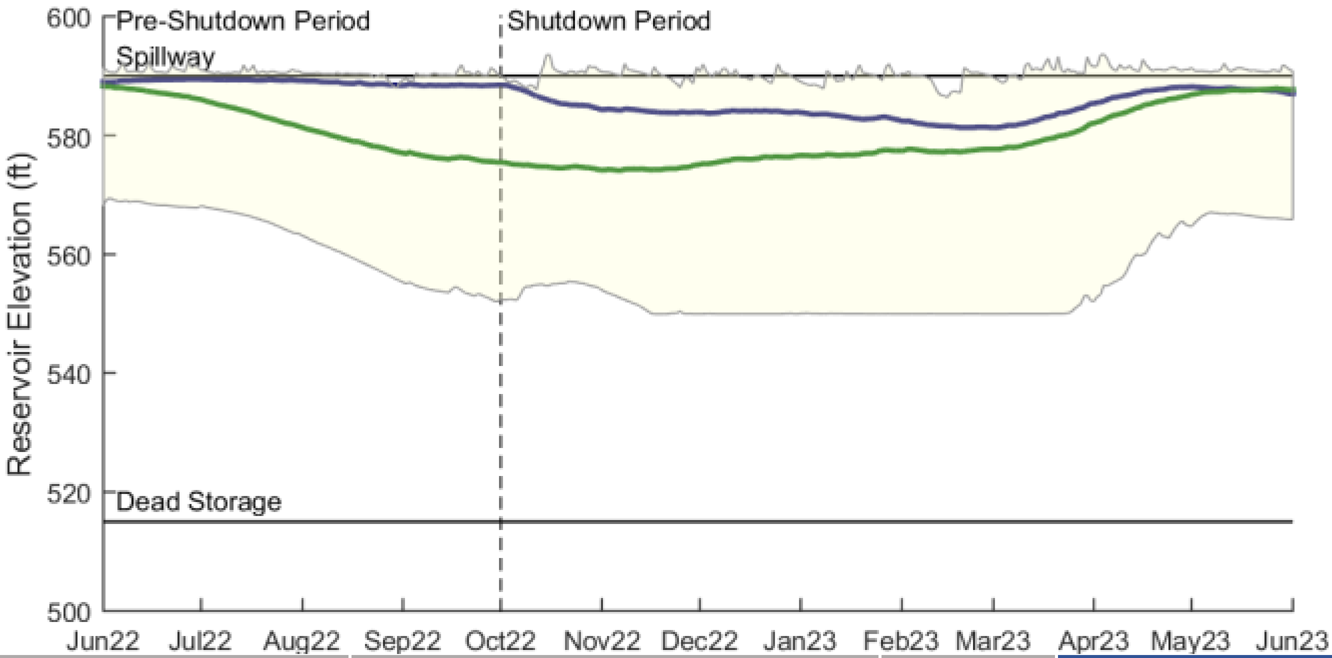


Figure 10.4-11: Ashokan Reservoir Study Area

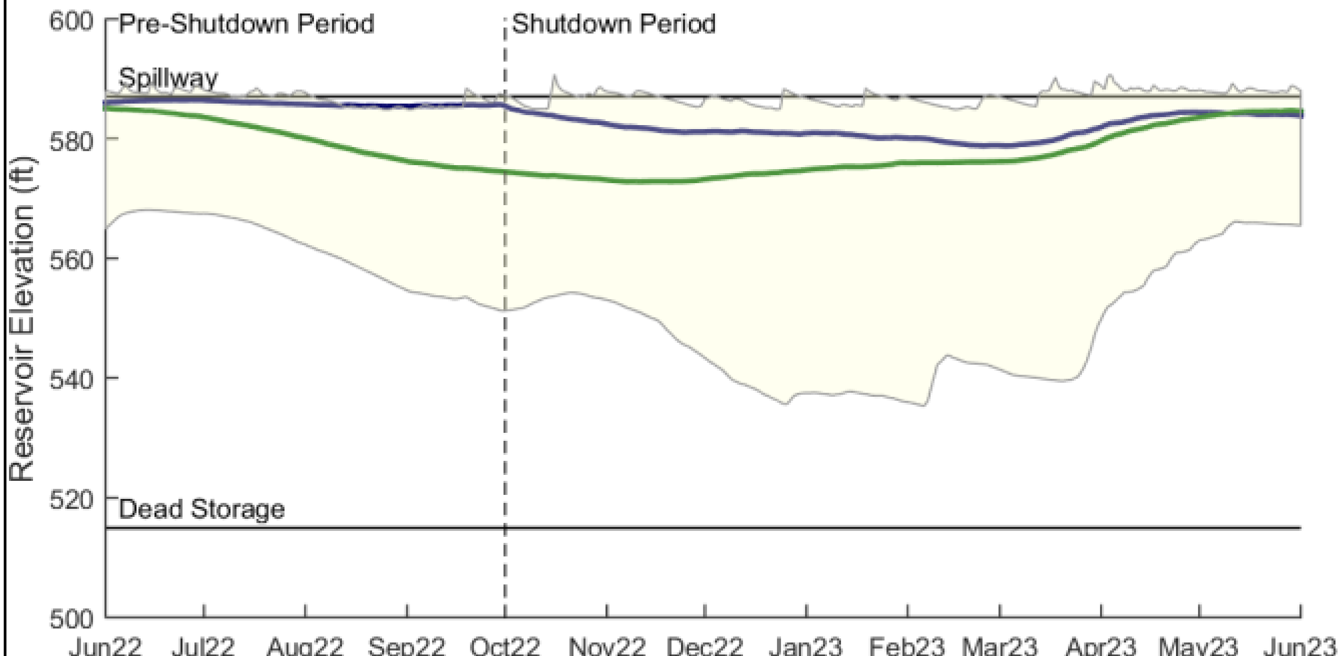


		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	587	569	591	589	2
	July	584	566	590	589	5
	August	579	559	589	589	10
	September	576	555	590	588	12
Shutdown Period	October	575	554	588	586	11
	November	574	551	589	584	10
	December	576	550	589	584	8
	January	577	550	588	583	6
	February	577	550	587	582	5
	March	579	550	588	583	4
	April	585	560	591	587	2
	May	588	566	591	588	0

Note: There are no water utility intakes for drawing water directly from the reservoir.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.4-12: Elevation Dataset Mean and Range for Typical Operations and WSSO – Ashokan Reservoir Study Area (West Basin)



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	585	568	587	586	1
	July	582	566	587	586	4
	August	578	559	585	586	8
	September	575	554	586	586	11
Shutdown Period	October	574	553	586	584	10
	November	573	550	586	582	9
	December	574	539	586	581	7
	January	575	537	585	581	6
	February	576	544	585	579	3
	March	577	541	585	580	3
	April	582	557	588	584	2
	May	584	565	588	584	0

Note: There are no water utility intakes for drawing water directly from the reservoir.

Figure 10.4-13: Elevation Dataset Mean and Range for Typical Operations and WSSO – Ashokan Reservoir Study Area (East Basin)

However, they could continue for the foreseeable future, as needed for water supply purposes, both during WSSO and following the completion of the RWBT temporary shutdown. Higher flows through the Catskill Aqueduct would result in higher velocities at the intake structure. Water withdrawn from Ashokan Reservoir passes through two, 60-inch gate valves to a bar rack structure before entering the Upper Gate Chamber and being conveyed into the Catskill Aqueduct. This bar rack structure primarily prevents large debris from entering the system and clogging the valves that feed the Lower Gate Chamber. Velocities at the bar rack structure would be expected to increase from approximately 24 feet per second to 26 feet per second at the maximum flow rate, which represents an approximately 7.8 percent increase. Increased velocities at maximum flows would be a minor change and are not anticipated to increase the potential for impingement or entrainment of fish.

Based on these results, there would be no significant adverse impacts to the Ashokan Reservoir Study Area from WSSO, and no further analysis is warranted.

Therefore, no potential for significant adverse impacts from WSSO to Ashokan Reservoir. Therefore, no further analysis is warranted for the Ashokan Reservoir Study Area.

10.4.5 ESOPUS CREEK DOWNSTREAM OF ASHOKAN RESERVOIR STUDY AREA IMPACT ANALYSIS

10.4.5.1 Study Area Location and Description

Esopus Creek downstream of Ashokan Reservoir flows approximately 30 miles from the Olivebridge Dam to the Hudson River through Ulster County (see **Figure 10.4-14**). Flows from Ashokan Reservoir to Esopus Creek are governed by the Interim Ashokan Release Protocol (IRP). The IRP provides for community releases; discharge mitigation releases that enhance flood mitigation; and operational releases intended primarily to protect water quality (and which also further the potential for flood mitigation). The creek supports a warmwater fishery along most of its length; trout can be found in the upstream portion, but are not stocked by NYSDEC. Recreational activities such as boating and swimming occur at points along the creek's length, typically towards the downstream end where flows are higher. The water quality classification for this portion of Esopus Creek is Class A(T) starting at the dam, transitioning to Class B approximately 18 miles downstream of the reservoir.

10.4.5.2 Study Area Evaluation

Under typical operations, DEP releases water to Esopus Creek from Ashokan Reservoir per the IRP and manages the reservoir storage to limit spills. Despite proactive management of Ashokan Reservoir's storage, the reservoir can spill during wet weather conditions. Under WSSO, releases to meet the Ashokan Reservoir Combined Seasonal Storage Objective (CSSO) under the IRP would be temporarily discontinued, while community releases would be maintained.[42]

[42] The Ashokan Reservoir storage target fluctuates seasonally and, as a result, forecast-based releases are used to control reservoir storage and meet a Combined Seasonal Storage Objective.

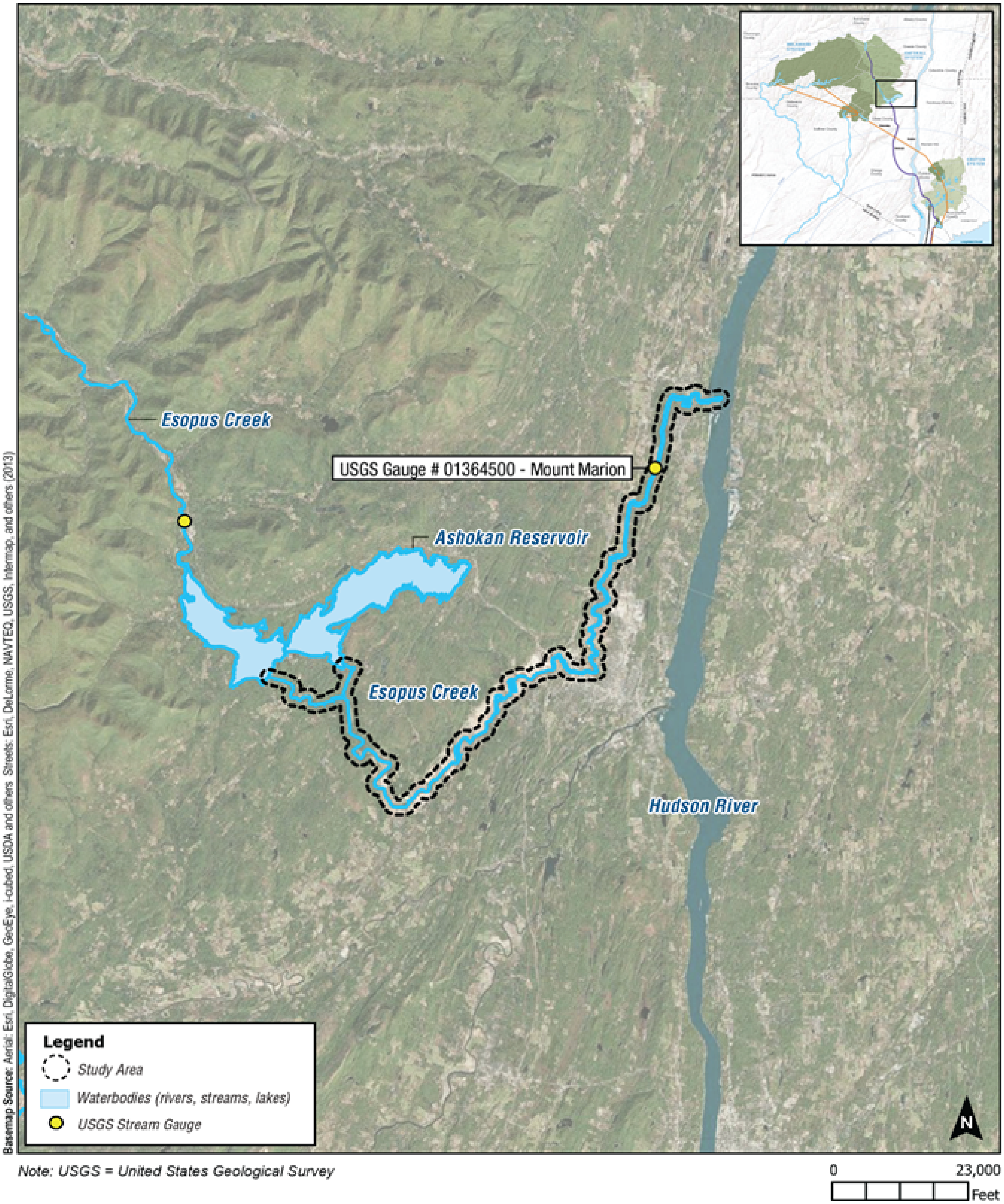


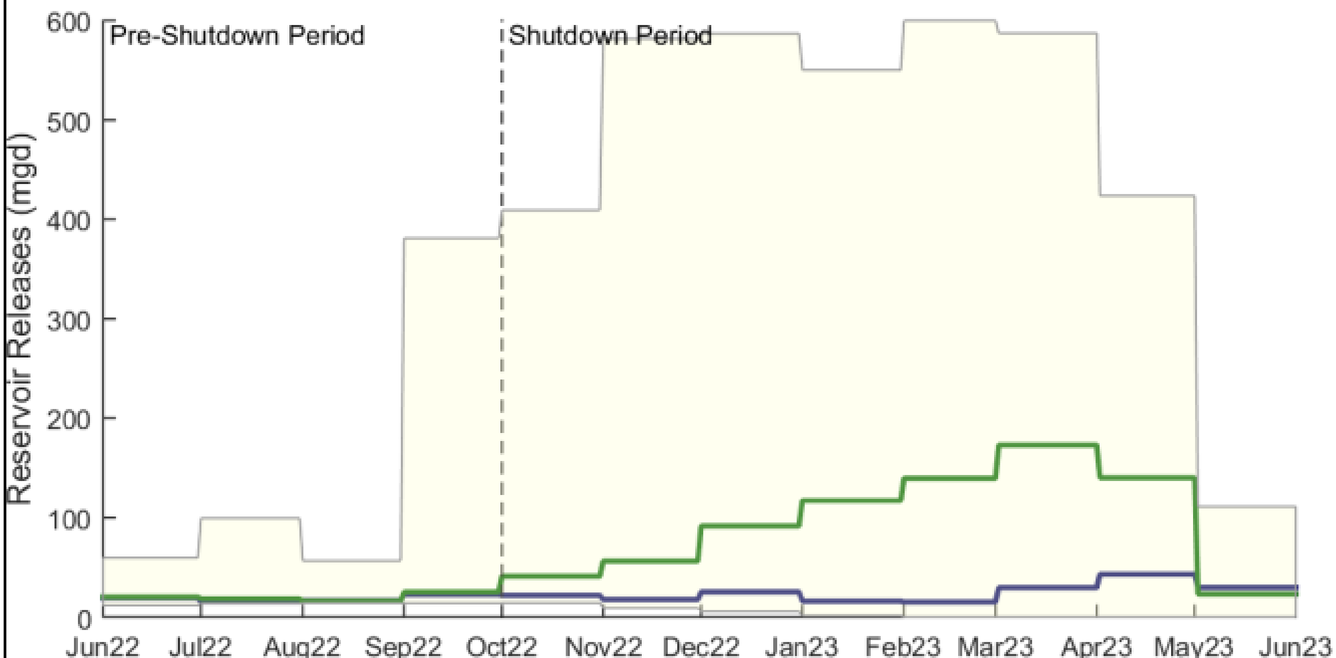
Figure 10.4-14: Esopus Creek Downstream of Ashokan Reservoir Study Area

A variance from the IRP during Delaware Aqueduct repairs is permitted in the IRP as part of the October 2013 Order on Consent. This variance from the CSSO would commence during the pre-shutdown period in June to facilitate Ashokan Reservoir being full at the start of the RWBT temporary shutdown in October.[43] The IRP variance would continue through the end of the shutdown in May. During this time DEP may consider, as applicable, releases in advance of known, large storm events when water supply objectives can also be achieved. Based on modeling analyses, under typical operations, monthly average daily releases can range from 0 mgd up to approximately 600 mgd, the maximum allowed under the IRP (see **Figure 10.4-15**). The monthly average daily spills can reach approximately 1,470 mgd (see **Figure 10.4-16**). Spills can occur during any month but are more frequent and of larger magnitude in the spring. Daily spills can reach 10,000 mgd under typical operations.

During the pre-shutdown period, releases into Esopus Creek downstream of the Ashokan Reservoir West Basin would be lower than typical conditions by up to 3 mgd (see **Figure 10.4-15**). During the pre-shutdown period, spills into Esopus Creek downstream of the Ashokan Reservoir East Basin would be higher than typical conditions by up to approximately 114 mgd (see **Figure 10.4-16**). During the temporary shutdown of the RWBT, releases into Esopus Creek downstream of the Ashokan Reservoir West Basin would be lower than typical conditions by up to approximately 142 mgd (see **Figure 10.4-15**). During the temporary shutdown of the RWBT, spills into Esopus Creek downstream of the Ashokan Reservoir East Basin would be higher than typical conditions by up to approximately 62 mgd (see **Figure 10.4-16**). The dataset mean during WSSO for both spills and releases from Ashokan Reservoir to Esopus Creek would remain within the range of typical operations. In accordance with the variance to the IRP that would be in place, the modeling assumed no releases to meet the CSSO during the pre-shutdown period and the temporary shutdown.

During WSSO, the probability of high flows would be slightly higher than typical since releases would not be made to meet the CSSO (see **Figure 10.4-17** and **Figure 10.4-18**). For the high flow probability curves, data is presented for the combined releases and spills immediately below the dam and also at the Mount Marion USGS Gauge, approximately 28 miles downstream of Ashokan Reservoir's Olivebridge Dam. In addition to the modeled typical operations and the temporary shutdown scenarios, historical recurrence of high flows based on measurement data is also presented. Historical data are presented to provide context for the recent reductions in high flows attributable to implementation of the IRP, which was implemented in 2011 and effectively reduces high flows downstream of Ashokan Reservoir. When compared to the historical probability of high flows immediately downstream of the reservoir, the temporary shutdown would result in a smaller increase than when compared to the more recent IRP (see **Figure 10.4-17**). At the Mount Marion USGS Gauge, the temporary shutdown would result in high flow probabilities that are below the historical condition (see **Figure 10.4-18**).

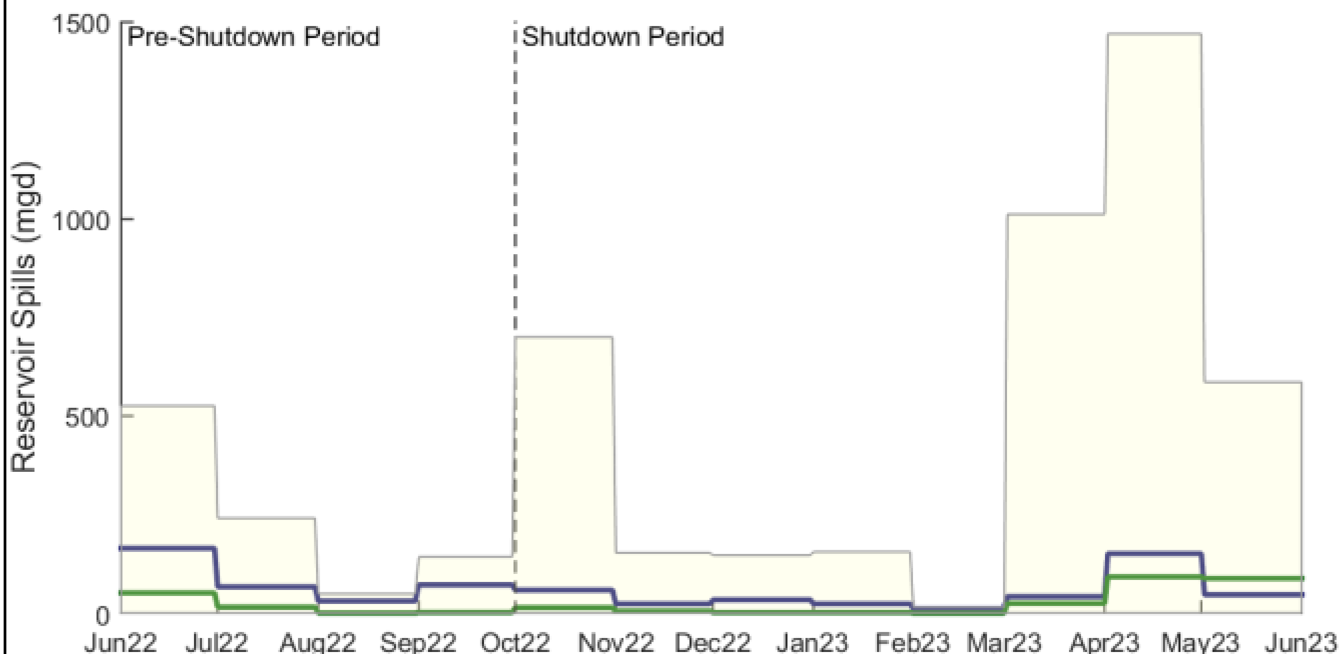
[43] Section 7 c. of the Interim Ashokan Release Protocol for Ashokan Reservoir states "DEC, or DEP with concurrence by DEC, determines that releases must be changed or interrupted as necessary for inspection, maintenance, testing and repairs (including Delaware Aqueduct repairs)."



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	21	12	60	20	-1
	July	19	14	100	16	-3
	August	16	15	57	17	1
	September	26	15	381	23	-3
Shutdown Period	October	41	15	409	22	-19
	November	56	9	582	18	-38
	December	92	6	587	26	-66
	January	117	1	550	16	-101
	February	140	0	600	16	-124
	March	171	0	588	29	-142
	April	145	0	436	44	-101
	May	25	0	117	30	5

Note: The OST model does not release water from the East Basin of Ashokan Reservoir for the WSSO simulations.

Figure 10.4-15: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Esopus Creek Downstream of Ashokan Reservoir Study Area

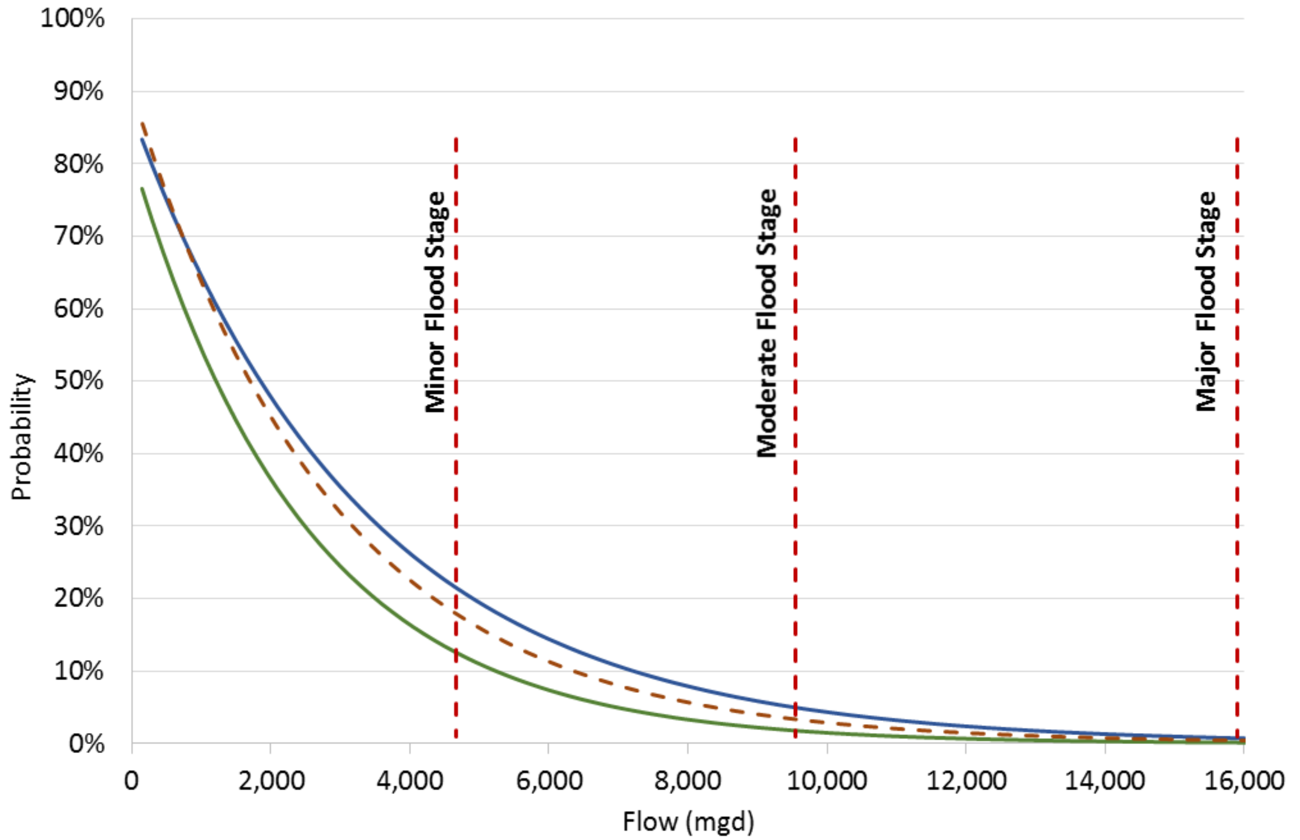


		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	51	0	526	165	114
	July	15	0	241	67	52
	August	1	0	49	31	30
	September	2	0	142	72	70
Shutdown Period	October	14	0	700	58	44
	November	5	0	153	23	18
	December	2	0	147	34	32
	January	2	0	155	23	21
	February	0	0	15	12	12
	March	22	0	1013	37	15
	April	92	0	1470	154	62
	May	87	0	549	49	-38

Note: Spills can only occur from the East Basin at Ashokan Reservoir.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.4-16: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Esopus Creek Downstream of Ashokan Reservoir Study Area

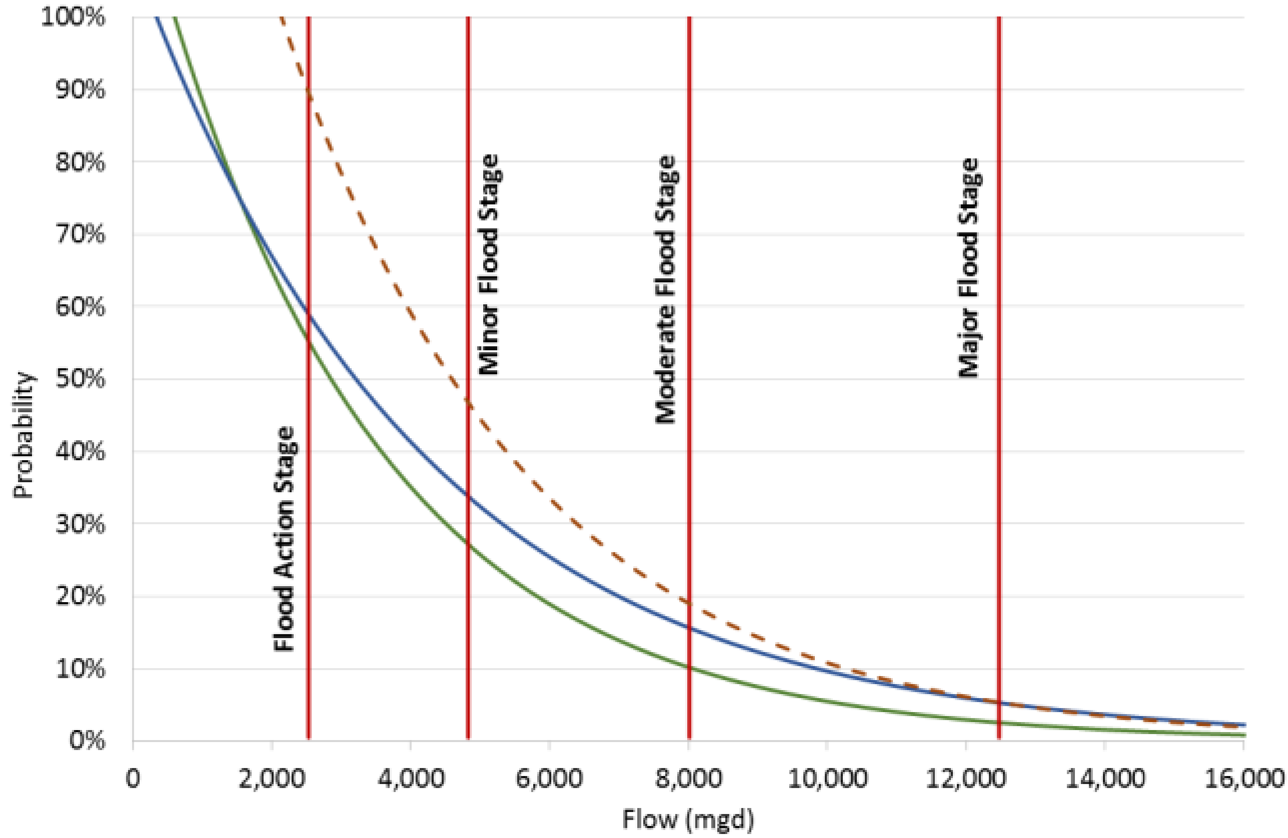


	Typical	WSSO	Difference (perc pts)
Minor Flood Stage	15%	22%	+8%
Moderate Flood Stage	2%	5%	+3%
Major Flood Stage	0.1%	0.7%	+0.6%

Note: The first location downstream of Ashokan Reservoir with NWS flood stages delineated is the USGS Mount Marion Gauge along the Esopus Creek. Flood stages at this location have been estimated based on the flood stage delineations at the East Ashokan spillway.

Legend
WSSO — Typical — Historical

Figure 10.4-17: Annual Probability of High Flows from Spills and Releases – Esopus Creek Downstream of Ashokan Reservoir Study Area



	Typical	WSSO	Difference (perc pts)
Flood Action Stage	53%	57%	+4%
Minor Flood Stage	27%	34%	+7%
Moderate Flood Stage	10%	16%	+6%
Major Flood Stage	3%	6%	+3%

Note: Mount Marion USGS Gauge is approximately 28 miles downstream of Olivebridge Dam.

Legend
WSSO — Typical — Historical

Figure 10.4-18: Annual Probability of High Flows at Mount Marion USGS Gauge – Esopus Creek Downstream of Ashokan Reservoir Study Area

However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would not be the cause of flooding. In fact, the reservoir would reduce flood peaks downstream by attenuating flows from upstream of the reservoir, even when it is full and spilling. The results of the modeling indicate that there would be a minor, temporary reduction in this attenuation during the RWBT temporary shutdown as indicated by the minor increase in probability of flows reaching flood stage. The change in flood stage is estimated to be an approximately seven percentage point increase in minor flooding, an approximately six percentage point increase in moderate flooding, and an approximately three percentage point increase in major flooding at the Mount Marion gauge (see **Figure 10.4-18**).

Modeling results predict that the dataset mean for spills and releases (flows) would remain within those observed during typical operations, community releases would continue during the shutdown, and there would only be minor reductions in the ability of Ashokan Reservoir to attenuate large storm events. Therefore, there would be no significant adverse impacts to Esopus Creek downstream of Ashokan Reservoir from WSSO, and no further analysis of Esopus Creek downstream of Ashokan Reservoir is warranted.

10.4.6 KENSICO RESERVOIR STUDY AREA IMPACT ANALYSIS

10.4.6.1 Study Area Location and Description

Kensico Reservoir is located in Westchester County, approximately 3 miles north of White Plains and is formed by impounding the Bronx River (see **Figure 10.4-19**). However, it receives most of its water from the City's west of Hudson reservoirs through the Catskill and Delaware aqueducts. Kensico Reservoir is the terminal drinking water reservoir for all Catskill and Delaware System reservoirs. There is no release requirement for Kensico Reservoir. The reservoir is operated such that it does not spill, which would result in a permanent loss of water from the water supply system.

Kensico Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is prohibited at Kensico Reservoir. The water quality classification for Kensico Reservoir is Class AA throughout its entire length, which indicates it is a high quality source of drinking water. In addition to water supply for the City, the Westchester Joint Waterworks has a direct connection to Kensico Reservoir for water supply.

10.4.6.2 Study Area Evaluation

Under typical operations, DEP manages diversions into the reservoir via the Catskill and Delaware aqueducts and diversions out of the reservoir via the Delaware Aqueduct, balancing diversions with natural inflow, in order to maintain the water surface elevation between approximately 355 feet and 357 feet. Releases from Kensico Reservoir are not required, and the reservoir is operated such that it does not spill. During the RWBT temporary shutdown, Kensico Reservoir would be operated in the same manner as during typical operations and water surface elevation would remain between approximately 355 and 357 feet (see **Figure 10.4-20**).

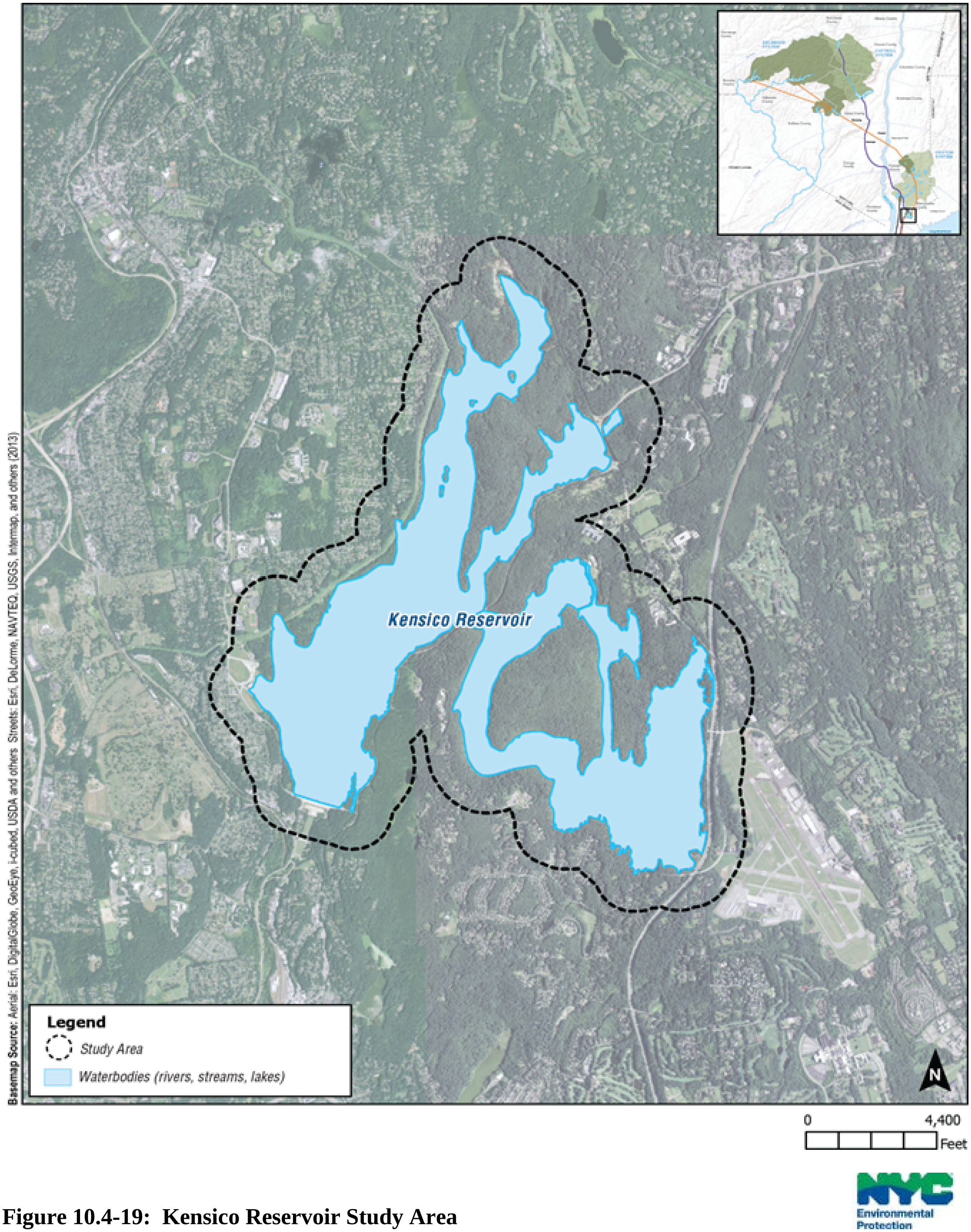
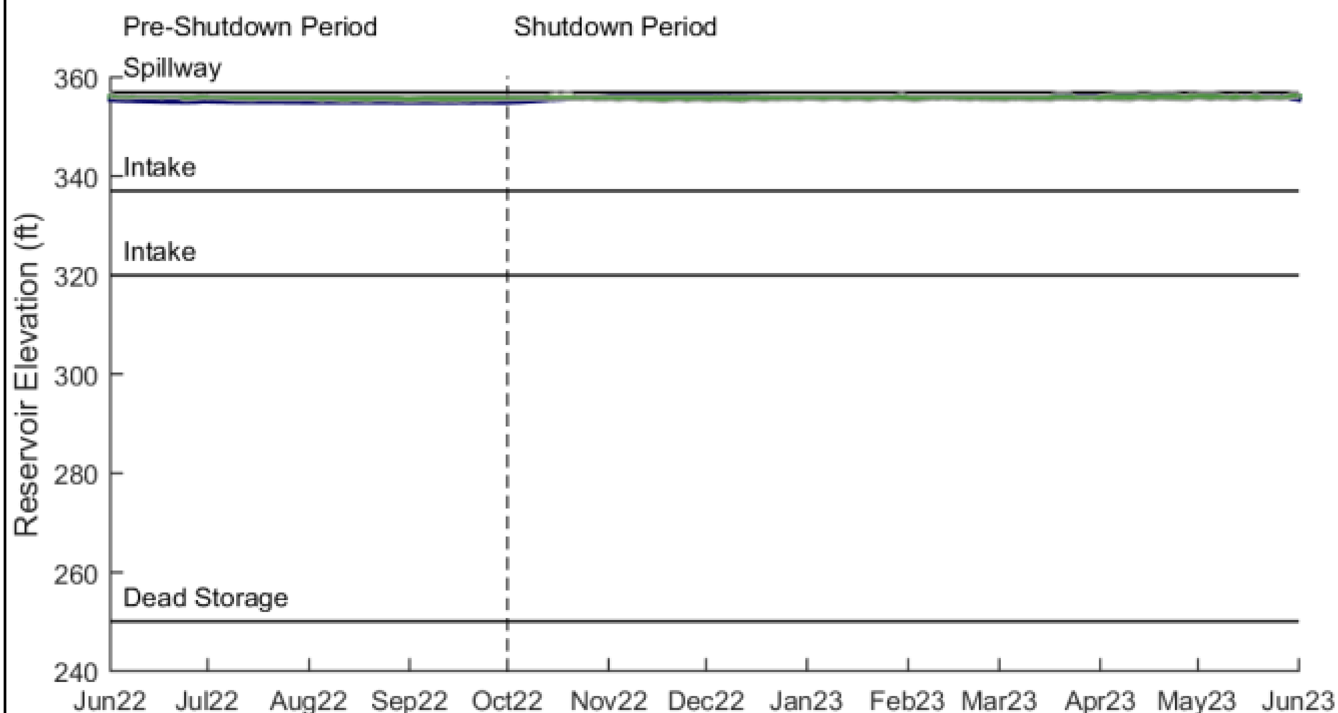


Figure 10.4-19: Kensico Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	356	356	356	355	-1
	July	356	356	356	355	-1
	August	356	355	356	355	-1
	September	356	355	356	355	-1
Shutdown Period	October	356	356	356	356	0
	November	356	355	356	356	0
	December	356	355	356	356	0
	January	356	355	356	356	0
	February	356	356	356	356	0
	March	356	355	356	356	0
	April	356	355	357	356	0
	May	356	356	357	356	0

Note: There is a direct water utility connection for the Westchester Joint Waterworks at Kensico Reservoir at elevation 337 feet.

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.4-20: Elevation Dataset Mean and Range for Typical Operations and WSSO – Kensico Reservoir Study Area

As noted previously, incoming Catskill Aqueduct water is treated with alum when other measures for controlling turbidity are not sufficient to maintain turbidity below the 5 Nephelometric Turbidity Unit (NTU) regulatory limit for water leaving Kensico Reservoir.[44] Alum addition at Kensico Reservoir is authorized by the Catalum SPDES Permit, which is the subject of a separate environmental review, and the likelihood of increased alum use during the RWBT temporary shutdown was documented in the Catalum SPDES Permit Consent Order dated October 4, 2013.

Typically, turbidity levels in Catskill Aqueduct water under 8 NTU are not treated with alum because dilution and settling in Kensico Reservoir are sufficient to reduce levels below regulatory limits prior to diversion from the reservoir. Since the Delaware System would be unavailable, DEP would seek to keep turbidity levels substantially below the 5 NTU limit during the shutdown.

During the temporary shutdown, there would be limited dilution with water from the Delaware Aqueduct supplied by the Croton Falls and Cross River pump stations and diversions from West Branch Reservoir. Therefore, it could be necessary to apply alum even when incoming Catskill water has low levels of turbidity (e.g., between 2 and 3 NTU) to ensure regulatory compliance for turbidity for water leaving Kensico Reservoir. Due to the potential for increased likelihood of treatment of Catskill Aqueduct water with alum, there could be higher than typical deposition of alum floc in Kensico Reservoir. Based on modeling results that indicate additional alum deposition from increased alum treatment, additional analysis of the potential for impacts is warranted for Kensico Reservoir. It should be noted, however, that while DEP is preparing for higher than typical alum treatment, turbidity is weather-dependent. It could remain below the threshold for treatment for the duration of the temporary shutdown, in which case there would be little to no alum treatment of Catskill Aqueduct water.

10.4.6.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Increased alum treatment would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because variations would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Kensico Reservoir Study Area and no further analysis is warranted.

The consistency of increased alum treatment during the temporary shutdown with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in increased alum treatment, except the Catalum SPDES Consent Order, which explicitly accounts for increased alum treatment during the temporary shutdown. Therefore,

[44] Nephelometric turbidity units are a measure of suspended particulates using light passing through a sample of water.

WSSO would not result in significant adverse impacts to public policy within the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.4 Socioeconomic Conditions

Potentially substantial increased alum treatment during the temporary shutdown would not cause indirect or direct effects on factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Further, increased alum treatment would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.6 Open Space and Recreation

There would be no change to Kensico Reservoir beyond increased alum deposition below the water surface from additional alum treatment during the temporary shutdown. Alum deposition would not affect fisheries in the reservoir (see Aquatic and Benthic Resources in Section 10.4.6.10, “Natural Resources”). WSSO would not result in significant adverse impacts to open space and recreation within the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.7 Critical Environmental Areas

Two CEAs, the “Westchester County Airport 60 Day/Night Average Noise Level Contour” (Westchester Airport CEA) and “County and State Park Lands,” both designated by Westchester County, were identified as occurring in the study area. The “County and State Park Lands” CEA encompasses all county and State parks within Westchester County. The parks contained in this CEA that overlap with the study area consist of the Kensico Dam Plaza and Cranberry Lake Park (see **Figure 10.4-21**). Kensico Dam Plaza is a County Park located at the foot of the Kensico Dam. There would be no change to Kensico Reservoir beyond increased alum deposition below the water surface. Alum deposition from increased alum treatment would not affect these Critical Environmental Areas. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Kensico Reservoir Study Area and no further analysis is warranted.

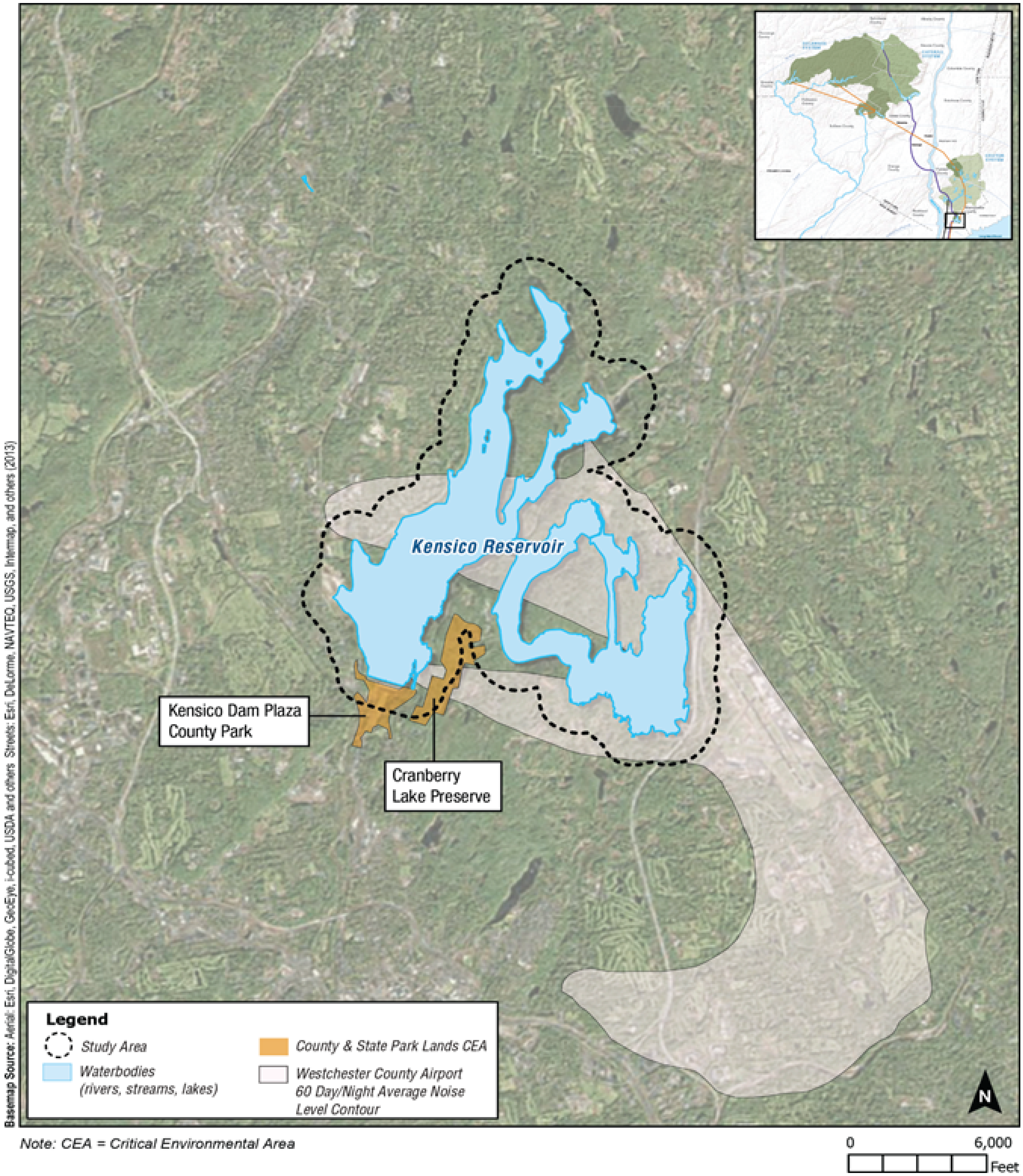


Figure 10.4-21: Critical Environmental Areas – Kensico Reservoir Study Area

10.4.6.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the Kensico Reservoir Study Area. The potential mechanism for potential historic or cultural resources impacts from WSSO would be through erosion. Water surface elevations would not change from typical operations during WSSO and erosion is not likely (see Geology and Soils in Section 10.4.6.10, "Natural Resources").

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no effect on cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.9 Visual Resources

Water surface elevations would not differ from typical during WSSO. While there would be increased alum treatment during the temporary shutdown, alum removes turbidity from the water column. There would not be any visual contrast in the reservoir due to increased alum treatment. Therefore, WSSO would not result in significant adverse impacts to visual resources within the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.10 Natural Resources

The potential for impacts to natural resources from WSSO within the Kensico Reservoir Study Area is discussed below.

Geology and Soils

Water surface elevations would not differ from typical during WSSO and alum deposition below the reservoir water surface would not impact geology or soils in Kensico Reservoir. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the Kensico Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions, with the exception of possible changes in habitat due to natural vegetative succession. Addition of alum to Kensico Reservoir that is greater than typical conditions would not have an effect on the ecological communities within the study area. The reservoir would continue to function as a lacustrine environment supporting a fishery, and any upland communities would be unchanged by the addition of alum. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the Kensico Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The addition of alum to Kensico Reservoir would not result in significant changes within the study area to critical wildlife habitat, wildlife movement or its ability to forage or breed. Addition of alum would occur below the water surface and no terrestrial wildlife would be subject to its affects. Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the reservoir would still have a source of prey in the reservoir. Additional alum deposition in Kensico Reservoir would not have negative effects on the fishery present in Kensico Reservoir (see Aquatic and Benthic Resources in Section 10.4.6.10, “Natural Resources”). There would be no drawdown of Kensico Reservoir from WSSO. Therefore, WSSO would not result in significant adverse impacts to wildlife in the Kensico Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Kensico Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Kensico Reservoir Study Area include the following: Blocks 5955D, 6055C, 5954B, and 6054A. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the Kensico Reservoir Study Area include the Mount Kisco, Glenville, and White Plains Quadrangles. There are no federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, or unlisted rare or vulnerable aquatic species that occur in the Kensico Reservoir Study Area. There would be no effects on terrestrial species as a result of greater levels of alum treatment during the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the Kensico Reservoir Study Area and no further analysis is warranted.

Aquatic and Benthic Resources

The temporary shutdown would result in the potential for increased alum treatment at the Pleasantville Alum Plant for the Catskill Aqueduct, which could result in additional alum deposition at Kensico Reservoir, potentially affecting aquatic resources. The Catskill Aqueduct discharges into a small cove in Kensico Reservoir. When alum is added, the primary area of alum deposition is within the cove itself, which is approximately 10 acres. Some alum (typically less than 5 percent) could travel a short distance outside of the cove. Geophysical surveys of the reservoir bottom indicate that alum deposition is constrained to an approximately 80-acre area in the northwest corner of the reservoir.

DEP has used alum as a treatment strategy for many years. Alum deposition accumulates on the reservoir bottom and benthic organisms live in close relationship to reservoir/lake substrate. Therefore, the assessment focused on the potential affects of alum deposition on the benthic community. DEP sampled the Kensico Reservoir benthic community in proximity to the areas of alum deposition in April and July 2007. The 2007 surveys followed a period of alum treatment in

2005 and 2006 of approximately 9 million pounds of alum over 296 days. Sampling included 41 stations and revealed a relatively diverse and abundant benthic community living within the substrate.

In July 2014, a representative subset of the stations sampled in 2007 (23 of the original 41 stations) were selected and resampled. Results were used to provide a comparable database that could be used to determine if there were any changes to the benthos between 2007 and 2014 that could be attributed to alum treatment (see **Figure 10.4-22**). The 2014 sampling followed a period of alum treatment similar to that in 2011 and 2012. In this case, the total alum treatment was approximately 7.4 million pounds of alum over 350 days. In addition to the benthic sampling program, DEP conducted extensive bathymetric and sediment sampling studies in 2006 and 2014 to determine the depth, areal distribution, and chemical make-up (total and dissolved aluminum content) of the alum floc deposition within the area of the Catskill Influent Chamber cove and the adjacent area of the reservoir. The results of these geophysical studies were reviewed. The bathymetric and sediment sampling, along with the grain-size distribution and percent solids and organic matter data from the benthic samples, were used to compare the benthic community composition within and outside the expected area of alum floc deposition. The four key findings from this evaluation were:

1. The 2007 and 2014 benthic sampling results obtained from the area of the Catskill Aqueduct at the Catskill Influent Chamber cove demonstrated a diverse community that was relatively similar to other large, soft-bottom lakes and reservoirs in the region.

2. Although some differences were noted, overall, the benthic communities in 2007 and 2014 were similar and consistent with the finding that the dominant benthic groups (mollusks, crustaceans, and chironomids) were the same in both survey years.

3. Overall, stations within and outside the area of estimated alum floc deposition had similar levels of silt/clay fractions and exhibited a corresponding decrease or increase in the number of benthic taxa and abundance. However, at some locations it was found that changes in the benthic population were not always clearly linked to either alum deposition or changes in silt/clay composition.

4. While there is the potential for localized impacts following alum application, results of comparisons between the stations located inside and outside the estimated area of alum floc deposition suggest that any potential long-term influence of alum floc deposition could be minimal within the Catskill Influent Chamber cove area. Variability in other naturally occurring factors, such as substrate type and water depth, most likely influence the benthic community of Kensico Reservoir to a greater extent.

The presence of alum occurs in less than 5 percent of the areal extent of the reservoir. Surveys of fish community indicate a healthy natural fishery for numerous species that is augmented by stocking of trout. While aluminum is acutely toxic to fish, studies in Kensico Reservoir indicate that the potential for mobilization of aluminum from the sediment is low, and that dissolved aluminum in the water column is similarly low.

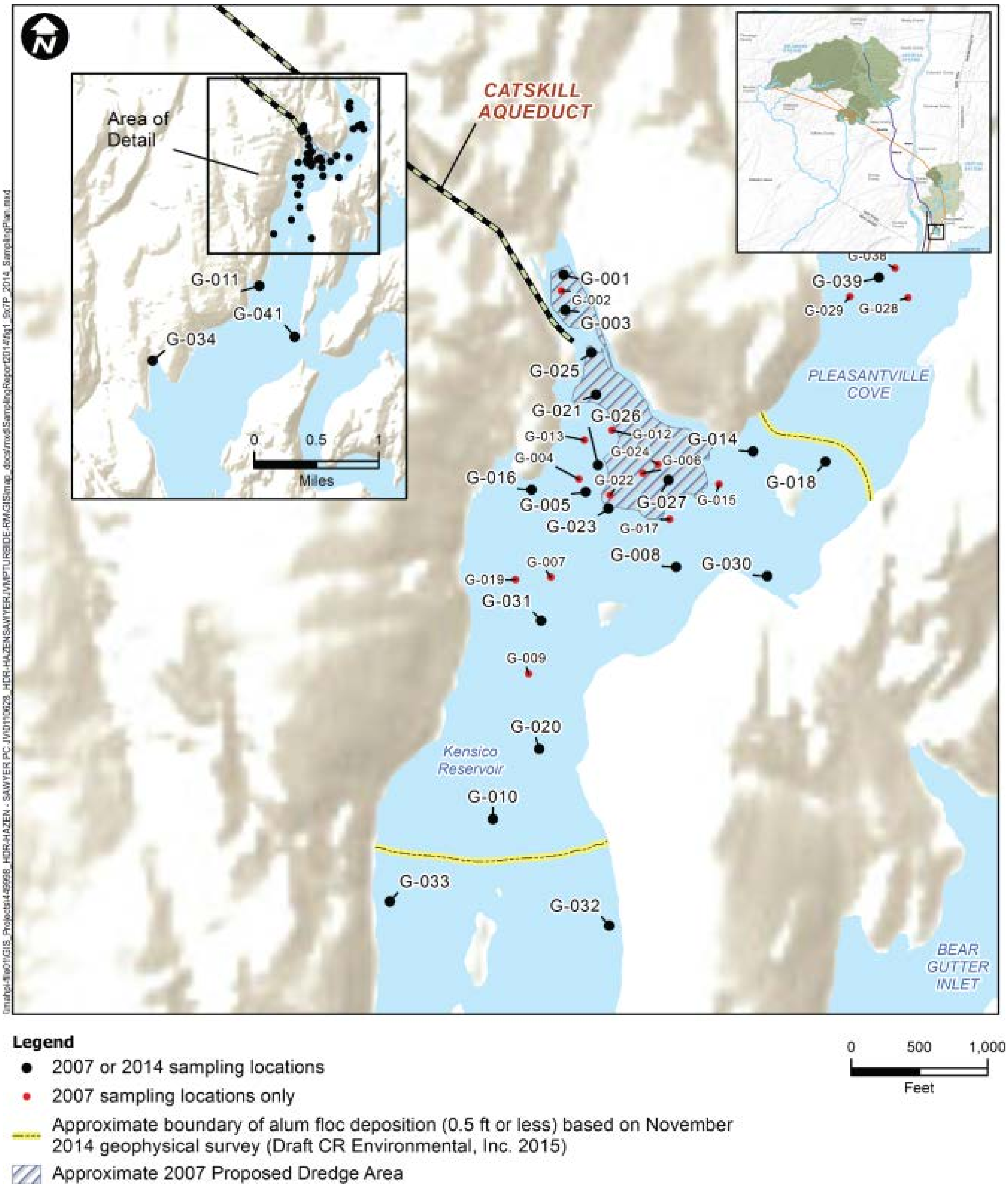


Figure 10.4-22: Benthic Sampling Locations – Kensico Reservoir Study Area

In the future without WSSO, it is anticipated that DEP would continue to treat Catskill water with alum only when required due to episodic turbidity events, and that the fishery and benthic community in Kensico Reservoir would remain as described above.

During the temporary shutdown, DEP would be reliant on water from the Catskill Aqueduct to meet demand. DEP would not be able to curtail diversions from Ashokan Reservoir to Kensico Reservoir during turbidity events. As part of WSSO, DEP would pursue an objective of maintaining flows leaving Kensico Reservoir at turbidity levels of 1.5 NTU or less, similar to baseline conditions. In order to achieve this objective, DEP would advance a proactive approach to safeguarding the system from a turbidity event and maintain compliance with the SWTR and FAD during the RWBT temporary shutdown. Therefore, alum application would be considered during the temporary shutdown to sufficiently treat, as necessary, the full capacity of Catskill Aqueduct flow.

The OST model was used to estimate potential alum application, areal extent of deposition, and alum thickness in Kensico Reservoir using a reasonable worst case range of triggers between 2.0 and 3.0 NTU for turbidity in the Catskill Aqueduct (note this is lower than the historical range of 8 NTU or greater). In the OST, Kensico Reservoir is partitioned into 28 grid cells and depth of alum floc deposition is estimated as an average settled thickness across each grid cell. Areal extent was identified at the grid cells that contained alum floc deposition.

The results of the modeling indicated that the median value of total mass of alum required during the temporary shutdown could range between 5 and 7 million pounds, for alum application triggers of 3.0 and 2.0 NTU, respectively.[45] The median number of days with alum addition from OST model simulations was 120 and 182 days, respectively.

The modeling also indicated that the areal extent of the alum deposition would be consistent with the areal extent of alum deposition to date from comparison with geophysical surveys. Current total depths of alum floc deposition from all prior historical alum addition events range from approximately 0.5 to 9.7 feet, per the geophysical coring conducted in November 2014. The OST modeling indicated that alum treatment during the temporary shutdown could result in additional alum floc deposition between approximately 0.1 to 1.1 feet in the same areas of the reservoir where alum floc has historically deposited (see **Figure 10.4-23**).[46]

Anticipated median value for alum treatment during the temporary shutdown would be within the range experienced under historical events in 2005/2006 and 2011/2012 (see **Table 10.4-1**). Additionally, the long-term effects to the Kensico Reservoir benthic community would be evaluated as part of the Catalum environmental review, which would include the additional alum treatment that could occur during the temporary shutdown.

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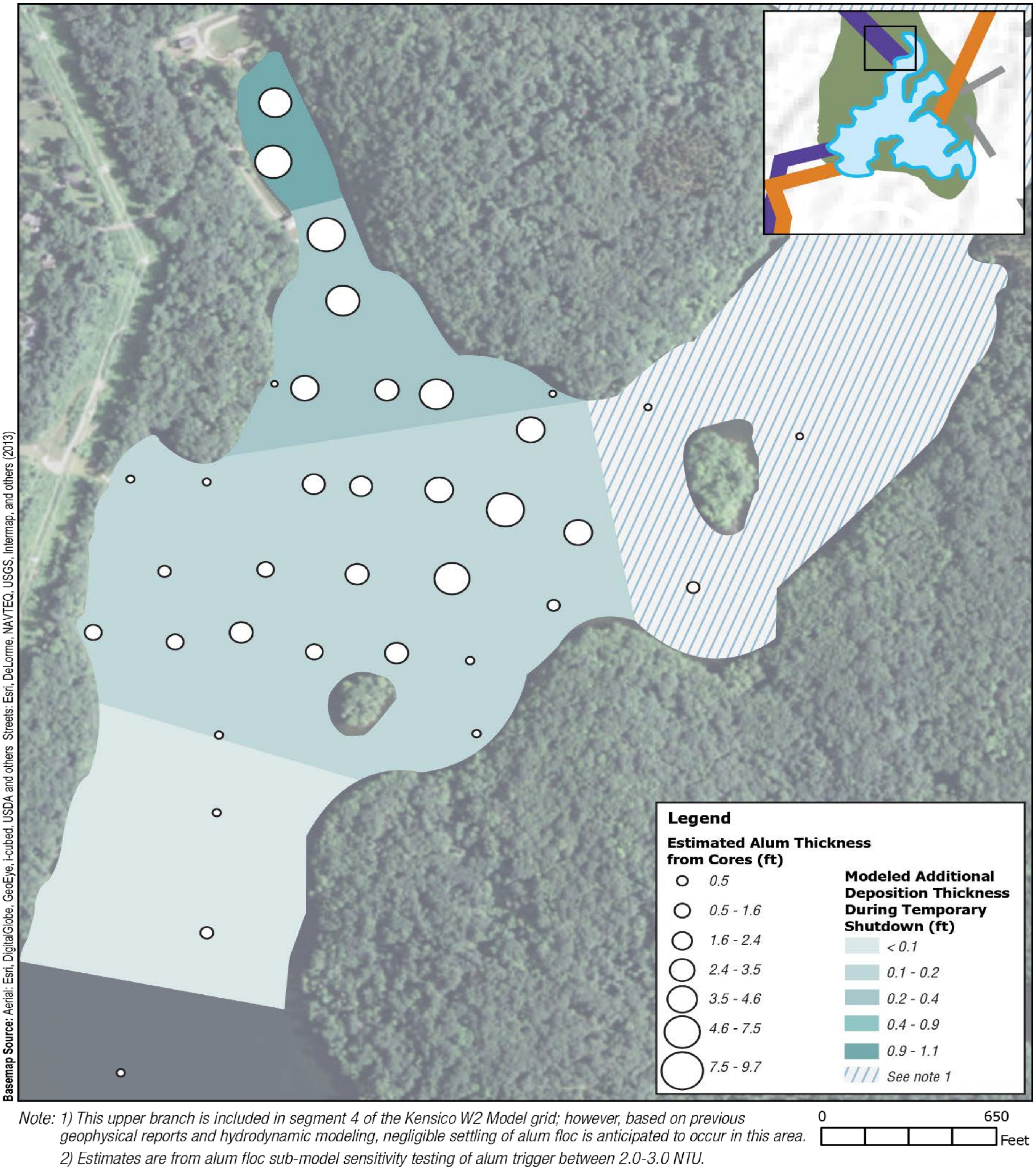
[45] The alum trigger in the model is the turbidity level at which DEP decides to apply alum. The range for the triggers was determined by prior laboratory analyses.

[46] Predicted depth of alum deposits is based on lateral averages within the corresponding model grid cells. The OST does not have the level of resolution needed to account for variations in reservoir flow profiles that may influence specific areas of higher or lower deposition within a given model grid cell.



Note: 1) This upper branch is included in segment 4 of the Kensico W2 Model grid; however, based on previous geophysical reports and hydrodynamic modeling, negligible settling of alum floc is anticipated to occur in this area.
2) Estimates are from alum floc sub-model sensitivity testing of alum trigger between 2.0-3.0 NTU.

Figure 10.4-23: Estimated Depth of Sediment Containing Alum from 2014 Geophysical Cores and Modeled Range of Average Settled Thickness of Alum Floc during RWBT Shutdown Operations – Kensico Reservoir Study Area

Table 10.4-1: Summary Data from Historical Alum Addition Events

<table>
<tr><th>Start Date</th><th>Alum Treatment Days</th><th>Total Alum Used by Event (lbs)</th><th>Total Alum Used by Year (lbs)</th></tr>
<tr><td>2/21/1981</td><td>72</td><td>3,060,960</td><td>3,060,960</td></tr>
<tr><td>4/9/1984</td><td>44</td><td>1,241,680</td><td>1,241,680</td></tr>
<tr><td>4/6/1987</td><td>43</td><td>921,680</td><td>921,680</td></tr>
<tr><td>1/22/1996</td><td>151</td><td>2,477,954</td><td>2,477,954</td></tr>
<tr><td>1/14/1997</td><td>15</td><td>237,046</td><td>237,046</td></tr>
<tr><td>1/10/2001</td><td>23</td><td>482,226</td><td>482,226</td></tr>
<tr><td>4/5/2005</td><td>76</td><td>1,740,393</td><td rowspan="3">4,065,218</td></tr>
<tr><td>10/13/2005[1]</td><td>40</td><td rowspan="5">7,383,144</td></tr>
<tr><td>11/30/2005[1]</td><td>31</td></tr>
<tr><td>1/1/2006[1]</td><td>99</td><td rowspan="3">5,058,319</td></tr>
<tr><td>5/15/2006[1]</td><td>10</td></tr>
<tr><td>6/27/2006[1]</td><td>36</td></tr>
<tr><td>1/31/2011</td><td>11</td><td>208,462</td><td rowspan="3">4,777,739</td></tr>
<tr><td>3/2/2011</td><td>79</td><td>1,238,790</td></tr>
<tr><td>8/29/2011[2]</td><td>124</td><td rowspan="2">5,950,055</td></tr>
<tr><td>1/1/2012[2]</td><td>136</td><td>2,619,568</td></tr>
<tr><td rowspan="2">WSSO Estimate</td><td>120 to 182 days</td><td colspan="2">5 to 7 million</td></tr>
<tr><td>(median value)</td><td colspan="2">(median value)</td></tr>
<tr><td colspan="4">Notes:
[1] These are considered one event, 216 days of alum treatment from 10/13/05 through 8/2/06.
[2] These are considered one event, 260 days of treatment from 8/29/11 through 5/15/12.</td></tr>
</table>

The modeling indicates that alum deposition would be within the range of historical events. Benthic sampling identified no significant adverse impact to the benthic community from those prior events. Thus, the potential effects to aquatic and benthic resources from alum deposition that could occur during the temporary shutdown would be minor and temporary. Therefore, WSSO would not result in significant adverse impacts to the aquatic and benthic resources in the Kensico Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.4.6.2, "Study Area Evaluation"), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the Kensico Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the Kensico Reservoir Study Area and no further analysis is warranted.

Floodplains

During WSSO, water surface elevations would not differ from typical conditions, and alum deposition below the reservoir water surface would not impact floodplains in the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the Kensico Reservoir Study Area and no further analysis is warranted.

Groundwater

During WSSO, water surface elevations would not differ from typical conditions, and alum deposition below the reservoir water surface would not impact groundwater resources in the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to groundwater in the Kensico Reservoir Study Area and no further analysis is warranted.

Wetlands

During WSSO, water surface elevations would not differ from typical conditions, and alum deposition below the reservoir water surface would not impact wetlands resources in the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to wetlands in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. Water surface elevations would not differ from typical during WSSO, and alum deposition below the reservoir water surface would not impact hazardous materials in Kensico Reservoir. Therefore, WSSO would not result in significant adverse impacts to hazardous materials in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.12 Water and Sewer Infrastructure

There are no sewer outfalls at the study area. There is a direct water utility connection for the Westchester Joint Waterworks at Kensico Reservoir. During WSSO, water surface elevations would not differ from typical conditions, and alum deposition, which occurs under typical operations, would not impact water utility connections in Kensico Reservoir. Further, WSSO would not include any construction that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.13 Energy

Water surface elevations would not differ from typical during WSSO, and alum deposition below the reservoir water surface would not impact energy usage or generation for the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to energy in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.14 Transportation

Increased alum deposition below the water surface in Kensico Reservoir would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.15 Air Quality

Water surface elevations would not differ from typical during WSSO, and alum deposition below the reservoir water surface would not impact air quality for the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to air quality in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.16 Noise

Water surface elevations would not differ from typical during WSSO, and alum deposition below the reservoir water surface would not impact noise for the Kensico Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.6.17 Neighborhood Character

Alum deposition below the water surface in Kensico Reservoir during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the Kensico Reservoir Study Area and no further analysis is warranted.

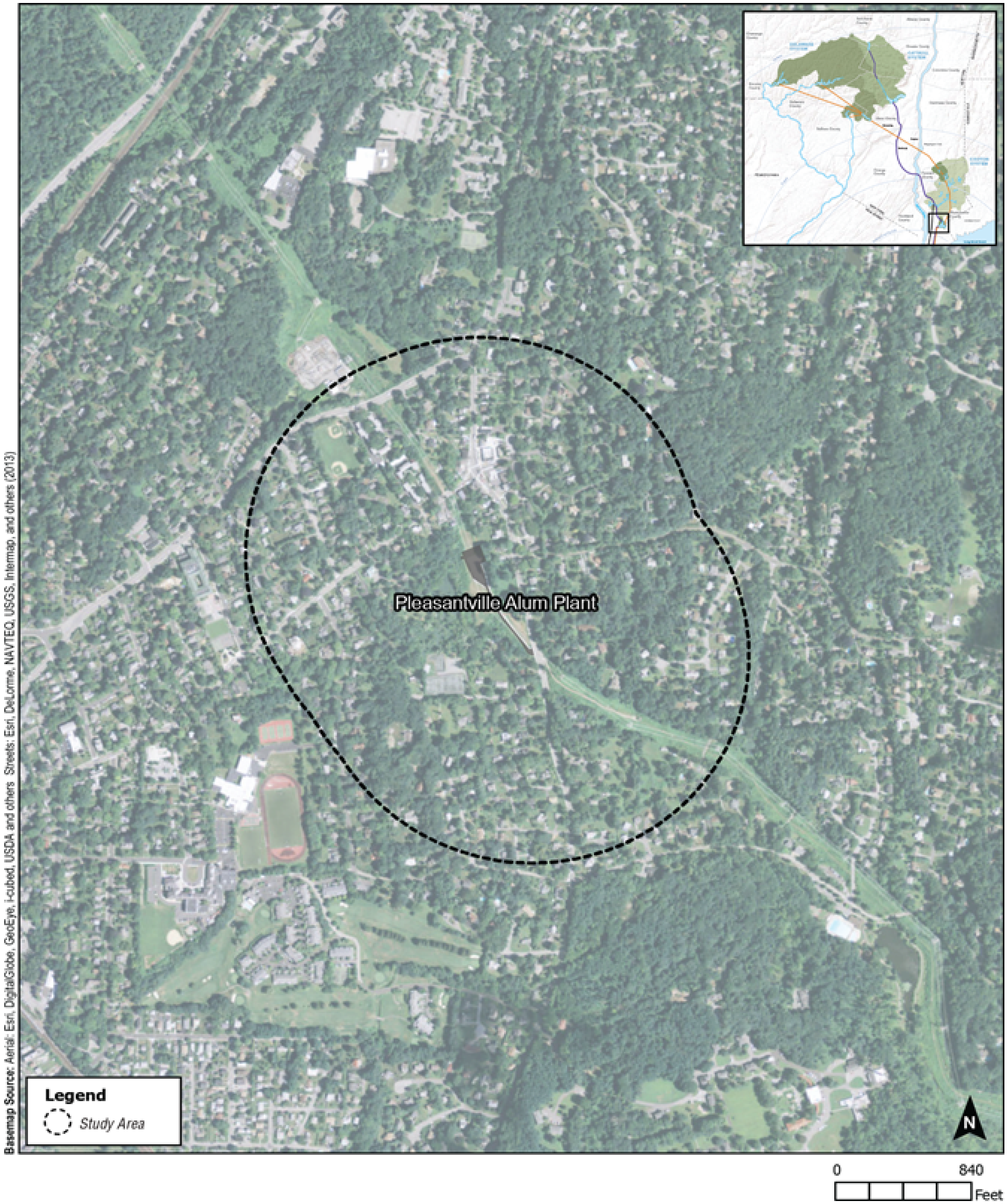
10.4.6.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from increased alum deposition in the Kensico Reservoir Study Area during the temporary shutdown. It is anticipated that under WSSO all applicable drinking water requirements would be met, including FAD objectives. Therefore, WSSO would not result in significant adverse impacts to public health in the Kensico Reservoir Study Area and no further analysis is warranted.

10.4.7 PLEASANTVILLE ALUM PLANT STUDY AREA IMPACT ANALYSIS

10.4.7.1 Study Area Location and Description

The Pleasantville Alum Plant is located in the Village of Pleasantville, Westchester County, New York (see **Figure 10.4-24**). The Pleasantville Alum Plant site is owned by DEP and has been used for water treatment purposes since the Catskill System was constructed in the early 1900s. As such, alum has been added to the water supply system for treatment of Catskill water at this location when turbidity levels were elevated as a result of severe storm events. The property is bordered by brush to the west, an open field to the north, single-family homes to the east, and an



Environmental Protection

Figure 10.4-24: Pleasantville Alum Plant Study Area

access road to the south. The site is accessible from the south via Broadway (State Route 141), by way of a paved access road that terminates at a 13-foot gate. The building and property are surrounded by an eight-foot high chain link fence, and the land consists primarily of pavement and grass.

10.4.7.2 Study Area Evaluation

Unlike other study areas included in WSSO, the Pleasantville Alum Plant Study Area is not a waterbody, nor are there any construction activities from WSSO at this location. However, the operation of the water supply system during the temporary shutdown could result in a higher than typical frequency of treatment of Catskill Aqueduct water with alum, which could result in more frequent deliveries of alum to the facility.

As the final reservoir in the Catskill/Delaware System before water enters the distribution network, the Kensico Reservoir is subject to federal water quality standards for coliforms and turbidity. Turbidity must be below 5 Nephelometric Turbidity Units (NTU) for water diverted to the City distribution system.[47] In addition to actions at Ashokan and Schoharie reservoirs to control turbidity in the watershed, DEP controls turbidity at Kensico Reservoir by mixing flows from the Catskill and Delaware aqueducts, or by curtailing diversions temporarily from the Catskill System. Under typical conditions, if these operational actions are not sufficient to manage turbidity, DEP can add alum to treat Catskill water before it enters Kensico Reservoir under approval from NYSDEC and New York State Department of Health (NYSDOH). During the shutdown, the City would be reliant on the full flow available from the Catskill System, and would have minimal ability to dilute even low levels of turbidity with flows from the Delaware Aqueduct. Therefore, DEP could be required to apply alum during the temporary shutdown and for turbidity levels that are much lower than under typical operations.

Increased alum treatment would result in increased truck traffic at the Pleasantville Alum Plant during the temporary shutdown. Therefore, additional analysis of the potential for impacts was warranted for Pleasantville Alum Plant Study Area. During the post-shutdown period, alum use would be unlikely because of the increased utilization of the Delaware System immediately following the end of the RWBT temporary shutdown.

The assessment of the potential for impacts from construction and operation of the proposed dechlorination facility at Pleasantville Alum Plant associated with the Catskill Aqueduct Repair and Rehabilitation, which would also be used for the additional alum deliveries associated with WSSO, is assessed in Chapter 9, “The Proposed Catskill Aqueduct Repair and Rehabilitation,” of this DEIS.

10.4.7.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses

[47] Nephelometric turbidity units are a measure of suspended particulates using light passing through a sample of water.

would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because variations would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

The consistency of temporary variations in traffic as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable. Therefore, WSSO would not result in significant adverse impacts to public policy within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.4 Socioeconomic Conditions

Increased alum deliveries during the temporary shutdown would not cause indirect or direct effects on factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and would not physically impact, or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.6 Open Space and Recreation

Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and would not impact open space and recreation resources in the study area. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.7 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and not impact historic and cultural resources.

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no effect on cultural resources in, or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.9 Visual Resources

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and not impact visual resources in the study area. Therefore, WSSO would not result in significant adverse impacts to visual resources within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.10 Natural Resources

The potential for impacts to natural resources from WSSO within the Pleasantville Alum Plant Study Area is discussed below.

Geology and Soils

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and would not impact geology or soils in the study area. Therefore, WSSO would not result in significant adverse impacts to geology or soils resources within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. No construction activities with the potential to result in disturbance to ecological communities would occur at the Pleasantville Alum Plant. WSSO would result in truck traffic that is elevated over typical conditions. Truck traffic would be confined to pre-existing roads and no new roads, staging areas, or parking areas are proposed. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The increase in truck traffic would not result in significant adverse impacts to traffic (see Section 10.4.7.14, "Transportation") and, therefore, would not result in a degree of traffic that is unprecedented for the study area. The increase in traffic would not result in significant changes within the study area to critical wildlife habitat, wildlife movement or its ability to forage or breed. Therefore, WSSO would not result in significant adverse impacts to wildlife in the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Pleasantville Alum Plant Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Pleasantville Alum Plant Study Area include the following: Blocks 5955B and 5955D. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the Pleasantville Alum Plant Study Area include the Ossining Quadrangle. There are no aquatic federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, or unlisted rare or vulnerable species that occur in the Pleasantville Alum Plant Study Area. The elevated truck traffic would be temporary and would occur primarily during the winter months when many species are dormant. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, Species of Special Concern, and unlisted rare or vulnerable species in the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Aquatic and Benthic Resources

There are no waterbodies at the Pleasantville Alum Plant. WSSO activities would consist of increased truck traffic for alum deliveries, which would be temporary in nature and not impact aquatic resources in the study area. Therefore, WSSO would not result in significant adverse impacts to aquatic and benthic resources within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Water Resources

Surface Water

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Runoff from the Pleasantville Alum Plant Study Area would not change from typical conditions during WSSO. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact surface water resources in the study area. Therefore, WSSO would not result in significant adverse impacts to surface water within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact floodplains in the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Groundwater

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact groundwater resources in the study area. Therefore, WSSO would not result in significant adverse impacts to groundwater within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

Wetlands

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact wetlands resources in the study area. Therefore, WSSO would not result in significant adverse impacts to wetlands within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.11 Hazardous Materials

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact hazardous materials in the study area. Therefore, WSSO would not result in significant adverse impacts to hazardous materials within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.12 Water and Sewer Infrastructure

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact water and sewer infrastructure in the study area. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.13 Energy

There would be no construction associated with WSSO in the Pleasantville Alum Plant Study Area. Activities at this study area would consist of increased truck traffic for alum deliveries, which would be temporary in nature and are not anticipated to impact energy production or consumption in the study area. Energy usage for equipment to treat water in the Catskill Aqueduct with alum would be within the range of typical operations. Therefore, WSSO would not result in significant adverse impacts to energy within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.14 Transportation

During the RWBT temporary shutdown, the total number of trucks related to the delivery of chemicals is estimated to be between 1 to 10 trucks per week on average, and up to 30 trucks per week for short durations. These chemical deliveries could generate between 2 to 20 vehicle trip ends (round trips) per week. This would be equivalent to 4 to 40 Passenger Car Equivalents

(PCE) per week on average and up to 60 vehicle trip ends (120 PCEs) during a peak period. These WSSO chemical deliveries would be in addition to the chemical deliveries associated with the Catskill Aqueduct Repair and Rehabilitation within the Pleasantville Alum Plant Study Area. As discussed in Section 9.17.4.8, “Transportation,” the Catskill Aqueduct Repair and Rehabilitation is anticipated to result in 1 truck on average and up to a maximum of approximately 5 trucks per week. This would generate approximately 2 to 10 vehicle trip ends per week for a short duration.

In summary, the total trucks due to WSSO and the repair and rehabilitation would generate approximately 30 vehicle trip ends per week on average to the Pleasantville Alum Plant Study Area during the temporary shutdown. That could generate up to 70 vehicle trip ends per week for short durations. Due to the limited number of chemical bays for deliveries and the length of time to unload the chemicals, deliveries would be staggered throughout the day and would not all occur at once.

The trip generation due to WSSO and the repair and rehabilitation at the Pleasantville Alum Plant would be below the *CEQR Technical Manual* screening threshold of 50 peak hour vehicle trip ends as described in Section 10.2.3.12, “Transportation.” Therefore, a transportation analysis is not warranted.

WSSO would not generate demands for public parking or transportation within the study area, and would not spur an increase in pedestrian activity within the study area. Alum deliveries would occur for a portion of the temporary chlorination period from 2019 through 2023. Following the completion of WSSO, alum deliveries would return to baseline conditions. Therefore, although there would be a temporary increase in traffic, WSSO would not result in significant adverse impacts to transportation within the Pleasantville Alum Plant Study Area and no further analysis is warranted.

10.4.7.15 Air Quality

The only air quality emissions sources from WSSO in this study area would be mobile emissions sources from alum deliveries at the Pleasantville Alum Plant during the temporary shutdown. Increased alum deliveries would be temporary during the temporary shutdown. Once the temporary shutdown is complete, chemical deliveries at the Pleasantville Alum Plant would return to baseline conditions. Therefore, an air quality impact analysis from WSSO within the study area is not warranted.

10.4.7.16 Noise

The only noise sources from WSSO in this study area would be noise sources from alum deliveries at the Pleasantville Alum Plant. The vehicle trips at this location from alum deliveries is estimated to include one to ten trucks per week, that would generate between two to 20 vehicle trip ends per week, equivalent to 94 to 470 noise PCEs per week. Alum deliveries would occur for a portion of the temporary chlorination period from 2019 through 2023. However, alum deliveries would only occur during daytime hours. The alum would be unloaded from the truck while it is parked on site, so there would be no truck idling required for the alum transfer. The facility driveway would be designed to reduce the need for trucks to back up for deliveries. Therefore, a noise impact analysis from WSSO within the study area is not warranted.

10.4.7.17 Neighborhood Character

The character of the Pleasantville Alum Plant Study Area is largely defined by public service/utility, residential, commercial, and vacant land uses, as well as its physical setting within a suburban area (see **Figure 10.4-24**). The site is accessible from the south via Broadway (State Route 141), by way of a paved access road that terminates at a 13-foot gate.

DEP has consulted with the Village of Pleasantville and Westchester County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the Pleasantville Alum Plant Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the Pleasantville Alum Plant Study Area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the Pleasantville Alum Plant Study Area was not warranted. As described in Section 10.4.7.3, "Land Use, Zoning, and Public Policy," Section 10.4.7.4, "Socioeconomic Conditions," Section 10.4.7.6, "Open Space and Recreation," Section 10.4.7.8, "Historic and Cultural Resources," Section 10.4.7.9, "Visual Resources," and Section 10.4.7.16, "Noise," an impact analysis for the Pleasantville Alum Plant Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; open space and recreation; historic and cultural resources; visual resources; or noise.

As described in Section 10.4.7.14, "Transportation," WSSO activities would be short-term and would result in a temporary increase in traffic during the RWBT temporary shutdown. This temporary increase in traffic would not result in a density of activity or service conditions that would affect the overall character of the study area. Following the completion of the RWBT inspection and repair, alum deliveries would return to baseline conditions.

Increased alum deliveries at the Pleasantville Alum Plant Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, a neighborhood character impact analysis from WSSO within the study area is not warranted.

10.4.7.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from increased chemical deliveries to the Pleasantville Alum Plant Study Area during the temporary shutdown. Therefore, a public health impact analysis from WSSO within the study area is not warranted.

10.5 CROTON WATER SUPPLY SYSTEM ASSESSMENT AND IMPACT ANALYSIS

The Croton System, constructed between 1842 and 1905, typically provides approximately 10 percent of the City's daily water supply, and can provide up to 30 percent during drought conditions. The Croton System consists of 12 reservoirs and 3 controlled lakes (see **Figure 10.5-1**). As described previously, the Croton System reservoirs are located east of the Hudson River. The Croton System consists of a series of interconnected reservoirs and lakes along the main stem of the Croton River or its tributaries extending into Westchester, Putnam, and Dutchess counties, terminating at the New Croton Reservoir. From there, water is conveyed through the New Croton Aqueduct to the Croton Water Filtration Plant.[48] Releases and spills from each of the Croton System reservoirs, except New Croton Reservoir, remain in the system and are available to the City for water supply purposes. Additional redundancy has been built in to the Croton System that allows water to be transferred to the Delaware System through two pumping stations at Cross River and Croton Falls Reservoirs, typically under emergency conditions, such as droughts.

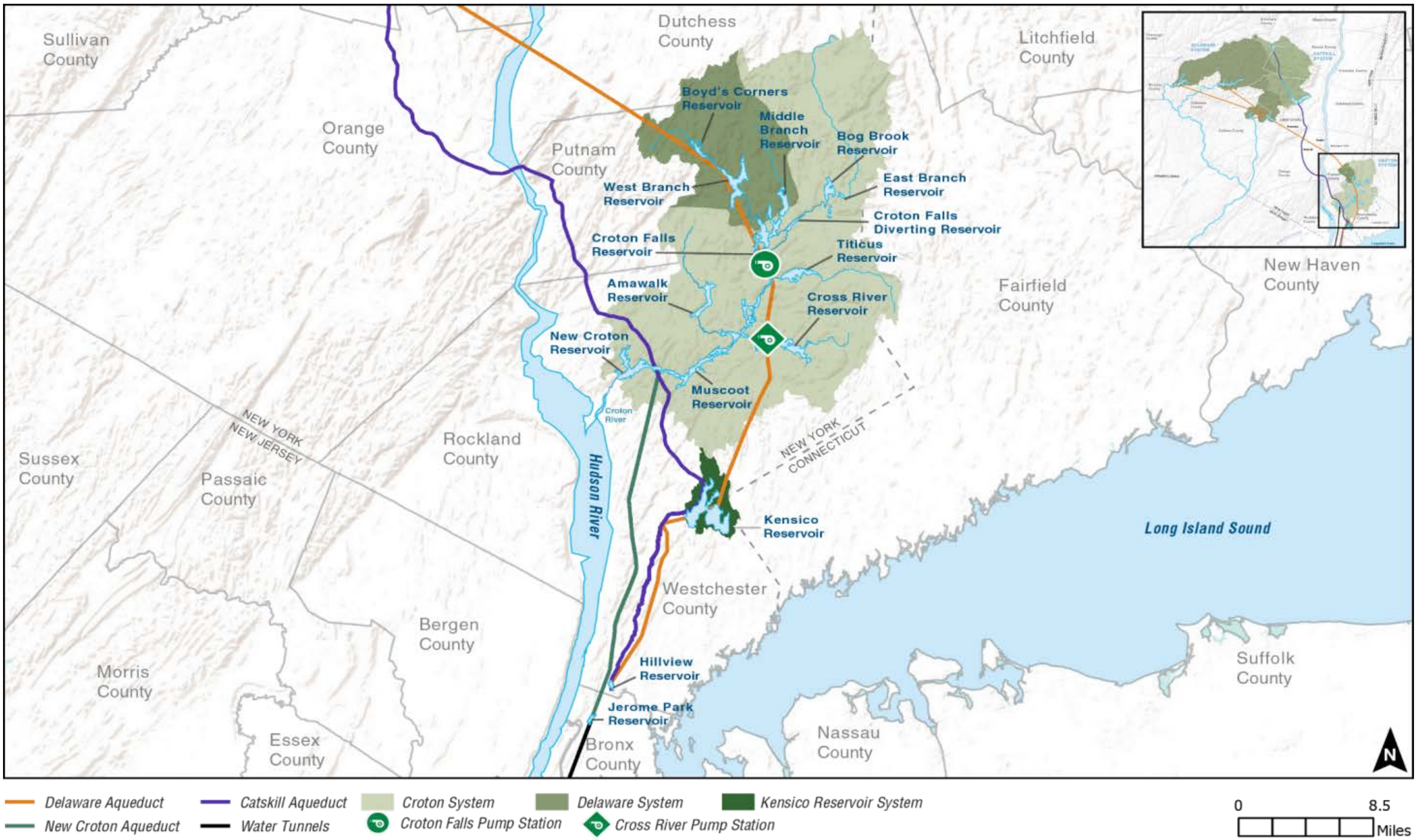
The Croton watershed has an area of approximately 375 square miles. It lies almost entirely within the State, and includes a small portion in the State of Connecticut. The Croton System provides drinking water for both the City and a number of upstate municipalities, and also provides a mix of recreational opportunities (e.g., fishing, boating, and swimming) and wildlife habitat for numerous species, some of which are protected.

The Croton System reservoirs are typically operated according to procedures that include releasing the required minimum flows to local streams, and allowing the reservoirs to fill and spill based on natural inflows. DEP does not maintain Croton System reservoirs at particular target elevations. Reservoirs are operated to maintain storage above intake elevations for outside community intakes to the extent practicable.

Diversions from the Croton System occur at New Croton Reservoir. Diversions in the summer when demands are higher are designed to trim the spill (i.e., maximize diversions after accounting for required releases, while preventing drawdown of the reservoir). In the winter when demands are lower, diversions are minimized. During drought conditions, diversions to the filtration plant increase up to 290 mgd, and upstream reservoirs are drawn down to maintain sufficient storage in New Croton Reservoir.

As previously discussed, the Cross River and Croton Falls pumping stations will enable DEP to pump water from the Croton watershed collected in Cross River and Croton Falls Reservoirs to the Delaware Aqueduct. These pumping stations will enable diversion of up to 240 mgd of additional Croton System water to Kensico Reservoir during droughts or other water supply emergencies. The Cross River Pumping Station will provide 60 mgd and the new Croton Falls Pumping Station will provide 180 mgd of capacity. At present, approval is required from the NYSDOH prior to operating the pumping stations.

[48] The Croton System was generally not used for the City between 2004 and 2015. The activation of the newly constructed Croton Water Filtration Plant in late 2015 allows for the treatment of the Croton System water supply prior to its distribution to the City.



NYC Environmental Protection

Figure 10.5-1: Croton Water Supply System

DEP would rely more heavily on the Croton System as part of WSSO to ensure adequate water supply is available to support the RWBT temporary shutdown. During the pre-shutdown, diversions from the Croton System would be minimized to allow the Croton System reservoirs to be full at the start of the shutdown. During the temporary shutdown, the City's water supply system demands would be met with diversions from the Catskill and Croton systems. The Croton Falls and Cross River pumping stations would be utilized to pump water from the Croton System to the lower portion of the Delaware Aqueduct once the shutdown commences to maximize conveyance of supply from the Croton System.

All reservoirs within the Croton System would be managed per applicable regulations throughout the duration of WSSO, with the exception of New Croton and West Branch Reservoirs. DEP would work directly with NYSDEC to establish variances from typical operations in order to support WSSO during the temporary shutdown that would allow DEP to reduce releases at these reservoirs to drought levels. The following sections describe how the overall change in operations for the Croton System from WSSO would alter operations at individual system reservoirs and associated flows to receiving waterbodies.

10.5.1 BOYD'S CORNERS RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.1.1 Study Area Location and Description

Boyd's Corners Reservoir is located in the Town of Kent in Putnam County, New York and is formed by impounding the West Branch Croton River (see **Figure 10.5-2**). Spills and releases continue along West Branch Croton River to the West Branch Reservoir. Boyd's Corners Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is popular for recreational fishing, but it is not stocked. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Boyd's Corners Reservoir. The water quality classification for Boyd's Corners Reservoir is Class AA throughout its entire length. While Boyd's Corners Reservoir serves the City's customers as part of the larger Croton System, no local communities draw directly from the reservoir.

10.5.1.2 Study Area Evaluation

Originally constructed as part of the City's Croton System, Boyd's Corners Reservoir is currently operated as part of the Delaware System. Under typical operations, the primary function is to help maintain the water surface elevation in West Branch Reservoir. DEP releases the required minimum flow of 10 mgd per 6 NYCRR Part 672-3 and may occasionally release more when hydrologic conditions are dry. The reservoir is generally kept near full, but is drawn down in the fall through early winter (October through January), and can reach dead storage in some years.

During the temporary shutdown, releases greater than the 10 mgd minimum flow would be required more frequently to augment storage in West Branch Reservoir. During the pre-shutdown period, water surface elevations in Boyd's Corners Reservoir would be marginally higher than typical conditions by up to 2 feet (see **Figure 10.5-3**). During the temporary shutdown of the RWBT, water surface elevations in Boyd's Corners Reservoir would be marginally lower than typical conditions by up to 5 feet (see **Figure 10.5-3**).

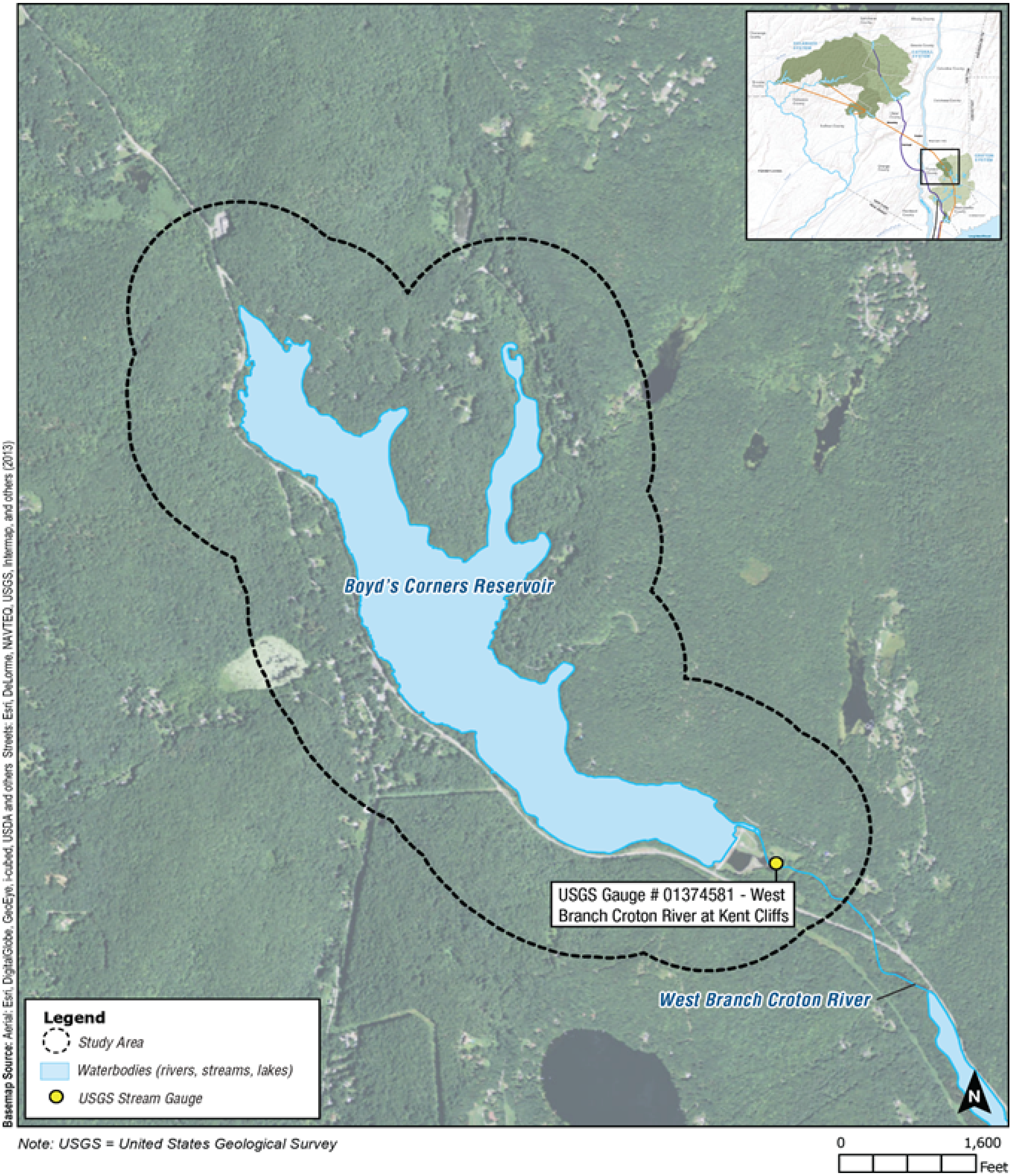
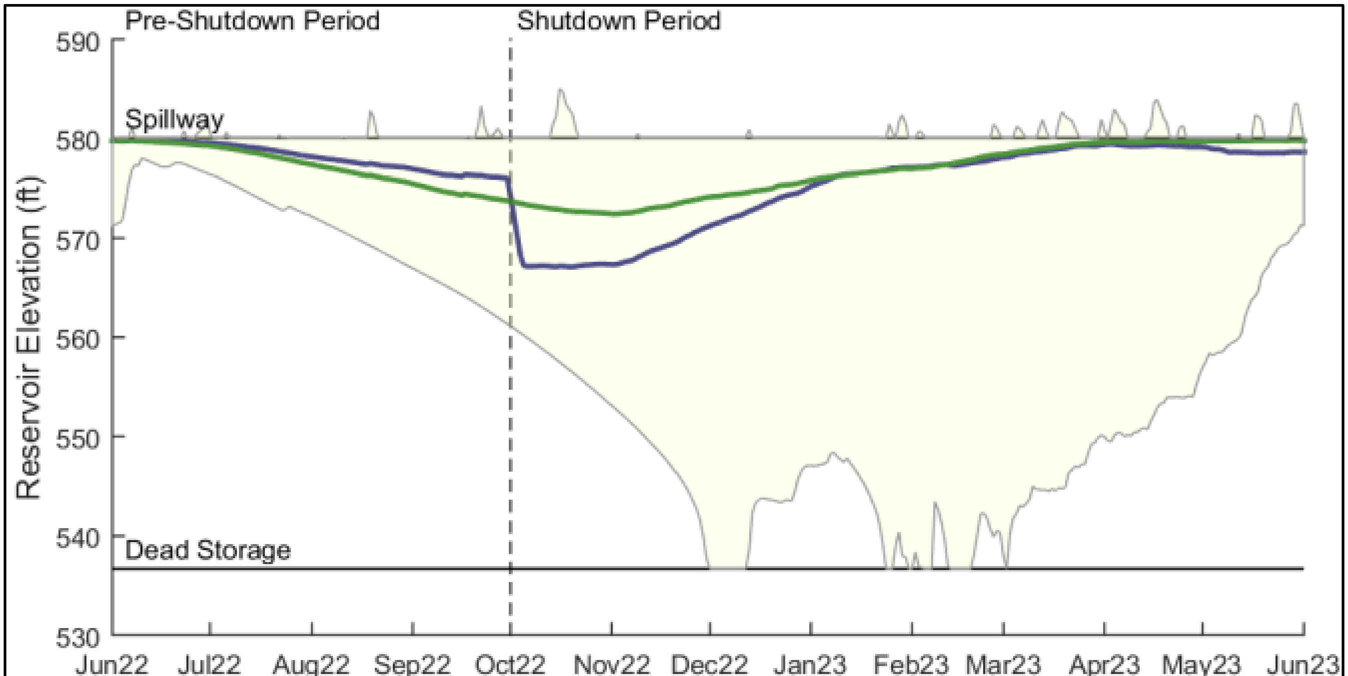


Figure 10.5-2: Boyd's Corners Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	580	578	580	580	0
	July	578	574	580	579	1
	August	576	570	580	578	2
	September	575	564	580	576	1
Shutdown Period	October	573	557	581	568	-5
	November	573	548	580	569	-4
	December	575	541	580	573	-2
	January	576	544	580	576	0
	February	578	539	580	577	-1
	March	579	545	580	579	0
	April	580	552	581	579	-1
	May	580	564	580	579	-1

Note: There are no water utility intakes for drawing water directly from the reservoir.

Figure 10.5-3: Elevation Dataset Mean and Range for Typical Operations and WSSO – Boyd's Corners Reservoir Study Area

The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Boyd's Corners Reservoir. Therefore, no further analysis is warranted for the Boyd's Corners Reservoir Study Area.

10.5.2 WEST BRANCH CROTON RIVER DOWNSTREAM OF BOYD'S CORNERS RESERVOIR STUDY AREA IMPACT ANALYSIS

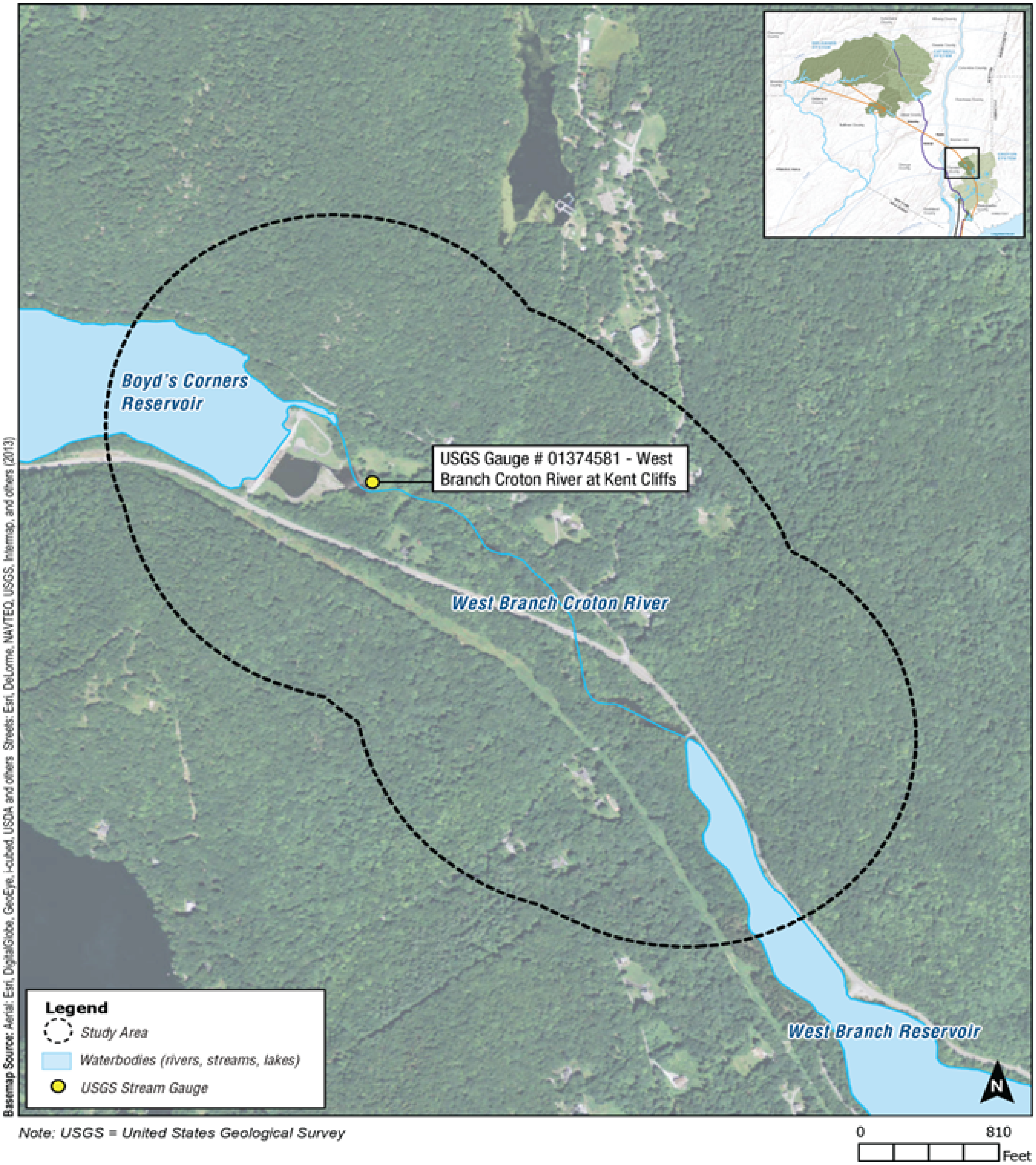
10.5.2.1 Study Area Location and Description

West Branch Croton River downstream of Boyd's Corners Reservoir flows approximately 0.5 mile through the Town of Kent in Putnam County (see **Figure 10.5-4**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the West Branch Croton River is Class A(T).

10.5.2.2 Study Area Evaluation

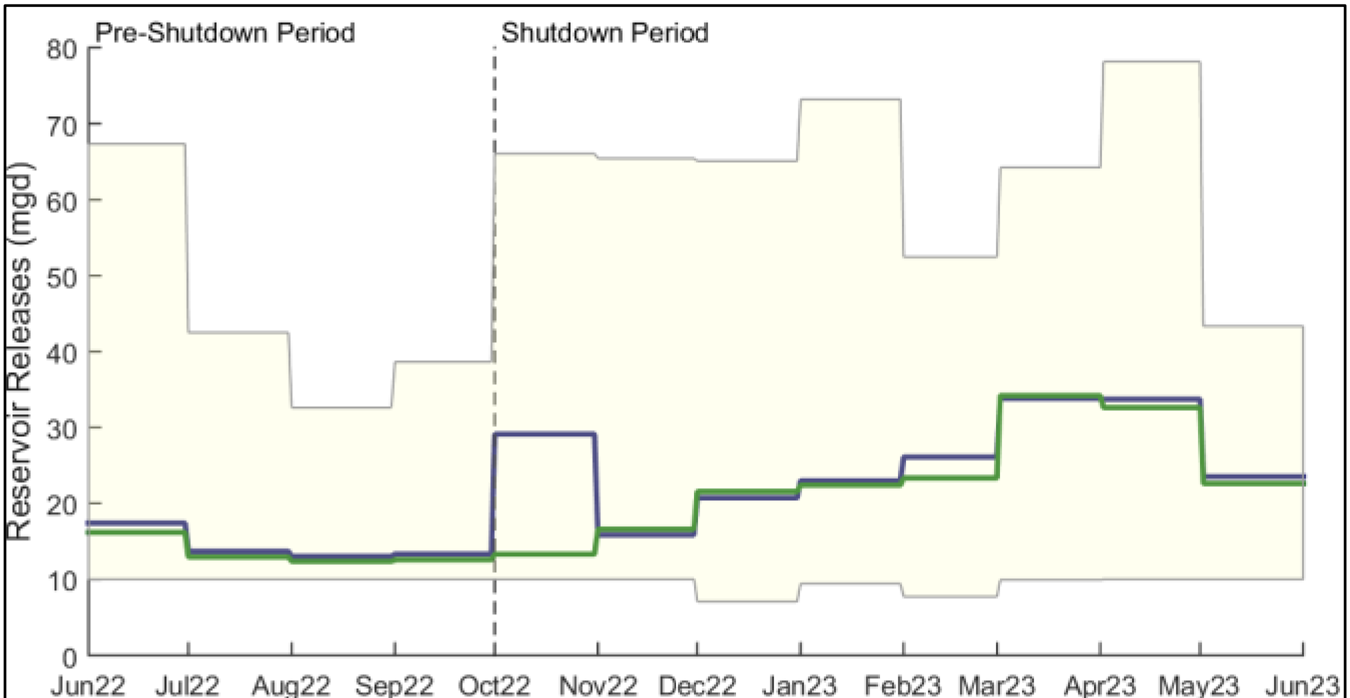
Under typical operations, the primary function of Boyd's Corners Reservoir is to help maintain the water surface elevation in West Branch Reservoir. DEP releases the required minimum flow of 10 mgd, and may occasionally release more when hydrologic conditions are dry. When hydrologic conditions are wet, the reservoir spills as necessary. Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 12 mgd up to approximately 79 mgd (see **Figure 10.5-5**). The monthly average daily spills can reach approximately 77 mgd (see **Figure 10.5-6**). Spills can occur during any month but are more frequent and of larger magnitude in the spring and fall. Daily spills can reach 600 mgd.

During the pre-shutdown period, releases and spills into the West Branch Croton River downstream of Boyd's Corners Reservoir would be marginally higher than typical conditions by up to 1 mgd (see **Figure 10.5-5** and **Figure 10.5-6)**. During the temporary shutdown of the RWBT, releases into the West Branch Croton River downstream of Boyd's Corners Reservoir would be marginally higher than typical conditions by up to approximately 16 mgd (see **Figure 10.5-5**). Spills occurring during the same period would be marginally lower than typical conditions by up to 1 mgd (see **Figure 10.5-6**). The dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be slightly lower than typical (see **Figure 10.5-7**). There would be no potential for significant adverse impacts to West Branch Croton River downstream of Boyd's Corners Reservoir from WSSO. Therefore, no further analysis of West Branch Croton River downstream of Boyd's Corners Reservoir is warranted.



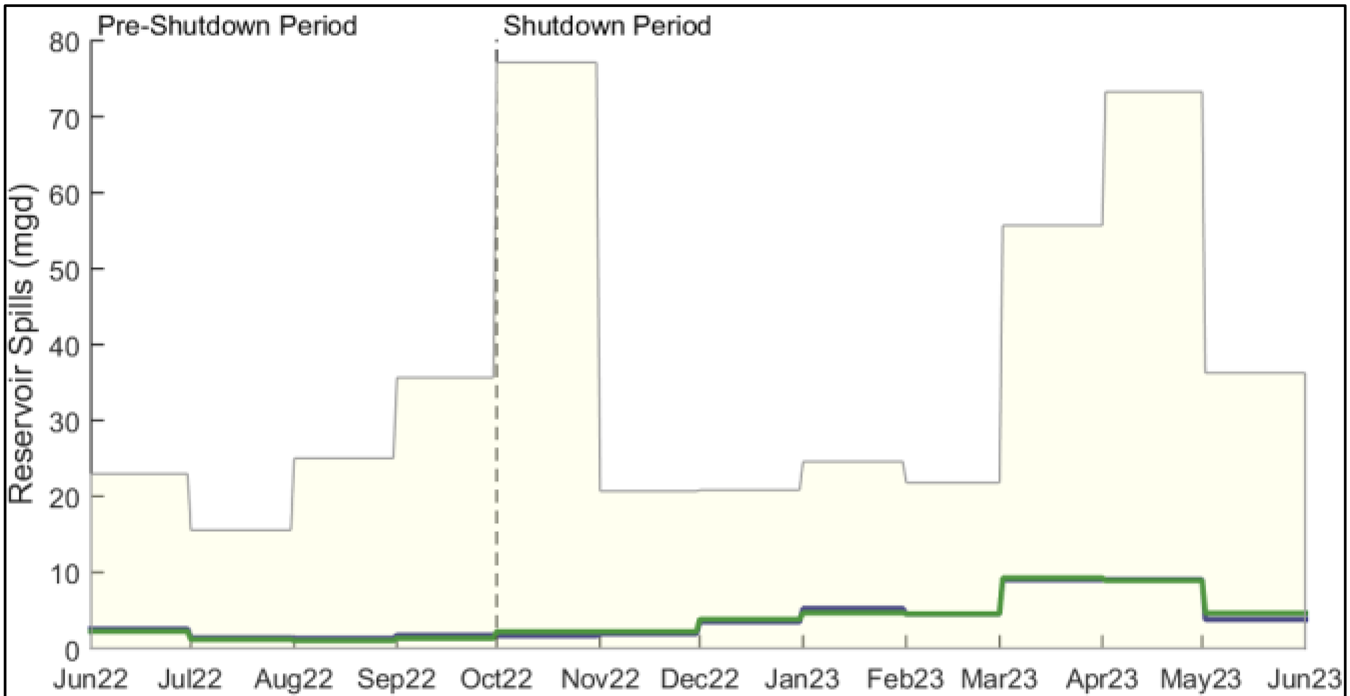
Note: USGS = United States Geological Survey

Figure 10.5-4: West Branch Croton River Downstream of Boyd's Corners Reservoir Study Area



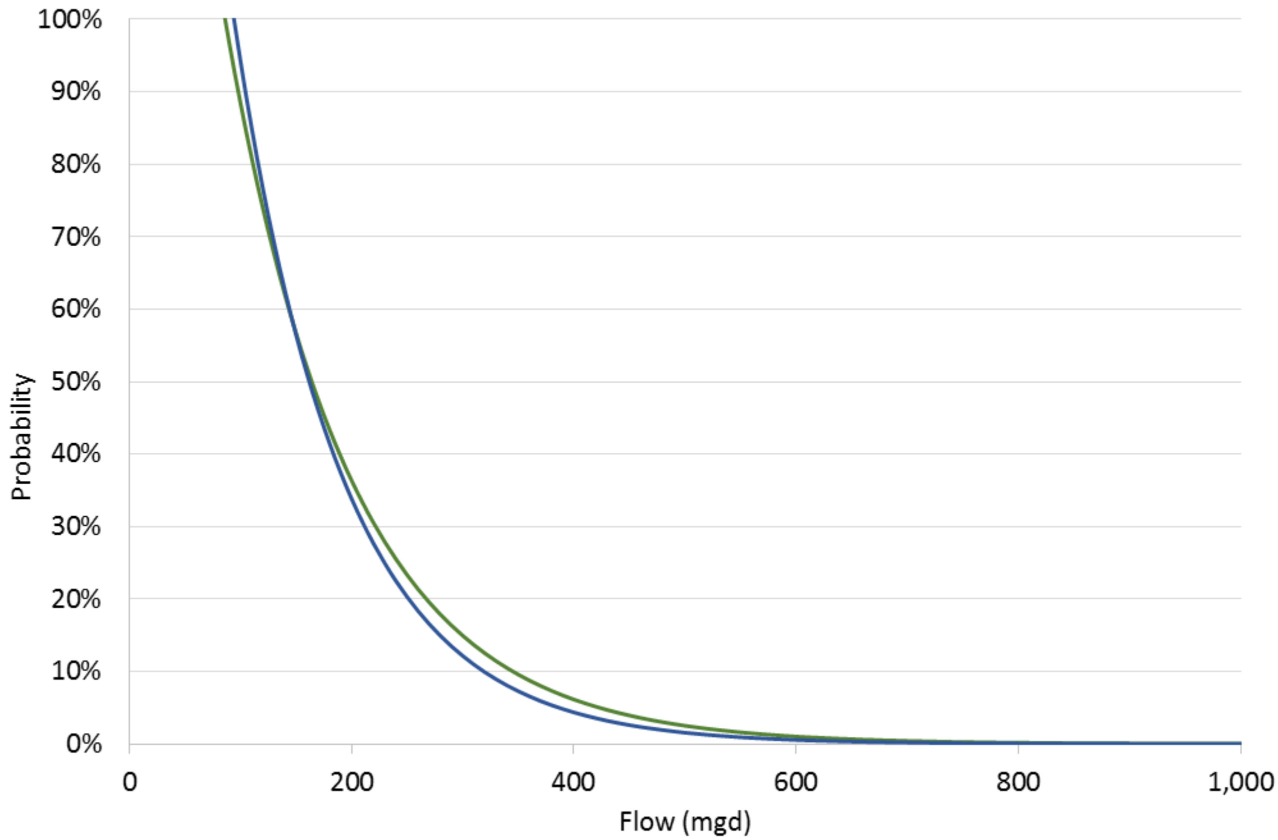
		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	16	10	67	17	1
	July	13	10	42	14	1
	August	12	10	33	13	1
	September	13	10	39	13	0
Shutdown Period	October	13	10	66	29	16
	November	17	10	65	16	-1
	December	22	7	65	21	-1
	January	22	9	73	23	1
	February	23	8	54	26	3
	March	34	10	64	34	0
	April	33	10	79	34	1
	May	23	10	44	24	1

Figure 10.5-5: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – West Branch Croton River Downstream of Boyd's Corners Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	2	0	23	3	1
	July	1	0	16	1	0
	August	1	0	25	1	0
	September	1	0	36	2	1
Shutdown Period	October	2	0	77	2	0
	November	2	0	21	2	0
	December	4	0	21	4	0
	January	5	0	25	5	0
	February	5	0	21	4	-1
	March	9	0	55	9	0
	April	9	0	73	9	0
	May	5	0	34	4	-1

Figure 10.5-6: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – West Branch Croton River Downstream of Boyd's Corners Reservoir Study Area



Note: There are no USGS gauges with National Weather Service flood stage delineations along the West Branch Croton River.

Figure 10.5-7: Annual Probability of High Flows from Spills and Releases – West Branch Croton River Downstream of Boyd's Corners Reservoir Study Area

10.5.3 West Branch Reservoir Study Area Impact Analysis

10.5.3.1 Study Area Location and Description

West Branch Reservoir is located in the Towns of Kent and Carmel, Putnam County, New York, and is formed by impounding the West Branch Croton River (see **Figure 10.5-8**). Originally part of the City's Croton System, the West Branch Reservoir currently functions as part of the Delaware System, serving as an intermediate reservoir for water that arrives from Rondout Reservoir via the RWBT. The West Branch Reservoir also receives water from its own small watershed and the Boyd's Corners Reservoir. Water diverted from West Branch Reservoir flows via the Delaware Aqueduct into the Kensico Reservoir in Westchester County, while releases and spills continue south along West Branch Croton River to the Croton Falls Reservoir. The West Branch Reservoir is connected to adjacent Lake Gleneida, one of the three controlled lakes that are part of the City's water supply. The water surface elevation at Lake Gleneida fluctuates in concert with the elevation at West Branch Reservoir. While West Branch Reservoir serves the City's customers as part of the larger Croton System, no local communities draw directly from the reservoir; however, the Town of Carmel withdraws water from Lake Gleneida.

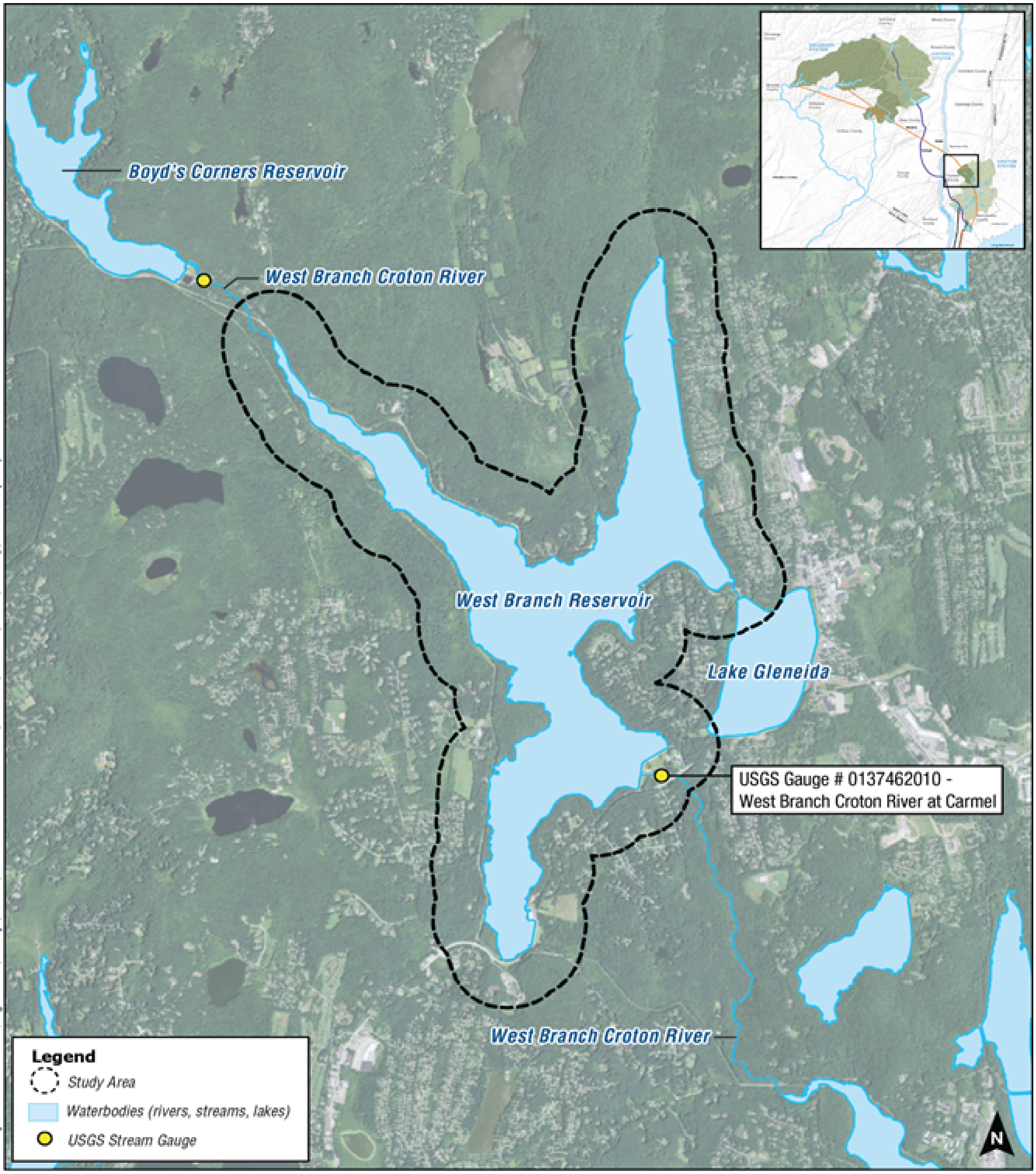
West Branch Reservoir, which is at the terminus of the RWBT, receives substantial inflow from the Delaware System. West Branch Reservoir serves a number of key functions within the water supply system. In addition to providing storage and balancing, the reservoir provides further detention time, which helps to improve water quality, and the basin adds to system resiliency by allowing for the bypassing of Kensico Reservoir by the Delaware Aqueduct and for disinfection at Shaft 10 of the Delaware Aqueduct. As such, West Branch Reservoir is operated to maintain elevations between approximately 501 to 503 feet to maximize the amount of time water is stored within the reservoir and corresponding detention time.

West Branch Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at West Branch Reservoir. The water quality classification for West Branch Reservoir is Class AA(T) throughout its entire length.

10.5.3.2 Study Area Evaluation

Under typical conditions, DEP operates West Branch Reservoir to balance flows from the RWBT, diversions to Kensico Reservoir, natural inflows, and flows from Boyd's Corners Reservoir to maintain water surface elevation in the reservoir between approximately 501 feet and 503 feet. DEP makes releases from West Branch Reservoir to meet the required minimum flow required under 6 NYCRR Part 672-3, shown below in **Table 10.5-1**.

Operations at West Branch Reservoir are maintained to prevent the occurrence of spills. Due to its importance as a balancing reservoir for the Delaware System, West Branch Reservoir is not drawn down during drought conditions.



Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others. Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Note: USGS = United States Geological Survey

Figure 10.5-8: West Branch Reservoir Study Area

Table 10.5-1: West Branch Reservoir Regulated Releases[49]

Reservoir Storage Condition	Stream Flow Condition		
	Above Normal	**Normal**	**Below Normal**
Above Normal	20 mgd (30.9 cfs)	20 mgd (30.9 cfs)	10 mgd (15.5 cfs)
Normal	20 mgd (30.9 cfs)	20 mgd (30.9 cfs)	10 mgd (15.5 cfs)
Below Normal	10 mgd (15.5 cfs)	5 mgd (7.7 cfs)	5 mgd (7.7 cfs)

During the temporary shutdown, the only source of inflow to West Branch Reservoir would be the West Branch Croton River, which includes releases and spills from Boyd's Corners Reservoir. West Branch Reservoir would not receive water from Rondout Reservoir via the RWBT. However, diversions to Kensico Reservoir from West Branch Reservoir via the Delaware Aqueduct would continue during the RWBT shutdown operations. Minimum releases to the West Branch Croton River would continue as well. During WSSO West Branch Reservoir would be operated in the same manner as during typical operations and water surface elevation would remain between approximately 501 feet and 503 feet (see **Figure 10.5-9**). As such, there would be no potential for significant adverse impacts from WSSO to West Branch Reservoir. Therefore, no further analysis is warranted for the West Branch Reservoir Study Area.

10.5.4 West Branch Croton River Downstream of the West Branch Reservoir Study Area Impact Analysis

10.5.4.1 Study Area Location and Description

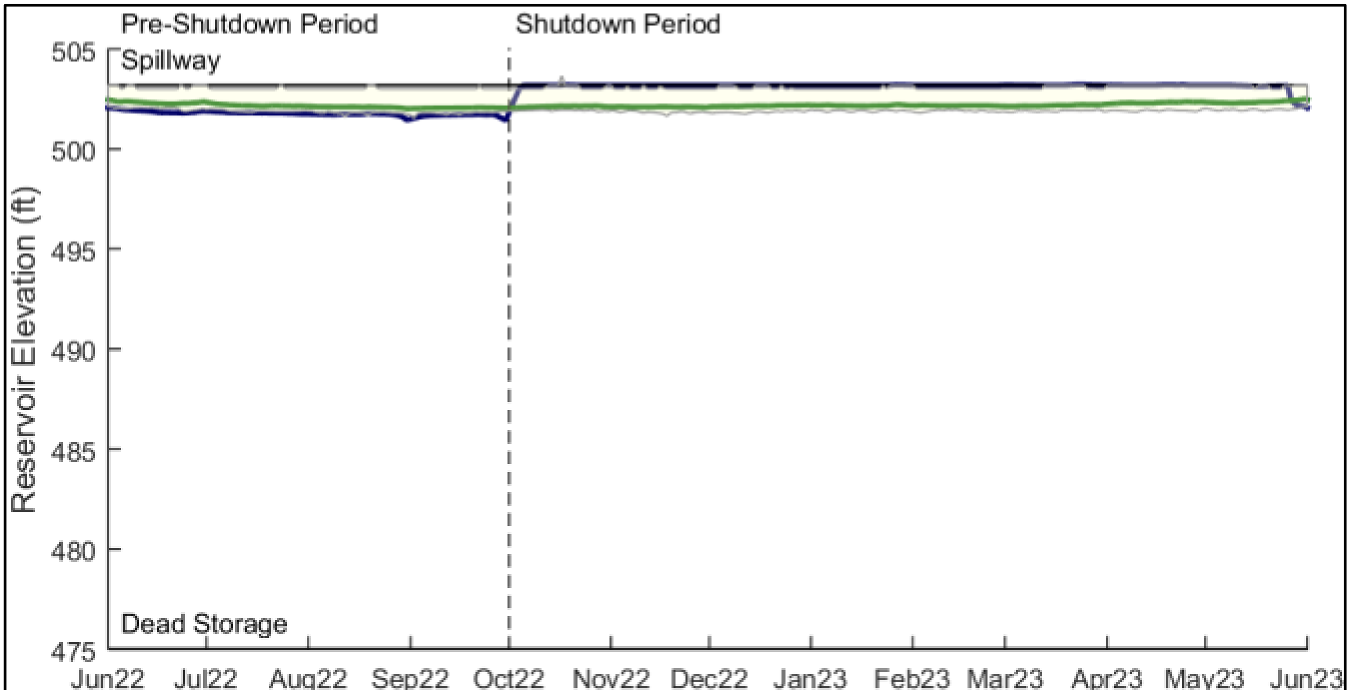
West Branch Croton River downstream of West Branch Reservoir flows approximately 2.2 miles through the Town of Carmel in Putnam County, New York (see **Figure 10.5-10**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, including trout, and is popular for recreational fishing, but it is not stocked with trout by NYSDEC. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the West Branch Croton River is Class A(TS).

10.5.4.2 Study Area Evaluation

Under typical operations at West Branch Reservoir, DEP makes releases to meet the required minimum flow per 6 NYCRR Part 672-3 (see **Table 10.5-1**), and maximizes storage, resulting in infrequent spills.[50] Under typical operations, releases generally fluctuate between 10 mgd and

49 Per 6 NYCRR Part 672-3670, Section 672-3, when the New Croton and Croton Falls Reservoirs spill, the required minimum flow from the West Branch Reservoir is set to 5 mgd.

50 Spills do not occur in the OST under either typical operations or WSSO model simulations, nor are spills anticipated to occur during the RWBT temporary shutdown. Therefore, spills from West Branch Reservoir into West Branch Croton River are not assessed.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	502	502	503	502	0
	July	502	502	503	502	0
	August	502	502	503	502	0
	September	502	502	503	502	0
Shutdown Period	October	502	502	503	503	1
	November	502	502	503	503	1
	December	502	502	503	503	1
	January	502	502	503	503	1
	February	502	502	503	503	1
	March	502	502	503	503	1
	April	502	502	503	503	1
	May	502	502	503	503	1

Note: There are no water utility intakes for drawing water directly from the West Branch Reservoir. However, there is a water utility intake for the Town of Carmel at Lake Gleneida at elevation 480 feet.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-9: Elevation Dataset Mean and Range for Typical Operations and WSSO – West Branch Reservoir Study Area

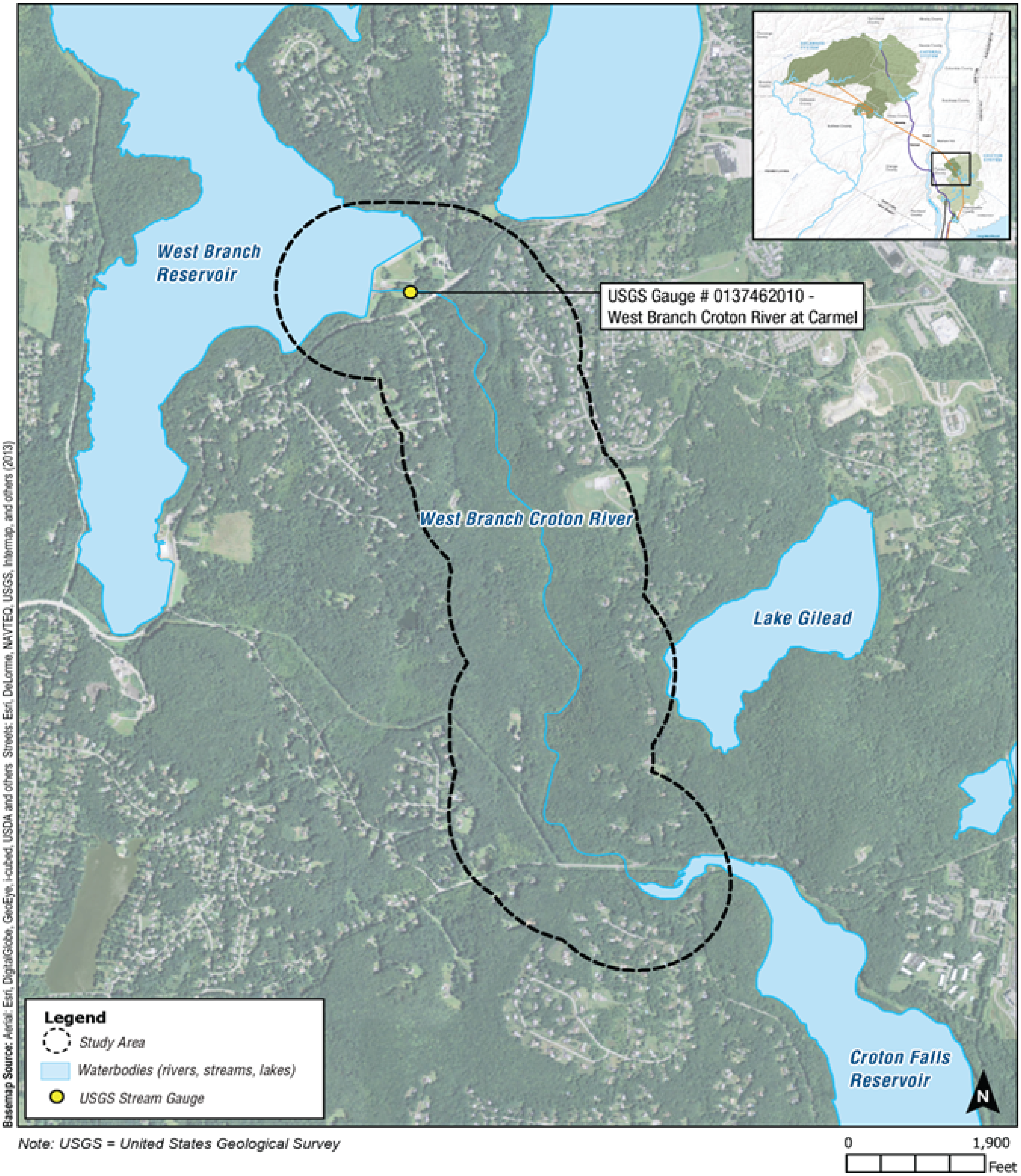


Figure 10.5-10: West Branch Croton River Downstream of West Branch Reservoir Study Area

20 mgd, occasionally dropping to the 5 mgd lower limit (see **Figure 10.5-11**). Five mgd releases most often occur due to spill at New Croton and Croton Falls reservoirs in the spring.

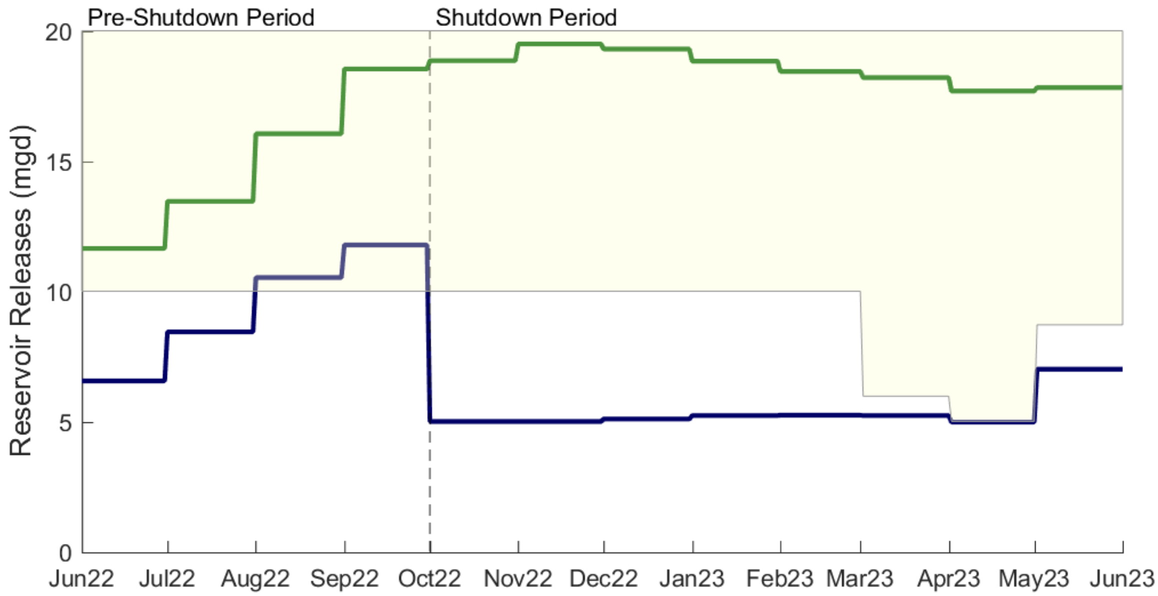
During the temporary shutdown, DEP would request a variance from NYSDEC to allow releases to be set at the lowest conservation release rate of 5 mgd from October through May in order to keep the elevation of the reservoir as high as possible. Further, while no variance would be in place during the pre-shutdown from June through September, release flows would be reduced during this period due to operations in the Croton System. As described previously, when the New Croton and Croton Falls reservoirs spill, which would occur more than typical during the pre-shutdown period, the required minimum flow from the West Branch Reservoir is set to 5 mgd Per 6 NYCRR Part 672-3670, Section 672-3. Therefore, during the pre-shutdown period, the dataset mean for releases from West Branch Reservoir would be below the typical range in June and July. During the pre-shutdown period, releases would be 5 to 7 mgd lower than typical (see **Figure 10.5-11**). During the shutdown, releases would be up to approximately 14 mgd lower than typical (see **Figure 10.5-11**). While the reduction in releases during WSSO represents a change from typical operations, it should be noted that the minimum drought-level releases were made from West Branch Reservoir between approximately 2012 and 2015 due to spills from New Croton and Croton Falls reservoirs, while the Croton System was offline and New Croton and Croton Falls reservoirs spilled regularly. Therefore, the proposed flows in the river during the shutdown would be similar, but of shorter duration, to those over the period from approximately 2012 to 2015.

Because DEP is planning to request a variance to set releases to the lowest conservation release rate during the temporary shutdown, an analysis of impacts that could result from WSSO was warranted for West Branch Croton River downstream of the West Branch Reservoir.

10.5.4.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Variations in flows would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because decreased releases would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

The consistency of decreased releases as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in receiving waterbody flows. Therefore, WSSO would not result in significant adverse impacts to public policy within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	12	10	20	7	-5
	July	13	10	20	8	-5
	August	16	10	20	11	-5
	September	19	10	20	12	-7
Shutdown Period	October	19	10	20	5	-14
	November	19	10	20	5	-14
	December	19	10	20	5	-14
	January	19	10	20	5	-14
	February	18	10	20	5	-13
	March	18	6	20	5	-13
	April	18	5	20	5	-13
	May	18	9	20	7	-11

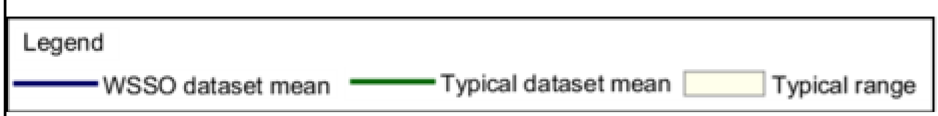


Figure 10.5-11: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – West Branch Croton River Downstream of West Branch Reservoir Study Area

10.5.4.4 Socioeconomic Conditions

Decreased releases from West Branch Reservoir during the temporary shutdown would not cause indirect or direct effects to factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Further, decreased releases would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.6 Open Space and Recreation

Open space and recreational resources include West Branch Reservoir, Croton Falls Reservoir and surrounding watershed lands, Lake Gilead, and the West Branch of the Croton River itself between West Branch Reservoir and Croton Falls Reservoir. No additional recreational resources were identified that abut the river.

The West Branch of the Croton River is an isolated section of stream channel that is an important sport fishery and spawning area for brown trout (*Salmo trutta*). NYSDEC fishing season for the West Branch Croton River downstream of West Branch Reservoir is from April 1 to September 30. This study area has limited access for fishing and there are no public parking areas located along this section of the West Branch Croton River.

DEP has consulted with the Towns of Carmel and Southeast and Putnam County, and it is DEP’s understanding that no plans to expand or create new open space or recreational resources are anticipated within the West Branch Croton River Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Use of the identified open spaces is anticipated to continue. Therefore, in the future without WSSO, it is assumed that use of the West Branch Croton River would be the same as baseline conditions.

During the temporary shutdown, flows in the river would be lower than typical, which could result in conditions that inhibit trout movement into the river from downstream locations. Low flows could also reduce suitable trout habitat and limit spawning during the shutdown. Reduced spawning could result in low fish populations the year following the shutdown (see Aquatic and Benthic Resources in Section 10.5.4.10, “Natural Resources”). Low flows could crowd fish into small areas unapproachable to anglers, or could crowd anglers together because of reduced fishing opportunities.

During WSSO, effects to open space and recreation would be expected in the form of reduced fishing opportunities during portions of two fishing seasons. Lower than typical flows overlap with the fishing season for this segment of stream during June and July of the pre-shutdown and April and May of the shutdown. However, recreational fishing effects would be similar to, and of shorter duration, than historical conditions when minimum releases were maintained from approximately 2012 through 2015. Further, effects would be localized at the West Branch Croton River south of West Branch Reservoir. Additional fishing opportunities in the Croton System would be unaffected in remaining segments of the West Branch Croton River, as well as the Titicus River, Cross River, East Branch Croton River, Muscoot River, and their tributaries during the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.7 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, no further analyses of Critical Environmental Areas within the West Branch Croton River Downstream of West Branch Reservoir Study Area is warranted.

10.5.4.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the West Branch Croton River Downstream of West Branch Reservoir Study Area. The potential mechanism for historic or cultural resources impacts from WSSO would be through erosion. While flows to West Branch Croton River would be lower during WSSO than typical operations, erosion is not likely (see Geology and Soils in Section 10.5.4.10, “Natural Resources”).

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no impact to historic and cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.9 Visual Resources

While stream flows would be lower than typical, flows would remain within the minimum that could be experienced by the stream, and would not result in a substantial visual change to the waterbody. There would not be any visual contrast in the stream due to turbidity during WSSO, nor would decreased flows result in erosion to the streambed or vegetation mortality (see Geology and Soils in Section 10.5.4.10, “Natural Resources”). Therefore, WSSO would not result in significant adverse impacts to visual resources within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.10 Natural Resources

The potential for impacts to natural resources from WSSO within the West Branch Croton River Downstream of West Branch Reservoir Study Area is discussed below.

Geology and Soils

While stream flows would be lower than typical, flows would remain within the minimum that could be experienced by the stream under typical conditions. Further, reduced stream flow would result in slower stream velocities, reducing the possibility of erosion. There would be no changes to geology or soils at West Branch Croton River downstream of West Branch Reservoir from reduced stream flows. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. During the period of lower flows during WSSO, it is possible that the fringe riparian areas around the West Branch Croton River would experience a lower surface water elevation than under typical operating conditions. During this period, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor but would not be significantly affected by the temporary reduction in flows. The temporary reduction of flows to West Branch Croton River would not result in changes to ecological communities in the vicinity of the West Branch Croton River Downstream of West Branch Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary reduction of flows to West Branch Croton River would not result in significant changes within the study area to critical wildlife habitat, wildlife movement or its ability to forage or breed. As discussed, the flows to the river would be reduced below typical conditions which would result in a temporarily altered shoreline and riparian area. These temporary changes would not prevent terrestrial wildlife from using the river for behaviors such as foraging or breeding. The drawdown is not anticipated to result in effects to the fish community (see Aquatic and Benthic Resources in Section 10.5.4.10, “Natural Resources”). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the river would still have a source of prey in the river. Any changes experienced by wildlife would be temporary and minor. Further, the temporary shutdown would occur primarily during winter when most wildlife is dormant. Therefore, WSSO would not result in significant adverse impacts to wildlife in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the West Branch Croton River Downstream of West Branch Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the West Branch Croton River Downstream of West Branch Reservoir Study Area include the following: Blocks 6058A, 6058C, and 6058D. The USGS Quadrangle used for the NYSDEC Herp Atlas that depicts the West Branch Croton River Downstream of West Branch Reservoir Study Area is the Lake Carmel Quadrangle. In total, these sources identified species with the potential to occur in the West Branch Croton River Downstream of West Branch Reservoir Study Area. Desktop assessments were conducted to assess the potential habitat for these species. Baseline ecological information and assessments for the study area for these species is shown in **Table 10.5-2**. Based on the assessment results, there would be no significant adverse impacts to these species as a result of changes in flows to West Branch Croton River. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Table 10.5-2: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the West Branch Croton River Downstream of West Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Reptiles and Amphibians				
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Suitable bog turtle habitat includes fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and “mucky.” Vegetation commonly includes calciphile species. Suitable bog turtle habitat is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require river environments for any part of their natural history.	Desktop assessments of wetlands occurring in the study area were conducted. Wetlands in the study area with a water table connected to the river may experience minor temporary effects to wetland vegetation resulting from reduced flows. Any wetlands that share a water table with the river would have historically experienced fluctuating conditions. Fluctuating water tables are not typical of suitable bog turtle habitat (Feaga et al. 2012). Reduced flows would not influence other wetlands in the study area that are not hydrologically connected to the river and that potentially contain suitable bog turtle habitat. Therefore, no effects to bog turtles are anticipated and no further analysis for bog turtles is warranted for this study area.
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats including forests with sandy, well-drained soils; dry open uplands such as meadows, pastures, open fields, and utility right-of-ways; and, moist lowlands and wetlands. Eastern box turtles are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtle does not require rivers for any part of their natural history.	Eastern box turtles could potentially utilize the forested areas upland of West Branch Croton River. However, eastern box turtles only rarely inhabit streams. Reduction in flows to West Branch Croton River would not prevent eastern box turtles from utilizing the riverine habitat and would not affect their nesting, foraging, or hibernating outside of the river. Therefore, no effects to eastern box turtles are anticipated and no further analysis for eastern box turtles is warranted for this study area.

Table 10.5-2: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the West Branch Croton River Downstream of West Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes, and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments, which can include streams, for their natural history.	Bald Eagles were not identified as occurring or potentially occurring in the study area; however, they have been documented at adjacent West Branch Reservoir. Flows in West Branch Croton River would be reduced to flows experienced during drought conditions. Reduced flows in West Branch Croton River would not affect breeding Bald Eagles nesting behaviors, foraging ability, or nesting habitat. Reduced flows are not anticipated to have negative effects on the fishery present in West Branch Croton River (see Aquatic Resources). Reduced flows could temporarily alter the location of the shallow water habitat in the river; however, foraging habitat would still be available. Therefore, no effects to Bald Eagles is anticipated are this study area and no further analysis for Bald Eagles is warranted for this study area.
Cooper's Hawk (*Accipiter cooperii*)	Protected - MBTA	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests. They are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. Cooper's Hawks forage primarily on other birds. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require rivers for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Reduced flows in West Branch Croton River downstream of West Branch Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.

Table 10.5-2: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the West Branch Croton River Downstream of West Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	Protected - MBTA	Special Concern	Red-headed Woodpeckers breed in open deciduous woodlands, especially beech or oak, groves of dead and dying trees, orchards, parks, open country with scattered trees, forest edges, and open wooded swamps with dead trees and stumps. In New York, open park-like upland woods including golf courses and along roadsides, and open wooded swamps and river bottoms with dead trees and standing water such as beaver ponds are two of the more common breeding habitats (McGowan 2008). Red-headed Woodpeckers could utilize but do not require rivers for any part of their natural history.	Red-headed Woodpeckers could utilize riverine habitats that have suitable trees for foraging or breeding; however, suitable habitat is more typically located in other habitats. Reduced flow to West Branch Croton River would be anticipated to reduce the vigor of woody vegetation occurring within or on the fringe of the river; however, this would be temporary and would not result in tree mortality or otherwise affect the suitability of a tree as habitat. Therefore, no effects to Red-headed Woodpeckers are anticipated and no further analysis for Red-headed Woodpeckers is warranted for this study area.
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize river environments for foraging and migrating when they are available.	Indiana bats have the potential to utilize West Branch Croton River for migration and foraging purposes. Reduction of flows to West Branch Croton River would not affect these behaviors and flow would still remain in the river allowing Indiana bats, if present, to continue using the river. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.

Table 10.5-2: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the West Branch Croton River Downstream of West Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
New England Cottontail (*Sylvilagus transitionalis*)	None	Special Concern	New England cottontail is known only to occur east of the Hudson River. This species prefers early successional habitat with dense vegetation generally associated with abandoned agricultural fields, wetlands, clear cuts of woodlands, utility right-of-ways, and other disturbed areas with shrubs and early successional vegetation (Arbuthnot 2008). New England cottontail do not require river environments for any part of their natural history.	The temporary reduction of flows to West Branch Croton River downstream of West Branch Reservoir would not be anticipated to affect dense woody vegetation typical of New England cottontail habitat. Woody vegetation at the river fringe could experience reduced vigor due to a lowered water table but would not lose its ability to provide cover and food for New England cottontail, if they occur in the study area. Therefore, no effects to New England cottontails are anticipated and no further analysis for New England cottontails is warranted for this study area.
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees of varying sizes. These bats are opportunistic, roosting in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize rivers for foraging and migrating when they are available.	NYNHP identified northern long-eared bat hibernacula within 5 miles of the study area. Northern long-eared bats have the potential to utilize West Branch Croton River for migration and foraging purposes. Reduction of flows to West Branch Croton River would not affect these behaviors and flow would still remain in the river allowing northern long-eared bats, if present, to continue using the river. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.

Table 10.5-2: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the West Branch Croton River Downstream of West Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Plants				
Large Twayblade (*Liparis lilifolia*)	None	Endangered	In New York State, large twayblade is known to occur in both upland and wetland habitats such as dry woodlands and wooded talus slopes and red maple dominated swamps with peat and sphagnum moss substrata. More specifically, large twayblade prefers areas recovering from a disturbance, usually after the aggressive succession of herbs and weeds but before the canopy fills out. Large twayblade is a perennial orchid and has a very specific fungal associate that the plant could not grow without. Large twayblade is pollinated by flies but more frequently self-pollinates. Seeds are dispersed primarily via wind (Mattrick 2004; NYNHP 2013). Large twayblade does not require river environments for any part of its lifecycle.	NYNHP identified large twayblade as occurring in the study area. Reduced flow to West Branch Croton River during the temporary shutdown would not affect large twayblade habitat. The plant does not inhabit the bed or banks of streams or rivers and the reduction in flow would not affect the water table or process of succession upland from the West Branch Croton River. Therefore, no effects to large twayblade are anticipated and no further analysis of large twayblade is warranted for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act
MBTA: Migratory Bird Treaty Act

Aquatic and Benthic Resources

The West Branch Croton River is an isolated section of stream channel that is an important sport fishery and spawning area for brown trout (*Salmo trutta*). Flows in this reach are maintained according to releases required under 6 NYCRR Part 672-3. Required flows range from 20 mgd during typical flow conditions to 5 mgd during drought conditions or when New Croton and Croton Falls reservoirs are spilling. These flows are sufficient to maintain the trout population, which is entirely dependent on natural reproduction. The invertebrate community in the West Branch Croton River is a diverse assemblage providing a food base for the relatively large population of juvenile trout in this stream. Natural reproduction of trout provides a sport fishery in the stream, as well as juvenile trout that drop downstream and supplement the stocking of trout in Croton Falls Reservoir. Adult trout from Croton Falls Reservoir move upstream in the fall to spawn in this stream channel.

In the future without WSSO, typical reservoir operations would continue and it is assumed that aquatic resources would remain the same as baseline conditions.

As described previously, to maintain desired elevations in West Branch Reservoir during the shutdown, releases would be limited to 5 mgd from October through May. This low flow condition could have an adverse effect on trout spawning and on habitat availability for juvenile trout. The reduced flow could minimize spawning areas, which are generally shallow areas over gravelly substrate. If trout spawned successfully in the remaining available substrate, the eggs deposited in the gravel could be subject to adverse winter conditions during incubation and early juvenile life in the gravel. When the young trout emerge from the gravel, they would have a limited amount of suitable habitat for growth and survival. In addition, they could be subject to increased predation by larger trout because they would be confined to a smaller area of habitat.

The temporary shutdown potentially could adversely affect 2-year classes of trout on a short-term basis. Trout could be affected over the approximately 8 months that releases would be less than typical. The reduced flow in the stream during the temporary shutdown would not permanently alter physical habitat in the stream. Following return to typical operations, trout would be able to spawn successfully, find available habitat for juvenile growth and migrate into the stream as adults. Recovery of trout populations would occur similar to previous periods of drought-level releases. Therefore, effects would be temporary, and natural regenerative processes would be expected to be sufficient to re-establish baseline conditions. Therefore, WSSO would not result in significant adverse impacts to aquatic resources in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.5.4.2, “Study Area Evaluation”), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the West Branch Croton River Downstream of West Branch Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the West

Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the West Branch Croton River Downstream of West Branch Reservoir Study Area. Lower than typical stream flows that would occur in the West Branch Croton River downstream of West Branch Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Groundwater

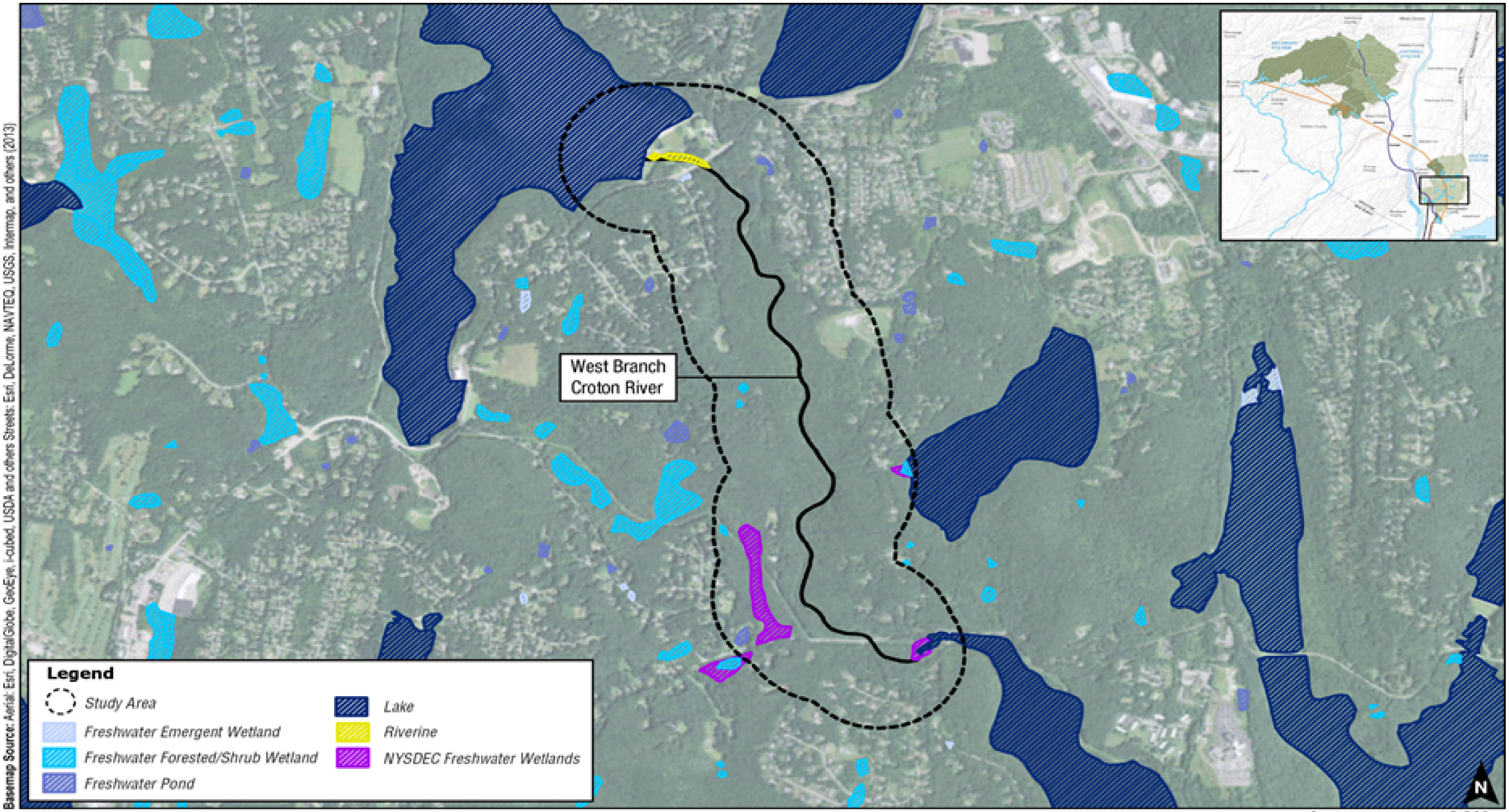
While stream flows would be lower than typical, flows would remain within the minimum that could be experienced by the stream under typical conditions. Decreased flows could result in minor decreases in the surficial aquifer immediately adjacent to the stream. However, short-term decreased flows would not appreciably change groundwater elevations in the vicinity of waterbody. Therefore, WSSO would not result in significant adverse impacts to groundwater in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the West Branch Croton River Downstream of West Branch Reservoir Study Area (see **Figure 10.5-12**). The study area extends 0.25-mile around the stream and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on West Branch Croton River. There are three NYSDEC wetlands mapped within or intersecting the study area. The three NYSDEC wetlands cover approximately 17 acres and consist of two Class I wetlands and one Class II wetland. There are seven USFWS NWI-mapped wetlands within or intersecting the study area. The seven USFWS NWI wetlands cover approximately 2 acres and consist of one emergent wetlands, four scrub/shrub or forested wetlands, and two ponds. Of the 17 acres of NYSDEC and 2 acres of NWI-mapped wetlands, approximately 0.3 acre, overlap and contain both NYSDEC and NWI-mapped wetlands.

The future without the temporary shutdown would consist of typical operations and management of the releases and spills from the West Branch Reservoir and dam. The flows in the West Branch Croton River would be within the typical range and the adjacent and nearby wetlands are assumed to be the same as baseline conditions.

Water releases to West Branch Croton River from West Branch Reservoir would be reduced for the duration of the temporary shutdown. However, these conditions have been present in the West Branch Croton River due to periodic droughts and sustained periods of spill from New Croton and Croton Falls reservoirs, such as between approximately 2012 and 2015 (see Section 10.5.4.2, “Study Area Evaluation”). Any wetlands hydrologically supported by the West Branch Croton River would have already been affected by fluctuating flows in the river.



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

Figure 10.5-12: Wetlands Resources – West Branch Croton River Downstream of West Branch Reservoir Study Area

Therefore, WSSO would not result in significant adverse impacts to wetlands in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities in this study area. The potential mechanism for disturbing potentially existing hazardous materials within the West Branch Croton River Downstream of West Branch Reservoir Study Area would be through excessive erosion. Stream flows would be lower than typical, which would reduce the potential for erosion (see Geology and Soils in Section 10.5.4.10, "Natural Resources").

Based on the low potential for erosion along West Branch Croton River downstream of West Branch Reservoir, WSSO would not result in significant adverse impacts to hazardous materials in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls in the study area. While stream flows would be lower than typical, flows would remain within the minimum that can be experienced by the stream under typical conditions. Further, WSSO would not include any construction in the West Branch Croton River Downstream of West Branch Reservoir Study Area that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.13 Energy

Changes to flows for the West Branch Croton River Downstream of West Branch Reservoir Study Area during the temporary shutdown would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.14 Transportation

Stream flows for the West Branch Croton River Downstream of West Branch Reservoir Study Area would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.15 Air Quality

Stream flows for the West Branch Croton River Downstream of West Branch Reservoir Study Area would have no effect on air quality within the study area. Therefore, WSSO would not result in significant adverse impacts to air quality in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.16 Noise

Stream flows at the West Branch Croton River Downstream of West Branch Reservoir Study Area would have no effect on noise levels in the vicinity of the waterbody. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.17 Neighborhood Character

The character of the West Branch Croton River Downstream of West Branch Reservoir Study Area is largely defined by public service/utility, residential, and vacant land uses, as well as its physical setting within a rural area (see **Figure 10.5-10**). The West Branch Croton River flows approximately 2.2 miles through the study area.

DEP has consulted with the Towns of Carmel and Southeast, and Putnam County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the West Branch Croton River Downstream of West Branch Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the West Branch Croton River Downstream of West Branch Reservoir Study Area was not warranted. As described in Section 10.5.4.3, "Land Use, Zoning, and Public Policy," Section 10.5.4.4, "Socioeconomic Conditions," Section 10.5.4.8, "Historic and Cultural Resources," Section 10.5.4.9, "Visual Resources," Section 10.5.4.14, "Transportation," and Section 10.5.4.16, "Noise," an impact analysis for the West Branch Croton River Downstream of West Branch Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; visual resources; transportation; or noise.

As described in Section 10.5.4.6, "Open Space and Recreation," WSSO activities would be short-term and would result in a temporary change in open space and recreation during the RWBT temporary shutdown and during WSSO operations. However, recreational fishing effects would be similar to, and of shorter duration, than historical conditions when minimum releases were maintained from approximately 2012 through 2015. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

Stream flows at the West Branch Croton River Downstream of West Branch Reservoir Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Nor would stream flows have the potential to result in moderate effects on multiple elements that define a neighborhood's character. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.4.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from decreased flows to the West Branch Croton River Downstream of West Branch Reservoir Study Area during the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to public health in the West Branch Croton River Downstream of West Branch Reservoir Study Area and no further analysis is warranted.

10.5.5 MIDDLE BRANCH RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.5.1 Study Area Location and Description

Middle Branch Reservoir is located in the Town of Southeast, Putnam County, New York, west of the Village of Brewster, and was formed by impounding the Middle Branch Croton River (see **Figure 10.5-13**). Releases and spills flow directly to Croton Falls Reservoir. Middle Branch Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is popular for recreational fishing, but it is not stocked. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Middle Branch Reservoir. The water quality classification for Middle Branch Reservoir is Class A throughout its entire length.

10.5.5.2 Study Area Evaluation

Under typical operations, Middle Branch Reservoir spills as necessary based on inflows to the reservoir. There is no regulation for releases from Middle Branch Reservoir to Croton Falls Reservoir.[51] Releases occur for water supply purposes to provide supply for the Croton Falls Pump Station at Croton Falls Reservoir when conditions are dry, which can draw down Middle Branch Reservoir by approximately 5 feet. Brewster Heights Water District gets its water from Middle Branch Reservoir, where the water surface elevation is typically maintained above the intake elevation (see **Figure 10.5-14**). During WSSO, water surface elevations in Middle Branch Reservoir would vary minimally by approximately 1 or 2 feet compared to typical conditions (see **Figure 10.5-14**). The dataset mean for water surface elevations during WSSO would remain within the typical range.

[51] Because releases and spills flow directly to Croton Falls Reservoir and there are no regulated minimum releases, spills and releases from Middle Branch Reservoir are not assessed.

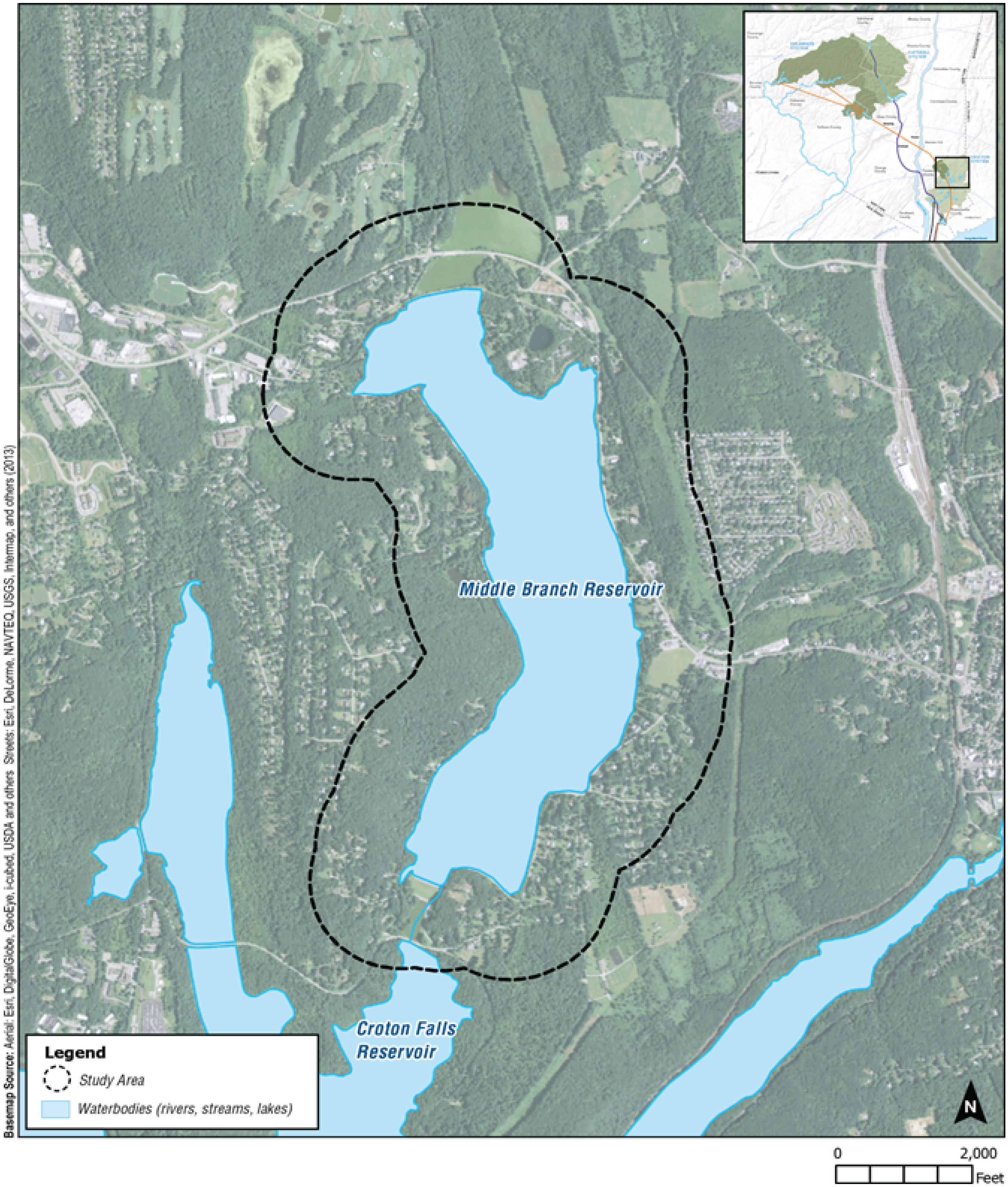
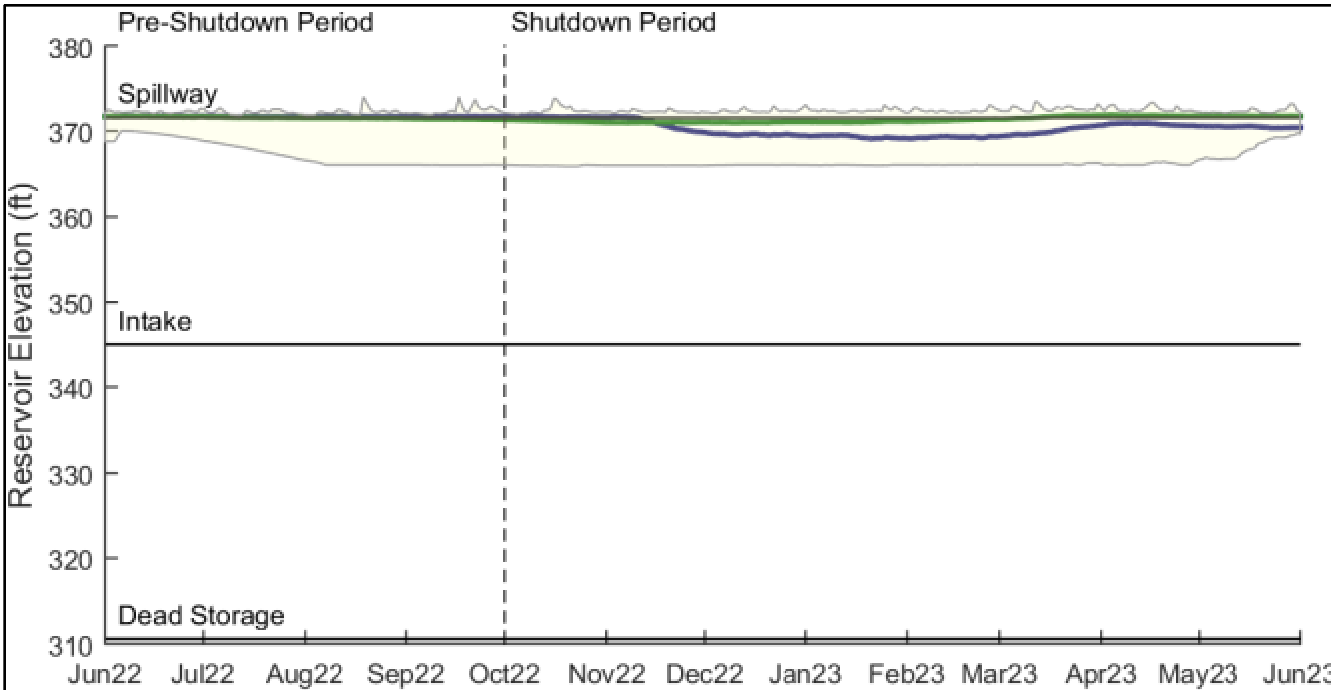


Figure 10.5-13: Middle Branch Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	372	370	372	372	0
	July	372	368	372	372	0
	August	371	366	372	372	1
	September	371	366	372	372	1
Shutdown Period	October	371	366	372	372	1
	November	371	366	372	371	0
	December	371	366	372	370	-1
	January	371	366	372	369	-2
	February	371	366	372	369	-2
	March	372	366	372	370	-2
	April	372	366	372	371	-1
	May	372	368	372	370	-2

Note: There is a direct water utility connection for Brewster Heights at Middle Branch Reservoir at elevation 345.0 feet.

Figure 10.5-14: Elevation Dataset Mean and Range for Typical Operations and WSSO – Middle Branch Reservoir Study Area

There would be no potential significant adverse impacts from WSSO to Middle Branch Reservoir. Therefore, no further analysis is warranted for the Middle Branch Reservoir Study Area.

10.5.6 BOG BROOK RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.6.1 Study Area Location and Description

Bog Brook Reservoir is located in the Town of Southeast in Putnam County (see **Figure 10.5-15**). The Reservoir was formed by impounding the Bog Brook, a small tributary to the East Branch Croton River. Releases flow to the continuation of Bog Brook, which joins with the East Branch Croton River and flows into Croton Falls Reservoir. The primary purpose of Bog Brook Reservoir is to provide supplemental storage for water from the East Branch Reservoir watershed. There is an underground tunnel connecting Bog Brook and East Branch Reservoirs, such that the water surface elevations of the two waterbodies fluctuate in concert. Because Bog Brook is hydraulically connected to East Branch Reservoir, Bog Brook does not have a primary spillway and spills occur via the East Branch Reservoir. Bog Brook Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Bog Brook Reservoir. The water quality classification for Bog Brook Reservoir is Class AA throughout its entire length. While Bog Brook Reservoir serves the City's customers as part of the larger Croton System, no local communities draw directly from the reservoir.

10.5.6.2 Study Area Evaluation

Under typical operations, DEP operates Bog Brook Reservoir by meeting the required minimum releases. In addition, supplemental releases from East Branch Reservoir, which is hydraulically connected to Bog Brook Reservoir, can be used to maintain reservoir storage, and thus maintain pump station operation, at Croton Falls Reservoir during droughts.[52] Therefore, reservoir drawdown can vary substantially under typical operations, approaching dead storage during droughts (see **Figure 10.5-16** and **Table 10.5-3**). Due to this regular drawdown, the banks are rocky and reinforced with riprap in some locations. Bog Brook Reservoir was drawn down less when the Croton System was offline from 2005 to 2015, as described previously. Water surface elevations are expected to fluctuate more now that the Croton Water Filtration Plant is online.

During pre-shutdown operations, there would be no differences from typical operations at Bog Brook Reservoir, and reservoir water surface elevations would remain within 1 foot of typical operations (see **Figure 10.5-16**). During the temporary shutdown operations, DEP would utilize the Croton Falls Pump Station to augment flow to Kensico Reservoir. Therefore, East Branch Reservoir releases would be higher than typical to maintain water surface elevation in Croton

[52] Releases from East Branch Reservoir and Bog Brook Reservoir can be routed to Croton Falls Reservoir via the Croton Falls Diverting Reservoir.

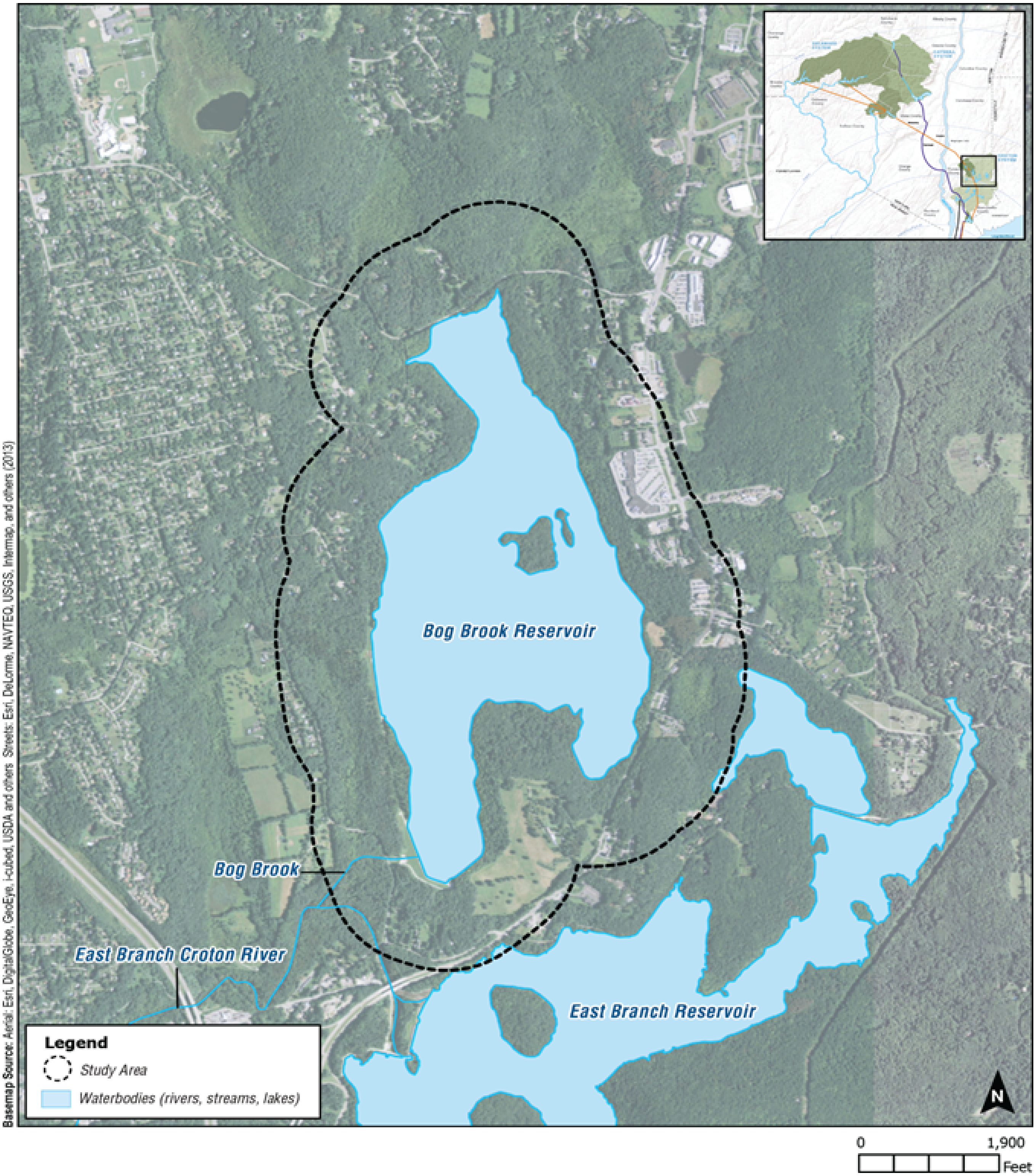
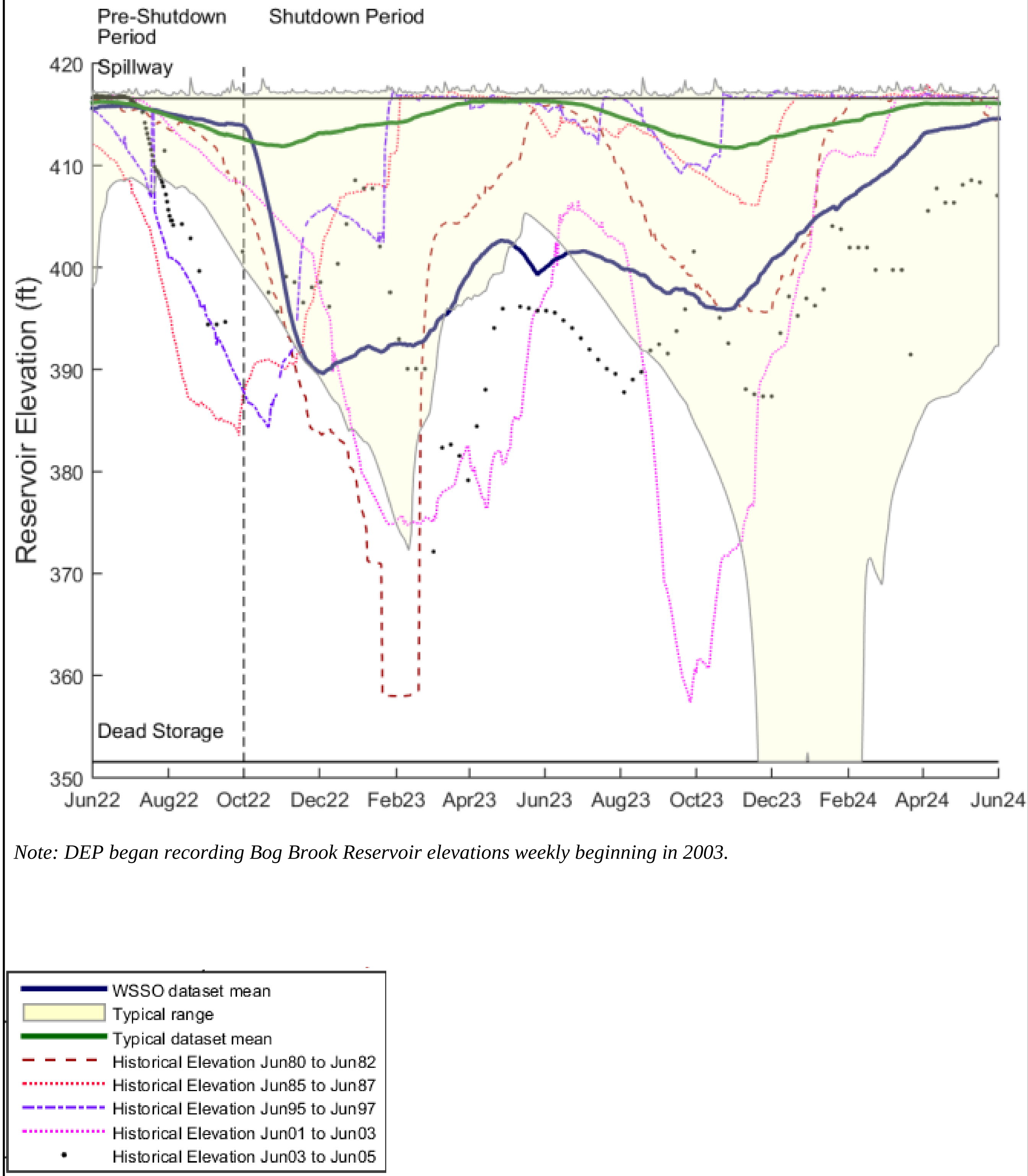


Figure 10.5-15: Bog Brook Reservoir Study Area



Note: DEP began recording Bog Brook Reservoir elevations weekly beginning in 2003.

Figure 10.5-16: Elevation Dataset Mean and Range for Typical Operations and WSSO – Bog Brook Reservoir Study Area (Sheet 1)

		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	416	406	417	416	0
	July	415	409	417	415	0
	August	414	408	417	415	1
	September	413	403	417	414	1
Shutdown Period	October	412	397	417	408	-4
	November	412	392	417	393	-19
	December	413	386	417	391	-22
	January	414	380	417	392	-22
	February	415	379	417	393	-22
	March	416	396	417	396	-20
	April	416	398	417	402	-14
	May	416	405	417	401	-15
Post-shutdown Period	June	416	402	417	401	-15
	July	415	397	417	401	-14
	August	414	392	417	399	-15
	September	413	388	417	398	-15
	October	412	380	417	396	-16
	November	412	362	417	398	-14
	December	413	352	417	402	-11
	January	414	352	417	406	-8
	February	415	362	417	408	-7
	March	416	380	417	411	-5
	April	416	387	417	413	-3
	May	416	390	417	414	-2

Figure 10.5-16: Elevation Dataset Mean and Range for Typical Operations and WSSO – Bog Brook Reservoir Study Area (Sheet 2)

Table 10.5-3: Bog Brook Reservoir Historical Drawdowns

Start Date	End Date	Max Drawdown Water Surface Elevation (Feet)	Average Drawdown Water Surface Elevation (Feet)	Duration (Months)
Jan-04	May-05	372	394	16
Sep-01	Feb-03	357	390	18
Jul-95	Jan-96	384	398	7
Jun-85	Jan-86	383	396	8
Sep-80	Apr-81	358	388	8

Note:
Spillway water surface elevation is 416.50 feet, and dead storage water surface elevation is 351.60 feet.

Falls Diverting Reservoir and supply Croton Falls Reservoir. Due to higher releases, the Bog Brook Reservoir would be drawn down up to approximately 22 feet more than typical based on comparison of the dataset means (see **Figure 10.5-16**). Bog Brook Reservoir would recharge gradually after the end of the temporary shutdown and would not return to typical conditions for up to approximately 10 months following the end of the temporary shutdown of the RWBT (see **Figure 10.5-16**).

While the level of drawdown anticipated for Bog Brook Reservoir is not unprecedented, the reservoir has not experienced sustained drawdown in many years. Therefore, additional analysis of the potential for impacts was warranted for Bog Brook Reservoir.

10.5.6.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Water surface elevation changes from WSSO would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because changes in elevations would be temporary, WSSO activities would not physically displace or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning in the Bog Brook Reservoir Study Area and no further analysis is warranted.

The consistency of water surface elevation changes as a result of the project with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in reservoir water surface elevation. Therefore, WSSO would not result in significant adverse impacts to public policy in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.4 Socioeconomic Conditions

WSSO would not result in changes to socioeconomic conditions from direct or indirect population changes, displacement of residences and/or businesses, availability of housing stock, utility increases, or other changes to the regional economy. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.5 Community Facilities and Services

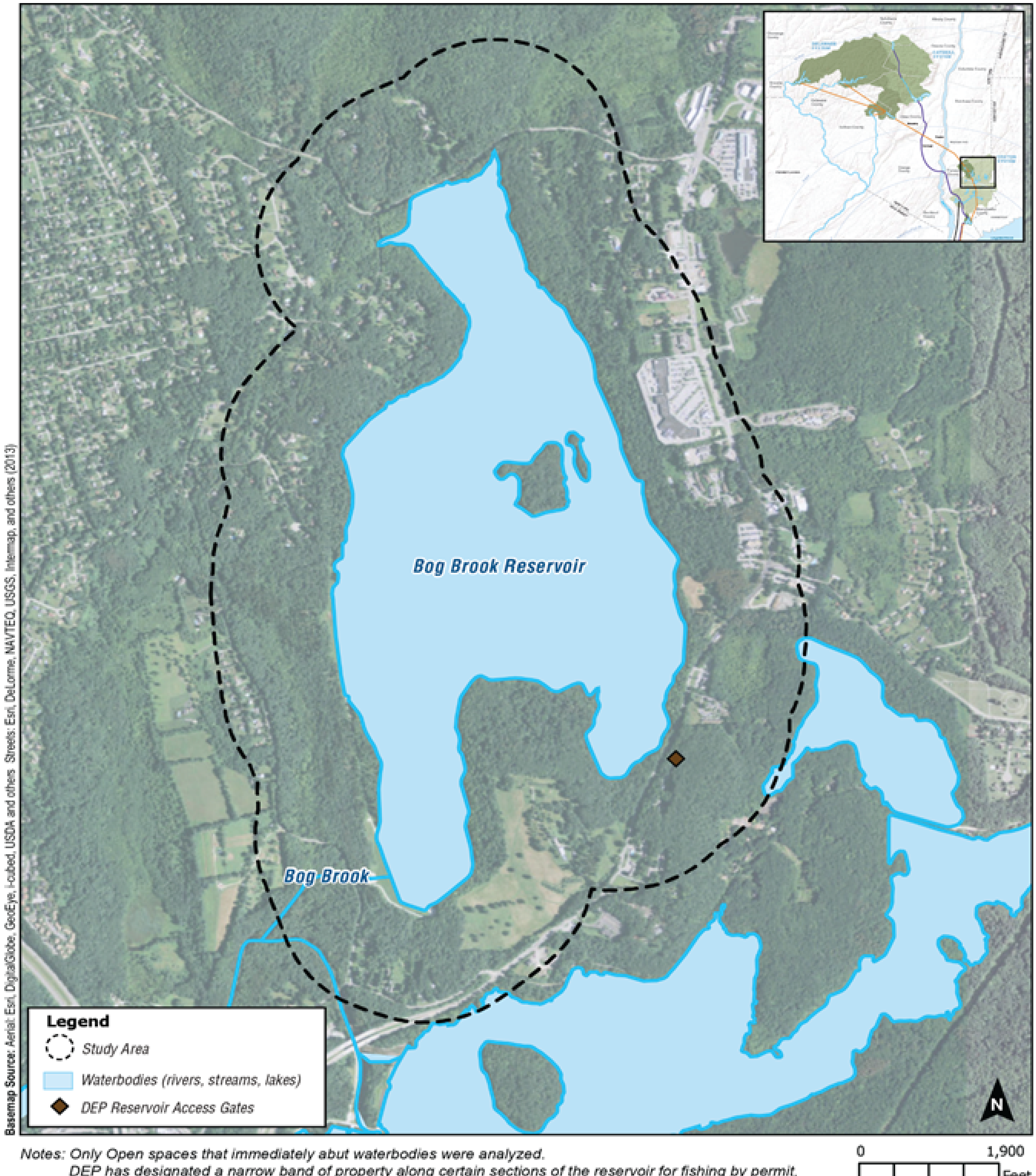
There would be no construction from WSSO in this study area. Further, reduced water surface elevations as a result of WSSO would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.6 Open Space and Recreation

Open space and recreational resources within the study area include the reservoir itself and surrounding watershed lands, which has a total area of approximately 379 acres and is located in the Town of Southeast, Putnam County, New York (see **Figure 10.5-17**). Bog Brook Reservoir provides recreational opportunities in the form of fishing (boating is allowed for the purposes of fishing). One DEP-owned and operated gate provides recreational users year-round shoreline and water access. The fish community is dominated by a mix of both coolwater and warmwater species and includes abundant species sought after by anglers (e.g., walleye [*Sander vitreus*], largemouth bass [*Micropterus salmoides*], smallmouth bass [*Micropterus dolomieu*], yellow perch [*Perca flavescens*], white perch [*Morone Americana*], black crappie [*Pomoxis nigromaculatus*], and bluegill [*Lepomis macrochirus*]). Fishing is conducted from both the shoreline and from non-motorized boats. Boat storage for use in the reservoir is provided by DEP at designated locations along the shoreline. There are approximately 234 boats stored at the Bog Brook Reservoir. Boats are launched from the shoreline.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the Bog Brook Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Use of identified open spaces is anticipated to continue. Therefore, in the future without WSSO, it is assumed that use of the Bog Brook Reservoir would be the same as baseline conditions. Similarly, it is assumed that the use of the waterbody would be the same as baseline conditions.

During the temporary shutdown, reservoir drawdown could create difficulties for launching and retrieving recreational boats. This could inhibit boating/fishing opportunities for anglers that have boats stored at Bog Brook Reservoir. However, fishing from the shore would still be possible under drawdown conditions. If permitted boat users wanted to move boats to another reservoir, they would need to follow DEP protocol for obtaining new permits and washing boats before moving boats to a different reservoir. Restrictions at some DEP reservoirs and a potential backlog from numerous users seeking new permits could inconvenience anglers that have boats stored at Bog Brook Reservoir. Reservoir drawdown could affect ice formation, potentially restricting ice fishing opportunities during the winter of the RWBT temporary shutdown. These temporary inconveniences to boating for the purpose of fishing that could occur during WSSO



Notes: Only Open spaces that immediately abut waterbodies were analyzed.
DEP has designated a narrow band of property along certain sections of the reservoir for fishing by permit, accessible only through designated access gates. Due to the map scale this open space is not shown.

Figure 10.5-17: Open Space and Recreation Resources – Bog Brook Reservoir Study Area

would be similar to those that occurred during historical drawdowns of a similar magnitude (see **Figure 10.5-16** and **Table 10.5-3**).

DEP outreach efforts would serve to notify recreational users of potential changes to reservoir access in advance of the RWBT temporary shutdown, as is standard for planned changes at DEP reservoirs. Notifications would disclose any special regulations required during WSSO.

Reservoir drawdown could temporarily affect fish populations, which would in turn reduce the quality of angling for a similar duration of time (see Aquatic and Benthic Resources in Section 10.5.6.10, “Natural Resources”). This loss could involve sub-adult and adult fish, which are the size ranges regulated by NYSDEC and targeted by anglers. Further, NYSDEC would monitor habitat conditions in Bog Brook Reservoir and could curtail trout stocking in April of the temporary shutdown if unfavorable habitat conditions are present in the reservoir.

During WSSO, temporary effects to open space and recreation would occur in the form of reduced recreational boat access and reduced fishing opportunities for up to 18 months of sustained drawdown. However, no significant adverse impacts to open space and recreation would be expected to fishing opportunities or long-term recreational usage. Therefore, WSSO would not result in significant adverse impacts to open space and recreation in the Bog Brook Reservoir Study Area and no further analysis is warranted.

During WSSO, temporary effects to open space and recreation would occur in the form of reduced recreational boat access and reduced fishing opportunities for up to 18 months of sustained drawdown. However, no significant adverse impacts to open space and recreation would be expected to fishing opportunities or long-term recreational usage. Therefore, WSSO would not result in significant adverse impacts to open space and recreation in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.7 Critical Environmental Areas

No Critical Environmental Areas were identified within the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas within the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.8 Historic and Cultural Resources

There would be no construction from WSSO in the Bog Brook Reservoir Study Area. The potential mechanism for disturbing potential historic or cultural resources would be through erosion. While water surface elevations would be lower than typical, these changes are not anticipated to result in widespread erosion (see Geology and Soils in Section 10.5.6.10, “Natural Resources”).

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated that WSSO would have no effect upon cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.9 Visual Resources

The boundaries of the Bog Brook Reservoir Study Area are 0.25 mile beyond the reservoir itself. It also includes view corridors that extend further based on the locations that are publicly accessible. Visual resources, consisting of: three sites eligible for listing on the National and/or State Register of Historic Places, two locally significant resources, five local landmarks, and one local historic district were identified within the Bog Brook Reservoir Study Area, as shown in **Figure 10.5-18**.

The structures that are eligible for listing under the N/SR of Historic Places are the Sodom Road Bridge, a Greek Revival Farmhouse (also known as the Yale House, a local landmark), and Bog Brook Reservoir Dam that is part of the New Croton Aqueduct System. The five local landmarks include Budd’s Tavern, J Minor House, Stonehenge-Howes Residence, Yale House, and the Edith Diehl House. The two local resources include two reservoirs, East Branch and Bog Brook. The local historic district is the Milltown Area Historic District, along Milltown Road (including Budd’s Tavern). As described above, changes could occur to the water level of the reservoir as a result of WSSO and drawdown of Bog Brook Reservoir.

Bog Brook Reservoir is surrounded by forested lands, limiting many views of the reservoir from the visual resources noted above. The Bog Brook dam is the only visual resource with open, unobstructed views of the reservoir. However, the dam is not open to the public and does not warrant further analysis. Recreational users with valid permits would have direct views of Bog Brook Reservoir.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP’s understanding that no new projects or structures that would alter views from visual or aesthetic resources are anticipated within the Bog Brook Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Therefore, in the future WSSO, it is assumed that visual resources within the Bog Brook Reservoir Study Area would be the same as baseline conditions. During the temporary shutdown, supplemental releases from Bog Brook Reservoir would result in lower than typical water surface elevations in the reservoir. However, the shutdown would be temporary in nature and, as noted above, the views from the Sodom Road Bridge, Yale House, Budd’s Tavern, J Minor House, Stonehenge-Howes Residence, Edith Diehl House, and the Milltown Area Historic District are limited due to the vegetation surrounding the reservoir. Limited, obstructed views could occur through the vegetation during the temporary shutdown, but are not anticipated to impact the use or enjoyment of the visual resources.

As noted above, Bog Brook Reservoir is a local visual resource that provides recreational shoreline fishing and non-motorized boat fishing to the public with a DEP watershed access permit. Recreational users of Bog Brook Reservoir would be expected to have unobstructed views of the reservoir with potential lower water levels. These altered views would be temporary in nature, with views restored to baseline conditions upon completion of WSSO activities. Temporary effects to visual resources would be similar to those that occurred during historical drawdowns of a similar magnitude (see **Figure 10.5-16** and **Table 10.5-3**). Views during these events consisted of large expanses of dry, rocky soil around the edge of the reservoir.

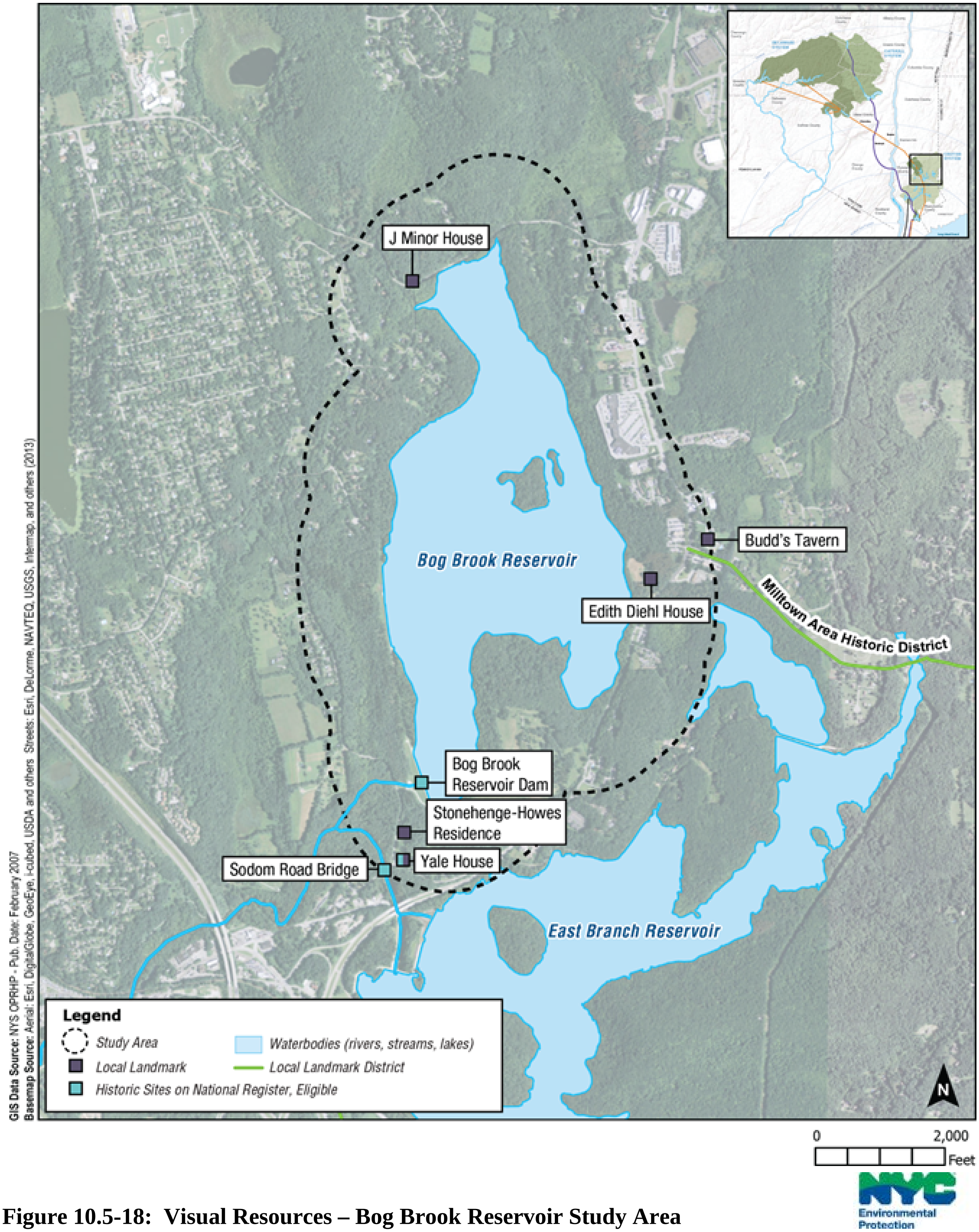


Figure 10.5-18: Visual Resources – Bog Brook Reservoir Study Area

Effects to visual resources would be temporary and minor. Therefore, WSSO would not result in significant adverse impacts to visual resources within the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.10 Natural Resources

The potential for impacts to natural resources from WSSO within the Bog Brook Reservoir Study Area is discussed below.

Geology and Soils

As described earlier, the banks of Bog Brook Reservoir are rocky and reinforced with riprap in some locations to prevent erosion from frequent fluctuations in reservoir elevations under typical operations. Because of regular drawdown, deposited sediment is regularly transported to deeper sections of the reservoir during refill. Sustained drawdown during WSSO would not result in erosion above what could occur under typical reservoir operations. There would be no changes to geology or soils at Bog Brook Reservoir from the reservoir drawdown. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. During the period of reservoir drawdown, it is possible that the fringe areas around the reservoir would experience a lower water table than under typical operating conditions. During this period, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor but would not be anticipated to be significantly affected by the drawdown. Temporary effects to ecological communities would be similar to those that occurred during historical drawdowns of a similar magnitude anticipated during WSSO (see **Figure 10.5-16** and **Table 10.5-3**). Temporary drawdown of the reservoir during WSSO would not result in changes to ecological communities in the vicinity of the Bog Brook Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary drawdown of the Bog Brook Reservoir would not result in significant changes within the study area to critical wildlife habitat, wildlife movement, or its ability to forage or breed. As discussed, the reservoir would be drawn down below typical conditions, which would result in a temporarily altered shoreline. These temporary changes would not prevent terrestrial wildlife from using the reservoir for behaviors such as foraging or breeding. The drawdown is not anticipated to result in significant effects to the fish community (see Aquatic and Benthic Resources in Section 10.5.6.10, "Natural Resources"). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the reservoir would still have a source of prey in the reservoir. Therefore, WSSO would not result in significant adverse impacts to wildlife in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Bog Brook Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Bog Brook Reservoir Study Area include the following: Blocks 6158A and 6158C. The USGS Quadrangle used for the NYSDEC Herp Atlas that includes the Bog Brook Reservoir Study Area is the Brewster Quadrangle. In total, these sources identified species with the potential to occur in the Bog Brook Reservoir Study Area. Desktop assessments were conducted to assess the potential habitat for these species. Baseline ecological information and assessments for the Bog Brook Reservoir Study Area for these species as shown in **Table 10.5-4**.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Amphibians and Reptiles				
Blue-spotted salamander (*Ambystoma laterale*)	None	Special Concern	Blue-spotted salamanders inhabit damp deciduous and deciduous/coniferous forests containing temporary ponds at a variety of elevations (Gibbs et al. 2007). They are often found where soils have high sand or loam content and can tolerate disturbance in suburban areas. Blue-spotted salamander do not inhabit open water environments. The blue-spotted salamander is an early breeder (i.e., March and April) and spends most of its lifecycle underground. Blue-spotted salamanders do not require large open water environments for any part of their natural history.	The forested habitat upland of Bog Brook Reservoir that blue-spotted salamander could inhabit would not be affected as a result of the drawdown. Therefore, no effects to blue-spotted salamanders are anticipated and no further analysis for blue-spotted salamanders is warranted for this study area.
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Bog turtles prefer fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and mucky. Vegetation commonly includes calciphile species. Vegetation is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of core bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require large open water environments for any part of their natural history.	A wetland approximately 1.5 miles from Bog Brook Reservoir was identified by NYNHP as recently containing bog turtles. This wetland drains into Bog Brook Reservoir and there are wetland corridors that connect this occurrence to other wetlands adjacent to Bog Brook Reservoir. Therefore, potential impacts to bog turtle habitat were assessed for this study area.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats from forests with sandy, well-drained soils, dry open uplands such as meadows, pastures, open fields, and utility right-of-ways, to moist lowlands and wetlands. They are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtles do not require large open water environments for any part of their natural history.	Potential eastern box turtle habitat adjacent to the reservoir would not be affected by the drawdown in Bog Brook Reservoir during WSSO. Therefore, no effects to eastern box turtles are anticipated and no further analysis for eastern box turtles is warranted for this study area.
Jefferson Salamander (*Ambystoma jeffersonianum*)	None	Special Concern	Jefferson salamanders inhabit large tracts of upland deciduous and mixed deciduous/coniferous forest with abundant stumps and logs, but also occur in bottomland forests that border agricultural or otherwise disturbed areas. The Jefferson salamander spends the majority of its lifecycle underground and relies on the tunnels created by burrowing small mammals. Jefferson salamanders breed early in the year (i.e., March and April). They are broadly distributed in south-central New York. Jefferson salamander do not require open water environments for any part of their natural history.	The upland forested habitat Jefferson salamander could inhabit would not be affected as a result of the drawdown. Therefore, no effects to Jefferson salamanders are anticipated and no further analysis for Jefferson salamanders is warranted for this study area.
Southern leopard frog (*Lithobates sphenocephala utricularius*)	None	Special Concern	Southern leopard frogs mostly inhabit open grasslands and wet meadows or shallow wetlands. After the breeding season, they could move to upland areas where shade is prevalent and where moisture is found in upland pools and puddles (Gibbs et al. 2007). Southern leopard frog require open water environments for their natural history.	Southern leopard frog habitat could be present at the fringes of the reservoir where any unhardened habitats exist. These fringe areas could be affected by the drawdown of Bog Brook Reservoir. Therefore, potential impacts to southern leopard frogs were assessed for this study area.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Spotted turtle (*Clemmys guttata*)	None	Special Concern	Spotted turtle habitat consists of vernal pools in the spring, upland forest for part of summer after pools dry out, and wet meadows, forested swamps, or sphagnum bogs for overwintering. They are strongly associated with pools that are shallow, have clear water, and have a muddy substrate. In winter, spotted turtles could inhabit abandoned mammal lodges or burrows or under the roots of flooded shrubs and trees, and could congregate with bog turtles or snapping turtles during this time (Gibbs et al. 2007). Spotted turtle do not require large open water environments for any part of their natural history.	Wetlands that could contain suitable spotted turtle habitat occur adjacent to Bog Brook Reservoir. These wetlands could experience minor alteration to the water table if the water table is connected to the reservoir. A lowered water table could result in stressed herbaceous vegetation, thus WSSO could potentially have an effect on spotted turtle habitat. Therefore, potential impacts to spotted turtles were assessed for this study area.
Wood turtle (*Glyptemys insculpta*)	None	Special Concern	Wood turtles have large home ranges and typically inhabit riverside or streamside environments bordered by woodlands or meadows and utilize open sites with low canopy cover. Individuals bask along stream banks and hibernate in creeks (Gibbs et al. 2007). Wood turtles do not require large open water environments for any part of their natural history.	The drawdown would not affect the flow of any streams that are tributaries to Bog Brook Reservoir which could be potential suitable wood turtle habitat. Therefore, no effects to wood turtles are anticipated and no further analysis for wood turtles is warranted for this study area.
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes, and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments for their natural history.	The temporary Bog Brook Reservoir drawdown would have temporary effects on the reservoir's fishery and Bald Eagle foraging habitat. Therefore, potential impacts to Bald Eagles were assessed for this study area.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Cooper's Hawk (*Accipiter cooperii*)	None	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests, but they are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require open water environments for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to Bog Brook Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.
Northern Goshawk (*Accipiter gentilis*)	Protected - MBTA	Special Concern	Northern Goshawk habitat in New York consists of mature deciduous, coniferous, and mixed deciduous-coniferous forests with a relatively open understory. It is also found nesting in mature conifer plantations. Northern Goshawks prey primarily on mature birds and small mammals, but is also an opportunistic feeder and will take insects and fledglings depending on prey availability (Crocoll 2008). Northern Goshawk do not require open water environments for any part of their natural history.	Northern Goshawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to Bog Brook Reservoir would not affect any Northern Goshawk habitat, breeding, or foraging. Therefore, no effects to Northern Goshawks are anticipated and no further analysis for Northern Goshawks is warranted for this study area.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-shouldered Hawk (*Buteo lineatus*)	Protected - MBTA	Special Concern	In New York, Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas or flooded swamps/wetlands. Breeding Bird Atlas data show a steady increase in Red-shouldered Hawk populations, particularly in the Hudson River, as farmland reverts back to forest, resulting in increased habitat. Red-shouldered Hawks occasionally nest in suburban areas where forest cover is less contiguous. Migration and wintering habitats are similar to breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Crocoll 2008). Red-shouldered Hawks do not require open water environments for any part of their natural history.	Drawdown in Bog Brook Reservoir would not affect Red-shouldered Hawk habitat adjacent to the reservoir or affect any breeding or foraging behaviors. Therefore, no effects to Red-shouldered Hawks are anticipated and no further analysis for Red-shouldered Hawks is warranted for this study area.
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize open water environments for foraging and migrating when they are available.	Indiana bats have the potential to utilize Bog Brook Reservoir for migration and foraging purposes. Drawdown of Bog Brook Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.

Table 10.5-4: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Bog Brook Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
New England Cottontail (*Sylvilagus transitionalis*)	None	Special Concern	New England cottontail is known only to occur east of the Hudson River. This species prefers early successional habitat with dense vegetation generally associated with abandoned agricultural fields, wetlands, clear cuts of woodlands, utility right-of-ways, and other disturbed areas with shrubs and early successional vegetation (Arbuthnot 2008). New England cottontail do not require open water environments for any part of their natural history.	The drawdown would not be anticipated to affect dense woody vegetation typical of New England cottontail habitat that occurs in areas adjacent to the reservoir. Woody vegetation could experience reduced vigor due to a lowered water table but would not lose its ability to provide cover and food for New England cottontail. Therefore, no effects to New England cottontails are anticipated and no further analysis for New England cottontails is warranted for this study area.
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees that are 3 inches or more in diameter. These bats are opportunistic and will also roost in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize open water environments for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize Bog Brook Reservoir for migration and foraging purposes. Drawdown of Bog Brook Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.
Notes: BGPA: Bald and Golden Eagle Protection Act MBTA: Migratory Bird Treaty Act				

Following the initial analysis, four species were identified as having the potential to be affected by changes in reservoir water surface elevations at Bog Brook Reservoir that would occur as a result of WSSO. Therefore, an impact analyses for each of these species is below.

Bog Turtle (Clemmys [=Glyptemys] muhlenbergii)

No occurrences of bog turtles (*Clemmys [=Glyptemys] muhlenbergii*) were identified by NYNHP within the study area. Further, frequent or large magnitude fluctuations in water surface elevations, a common occurrence at Bog Brook Reservoir, are not typical of suitable bog turtle habitat (Feaga et al. 2012). However, there was a bog turtle occurrence identified by NYNHP in a wetland upstream of Bog Brook Reservoir approximately 0.75 mile away, outside of the study area. In the future without WSSO, it is assumed that natural resources within the study area would remain the same as baseline conditions with the exception of possible changes due to natural vegetative succession.

In the future with WSSO, no adverse impacts to bog turtles are expected. The anticipated changes in water surface elevations within the reservoir and the immediately surrounding areas that may occur from WSSO would be consistent with historical fluctuations associated with this reservoir. It is unlikely that bog turtles associated with the NYNHP-identified wetland would migrate to the fringe wetlands adjacent to Bog Brook Reservoir, because of the unsuitable habitat at Bog Brook Reservoir. The NYNHP-identified bog turtle wetland, as well as its tributaries and connecting streams, would be unaffected by changes in water surface elevations at Bog Brook Reservoir associated with WSSO, because the NYNHP-identified bog turtle wetland is approximately 0.75 mile beyond the study area limits, is located upstream of and at a topographic elevation that is higher than Bog Brook Reservoir and is not hydrologically supported by Bog Brook Reservoir

Therefore, WSSO is not anticipated to result in significant adverse effects to bog turtles or suitable bog turtle habitat in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Southern Leopard Frog (Lithobates sphenocephala utricularius)

Southern leopard frog (*Lithobates sphenocephala utricularius*) was identified as having the potential to occur in the study area by the NYSDEC Herp Atlas. Southern leopard frogs utilize a variety of aquatic habitats such as shallow emergent marshes, shrub swamps, sedge meadows, and eutrophic ponds (NYNHP 2015). Aquatic vegetation is usually associated with these habitats. The shoreline of Bog Brook Reservoir is primarily hardened with riprap. Southern leopard frogs would not be anticipated to utilize these hardened areas for foraging, resting, reproduction, or hibernation. Suitable habitats could be present at the softer fringe areas of the reservoir shoreline. In the future without WSSO, Bog Brook Reservoir would be operated under typical conditions and it is assumed that southern leopard frogs, if present, would continue to utilize the softened reservoir fringe for foraging, reproduction, resting, and hibernation.

In the future with WSSO, Bog Brook Reservoir would have a lower than typical surface water elevation for the duration of the temporary shutdown and the following growing season. The softened reservoir fringe areas would potentially have their hydrology affected by the drawdown of Bog Brook Reservoir. Southern leopard frog, if present, would be unable to use these habitats for this duration. However, ample suitable habitat occurs in the areas adjacent to Bog Brook Reservoir. The drawdown would occur prior to southern leopard frog hibernation. Therefore, southern leopard frogs, if present, would seek out other suitable habitat for hibernation. This would cause southern leopard frogs to be more susceptible to predation; however, southern leopard frogs are known to frequently migrate between upland, mating, and hibernation sites. Therefore, WSSO may affect, but is not likely to adversely affect, southern leopard frog and no further analysis is warranted.

Spotted Turtle (Clemmys guttata)

Spotted turtle (*Clemmys guttata*) was identified as having the potential to occur in the study area by the NYSDEC Herp Atlas. Spotted turtles would not utilize the open water habitat of Bog Brook Reservoir or the hardened riprap shoreline, but they could inhabit small ponds or vernal pools, marshes, bogs, or small woodland streams, if they occur in the study area. Herbaceous vegetation is typical of habitat surrounding these preferred aquatic systems and the substrates of the aquatic systems are typically soft or vegetated. There are wetlands around the perimeter of Bog Brook Reservoir in which suitable spotted turtle habitat could occur. These wetlands could be hydrologically connected with Bog Brook Reservoir. In the future without WSSO, Bog Brook Reservoir would be operated under typical conditions and spotted turtle, if present in the surrounding wetlands, would continue to utilize those habitats. In the future, it is assumed that these wetlands would largely remain the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession.

In the future with WSSO, Bog Brook Reservoir would have a lower than typical surface water elevation during the temporary shutdown and the following growing season. If the water table of the wetlands surrounding the reservoir were connected with the reservoir, then it could result in stresses to herbaceous vegetation in these wetlands such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. These changes to spotted turtle habitat would not result in direct, adverse effects to spotted turtles. There would still remain ample habitat in the wetlands for spotted turtles to forage, hibernate, mate, bask, and rest. Therefore, WSSO may affect, but is not likely to adversely affect, spotted turtle habitat and no further analysis is warranted.

Bald Eagle (Haliaeetus leucocephalus)

Breeding Bald Eagles (*Haliaeetus leucocephalus*) were identified by NYNHP as occurring on the shoreline of Bog Brook Reservoir. Bog Brook Reservoir represents high quality habitat for Bald Eagles and provides ample foraging opportunities on the fisheries within the reservoir and ample nesting, perching, and roosting habitat in the trees along the reservoir shoreline. In the future without WSSO, Bald Eagles, if present, would continue to utilize the reservoir and its surrounding area for foraging, mating and nesting, roosting, and perching.

In the future with WSSO, Bog Brook Reservoir would be drawn down beginning in the late fall when mating behaviors begin and would continue through the winter and following summer when Bald Eagles would be rearing eaglets. Bald Eagles most commonly forage in the shallows of open water environments such as Bog Brook Reservoir. However, in the winter they are known to forage more commonly over deeper open water. The drawdown would result in an altered shoreline, changing how the fish use the shallow areas of the reservoir. This drawdown would not cause significant adverse impacts to the fishery (see Aquatic and Benthic Resources in Section 10.5.6.10, “Natural Resources”). Both the shallows and open water areas of the reservoir would continue to be habitat for Bald Eagle prey species. If foraging in shallows during the drawdown, Bald Eagles would have a longer distance to locate prey from and fly to their shoreline perches. Therefore, WSSO may affect, but is not like to adversely affect, breeding, overwintering, or foraging of Bald Eagles and no further analysis is warranted.

Based on the assessment results, there would be no significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species as a result of changes in reservoir water surface elevations at Bog Brook Reservoir and no further analysis is warranted.

Aquatic and Benthic Resources

Bog Brook Reservoir has a mean depth of approximately 33 feet and a maximum depth of approximately 60 feet in a small area near the dam. The baseline fish community in the reservoir is dominated by a mix of coolwater and warmwater species and includes many species sought after by anglers. Walleye are common, but are not currently stocked by NYSDEC. Largemouth and smallmouth bass are abundant, as well as yellow perch, white perch, black crappie, and bluegill. Brown trout (*Salmo trutta*) also occur and are stocked, but they are not among the most abundant species, because of limited coldwater habitat in the reservoir. Alewife (*Alosa pseudoharengus*) are abundant and provide forage for all of the predator fish in the reservoir.

In the future without WSSO, it is assumed that aquatic conditions in Bog Brook Reservoir would generally remain the same as baseline conditions, and there would be no change from typical operations of the reservoir.

As described previously, changes could occur to the water surface elevation of the reservoir as a result of the temporary shutdown and drawdown of the Bog Brook Reservoir. While water surface elevations would be lower than typical, they would be within the range of prior drawdown events (see **Figure 10.5-16** and **Table 10.5-3**). Drawdowns anticipated during WSSO could result in minor to moderate effects to aquatic resources due to the reduced habitat, partially exposed substrate, and reduced coldwater storage. This anticipated drawdown, which could persist for up to 18 months, would represent a seasonal reduction of habitat compared to typical operations. However, because Bog Brook Reservoir has modest drawdowns most years and extreme drawdowns occasionally, the drawdown anticipated during the temporary shutdown represents a minor change and temporary condition compared to typical operations.

During drawdown conditions, fish would be confined to a smaller area in the basin where they could be exposed to increased predation by piscivorous species, because the small fish could be forced into unfavorable habitat conditions. Increased mortality could result during the winter because of colder temperatures in portions of the reservoir due to anoxic zones from the high concentration of fish, organic matter decomposition, and ice/snow cover, which prevents re-oxygenation of the smaller volume.

Many fish species, such as alewife, survive during winter in local reservoirs because they can retreat to deep water where temperatures stay at or above their low temperature tolerance limit. Fish mortality could occur if temperatures drop below these thresholds for survival. A temporary reduction of the alewife population, in particular, could in turn affect growth rates of the piscivorous species. Growth rates would return to typical, as balanced fish and invertebrate communities are re-established.

Any benthic invertebrate community or habitat affected by the drawdown and subsequent partial exposure of the substrate would recover following a refill of the reservoir. This recovery has been observed in Bog Brook Reservoir following drawdown conditions comparable to those anticipated during the temporary shutdown. The benthic invertebrate community would recover at a faster rate than the fish populations due to faster growth rates.

The effects on fisheries and benthic species in the reservoir from WSSO would be similar to what has occurred in historically under severe drawdown conditions in the reservoir under typical operations (see **Figure 10.5-16** and **Table 10.5-3**). Therefore, effects would be temporary, and natural regenerative processes would be expected to be sufficient to re-establish baseline conditions. Therefore, WSSO would not result in significant adverse impacts to aquatic resources in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.5.6.2, "Study Area Evaluation"), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the Bog Brook Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the Bog Brook Reservoir Study Area within existing floodplains. Lower than typical water surface elevations that would occur in Bog Brook Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the Bog Brook Reservoir Study Area and no further analysis is warranted.

Groundwater

While the reservoir has the potential to be drawn down more than typical and for a longer duration, the reservoir can be drawn down considerably under typical operations. Further, based on USGS reports, the discharge from reservoirs to the groundwater system is small in comparison to the total groundwater recharge, indicating that reservoirs are not a major source of recharge (Wolcott and Snow 1995). Typically groundwater movement is from hilltops to streams and reservoirs in the region, and the hydraulic conductivity of the till deposits is small and of the same order of magnitude or lower than reservoir bottom sediments. Therefore, it is likely that the flow rate of water to or from the reservoirs is primarily controlled by the properties of the underlying aquifers and not reservoir storage elevation (Mullaney 2004). Aside from minor changes to the surficial aquifer immediately adjacent to the reservoir, there would not be widespread changes to groundwater from WSSO in the Bog Brook Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to groundwater in the Bog Brook Reservoir Study Area and no further analysis is warranted.

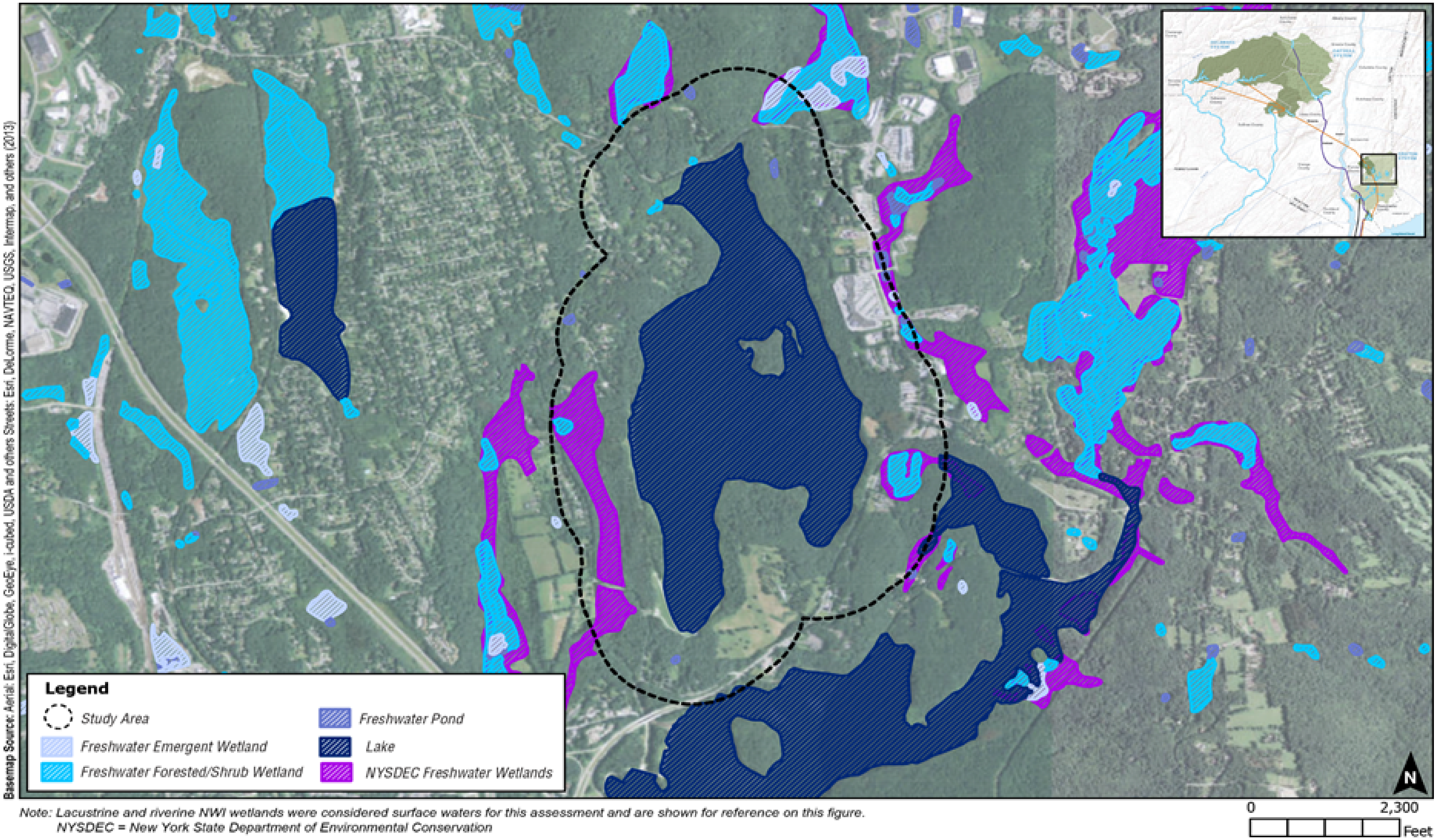
Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the Bog Brook Reservoir Study Area (see **Figure 10.5-19**). The study area extends 0.25 mile around the reservoir and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on Bog Brook Reservoir. There are nine NYSDEC wetlands mapped within or intersecting the study area. The nine NYSDEC wetlands cover approximately 259 acres and consist of five Class I wetlands, three Class II wetlands, and one Class III wetland. There are 20 USFWS NWI-mapped wetlands within or intersecting the study area. The 20 USFWS NWI wetlands cover approximately 59 acres and consist of three emergent wetlands, nine scrub/shrub or forested wetlands, and eight ponds. Of the 259 acres of NYSDEC and 59 acres of NWI-mapped wetlands, approximately 35 acres overlap and contain both NYSDEC and NWI-mapped wetlands.

In the future without WSSO, there would be no change from typical operations and management of Bog Brook Reservoir. Adjacent and nearby wetlands would not be affected in the future without the project. Therefore, wetlands within the Bog Brook Reservoir Study Area in the future without WSSO are assumed to be the same as baseline conditions.

Wetlands along the tributary streams or located inland at higher elevations would be unaffected by reservoir drawdown during the shutdown because they are above the full pool elevation and are not influenced by reservoir water. Lowered reservoir elevations are not anticipated to impact groundwater that may source some of these wetlands. Most of the mapped wetlands in the Bog Brook Reservoir Study Area occur in landscape positions (i.e., separated from the reservoir by elevation or landform) that would not be influenced by the proposed drawdown of Bog Brook Reservoir. Some of the mapped wetlands are located in shallow areas along the reservoir edge, also referred to as fringe wetlands.

Drawdown at Bog Brook Reservoir is anticipated to begin in October of the shutdown, and extend through the following spring before starting to refill (see **Figure 10.5-16**). Drawdown of Bog Brook Reservoir is part of the typical operation of the water supply system. The level of drawdown anticipated for the temporary shutdown of the RWBT has been experienced during past operation of the reservoir (including winter through spring of 1980-1981, the summers of 1985 and 1995, and the entire years of 2001 and 2004), and is anticipated under future typical operation of the Croton System.



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

Figure 10.5-19: Wetlands Resources – Bog Brook Reservoir Study Area

Drawdowns that occur at different times of year can affect fringe wetland vegetation differently. Drawdowns in the middle of the growing season in summer would affect fringe wetland vegetation differently than reservoir drawdown in the spring when the growing season is beginning. During winter through spring drawdowns, under typical climactic conditions, early spring vegetation such as spring ephemerals may not emerge or would be stressed due to the different hydrologic conditions. Emergence of other vegetation may similarly be affected. During summer drawdowns, under typical climactic conditions, vegetation that has emerged may experience effects to vegetation growth, flowering, or fruit production. Regardless of season, stress to fringe wetland vegetation can be triggered by even small drawdowns of a foot or less depending on rooting depth and other characteristics of individual plants.

Surface water fluctuations of this magnitude are typical for water supply reservoirs and are part of the typical hydrologic conditions for wetlands occurring on the fringes of water supply reservoirs. Furthermore, the seed bank and root stock of the fringe wetlands are typically robust and would not be anticipated to be permanently impacted by up to one growing season of lowered reservoir elevations.

Additionally, because the temporary shutdown of the RWBT would only commence in non-drought conditions, it is anticipated that the Bog Brook Reservoir, its watershed, and the fringe wetlands of Bog Brook Reservoir would still receive rainfall and runoff in amounts consistent with typical (i.e., non-drought) conditions. Upon refilling of Bog Brook Reservoir, the fringe wetlands would be anticipated to return to their typical condition. Therefore, WSSO would not result in significant adverse impacts to wetlands in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (e.g., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. The potential mechanism for disturbing potentially existing hazardous materials within the Bog Brook Reservoir Study Area would be through excessive erosion. While reservoir elevations could vary temporarily from typical operations during the shutdown, erosion of reservoir banks is not anticipated (see Geology and Soils in Section 10.5.6.10, “Natural Resources”). Therefore, WSSO would not result in significant adverse impacts to hazardous materials in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls in the study area. While water surface elevations would be lower than typical, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.5.6.10, “Natural Resources”). Further, WSSO would not include any construction that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.13 Energy

Water surface elevations at the Bog Brook Reservoir would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.14 Transportation

Water surface elevations in the Bog Brook Reservoir Study Area would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.15 Air Quality

While the reservoir has the potential to be drawn down more than typical and for a longer duration, the reservoir is drawn down regularly under typical operations. Regular drawdown limits the growth of macrophytes and aquatic vegetation, which would typically inhabit the reservoir shallows to about the top 10 feet of depth. Therefore, the banks are generally rocky with little vegetation. Vegetation is limited in deeper areas by low light conditions. Drawdown of the reservoir during WSSO would not result in objectionable odors or other air quality effects from decaying vegetation. Therefore, WSSO would not result in significant adverse impacts to air quality in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.16 Noise

Water surface elevations at the Bog Brook Reservoir Study Area would have no effect on noise levels in the vicinity of the reservoir. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.17 Neighborhood Character

The character of the Bog Brook Reservoir Study Area is largely defined by public service/utility, residential, commercial, and vacant land uses, as well as its physical setting within a rural area (see **Figure 10.5-15**). The Reservoir was formed by impounding the Bog Brook, a small tributary to the East Branch Croton River. Releases flow to the continuation of Bog Brook, which flows southwest from the reservoir in the study area to join with the East Branch Croton River.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP's understanding that no changes in land use and no new developments or structures are anticipated within the Bog Brook Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the study area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the Bog Brook Reservoir Study Area was not warranted. As described in Section 10.5.6.3, "Land Use, Zoning, and Public

Policy," Section 10.5.6.4, "Socioeconomic Conditions," Section 10.5.6.8, "Historic and Cultural Resources," Section 10.5.6.14, "Transportation," and Section 10.5.6.16, "Noise," an impact analysis for the Bog Brook Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; transportation; or noise.

As described in Section 10.5.6.6, "Open Space and Recreation," WSSO activities would be short-term and would result in a temporary change in open space and recreation during the RWBT temporary shutdown and during WSSO operations. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the Bog Brook Reservoir Study Area and no further analysis is warranted. As described in Section 10.5.6.9, "Visual Resources," WSSO activities effects to visual resources would be temporary and minor.

Water surface elevations at the Bog Brook Reservoir Study Area would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historical and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.6.18 Public Health

While Bog Brook Reservoir would be drawn down lower than typical, the reservoir would not be stagnant. Flow would continue through the reservoir from inflows into the reservoir and releases downstream to meet minimum releases and supply drinking water for the City. There would be no increase in potential for mosquito breeding at the reservoir. Additionally, Bog Brook Reservoir is a headwater reservoir in the Croton System and as such, removed from the terminal reservoir (New Croton Reservoir). While an increase in turbidity associated with the drawdown is not anticipated, any turbid water would have time to dissipate as it makes its way down through the system. In addition, water would be treated at the Croton Water Filtration Plant. Additionally, there would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from water surface elevations at the Bog Brook Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to public health in the Bog Brook Reservoir Study Area and no further analysis is warranted.

10.5.7 Bog Brook Downstream of Bog Brook Reservoir Study Area Impact Analysis

10.5.7.1 Study Area Location and Description

Bog Brook downstream of Bog Brook Reservoir flows approximately 0.3 mile through the Town of Southeast, Putnam County, New York (see **Figure 10.5-20**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, making it popular for recreational fishing, but it is not stocked with trout. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the Bog Brook is Class A(T).

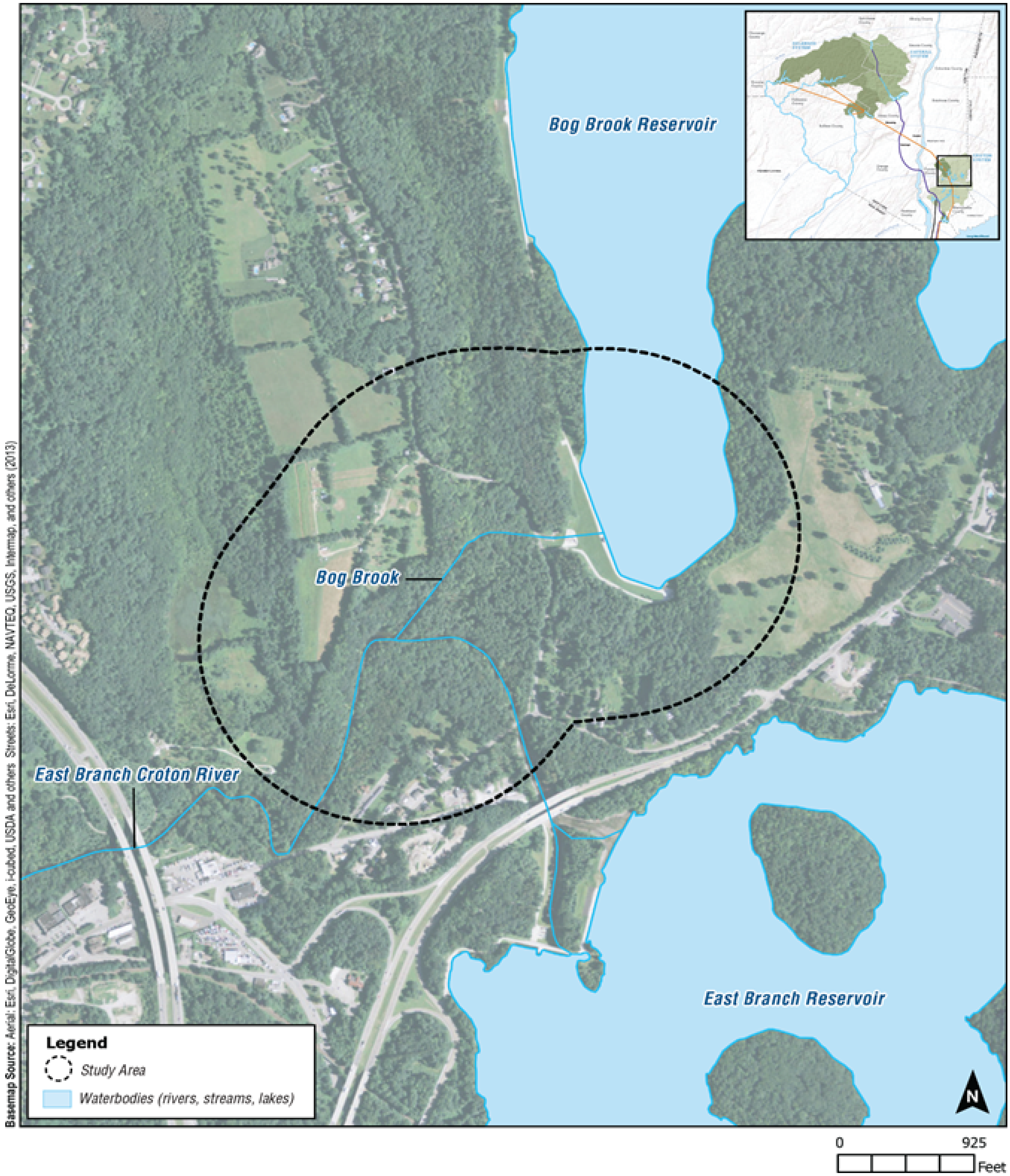


Figure 10.5-20: Bog Brook Downstream of Bog Brook Reservoir Study Area

10.5.7.2 Study Area Evaluation

Under typical operations, DEP releases the minimum flow of 5 mgd from Bog Brook Reservoir as required under 6 NYCRR Part 672-3, which would be unchanged during the RWBT temporary shutdown. Further, because there is no primary spillway, there are no reservoir spills. Therefore, modeled flows are the same under both typical operations and WSSO. There would be no significant adverse impacts to Bog Brook downstream of Bog Brook Reservoir from WSSO and no further analysis is warranted.

10.5.8 EAST BRANCH RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.8.1 Study Area Location and Description

Located in the Town of Southeast, Putnam County, New York, East Branch Reservoir (also known as Sodom Reservoir) was formed by impounding the East Branch Croton River (see **Figure 10.5-21**). The reservoir receives water from the East Branch Croton River. East Branch Reservoir is connected by a tunnel to Bog Brook Reservoir, so water flows freely between the two, and water surface elevations fluctuate in concert. Releases and spills flow into the continuation of the East Branch Croton River, which flows to the Croton Falls Diverting Reservoir, and eventually into the New Croton Reservoir in Westchester County. East Branch Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is popular for recreational fishing, but it is not stocked with trout. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at East Branch Reservoir. The water quality classification for West Branch Reservoir is Class AA throughout its entire length. While East Branch Reservoir serves the City’s customers as part of the larger Croton System, no local communities draw directly from the reservoir.

10.5.8.2 Study Area Evaluation

Under typical operations, DEP operates East Branch Reservoir by meeting the required minimum releases, allowing the reservoir to spill freely when water surface elevations are above the spillway. In addition, supplemental releases from the reservoir can be used to maintain reservoir storage, and thus maintain pump station operation, at Croton Falls Reservoir during droughts.[53] Therefore, reservoir drawdown can vary substantially under typical operations, approaching dead storage during droughts (see **Table 10.5-5**). Due to this regular drawdown, the banks are rocky and reinforced with riprap in some locations. East Branch Reservoir was drawn down less when the Croton System was offline from 2005 to 2015, as described previously. Water surface elevations are expected to fluctuate more now that the Croton Water Filtration Plant is online.

[53] Releases from East Branch Reservoir can be routed to Croton Falls Reservoir via the Croton Falls Diverting Reservoir.

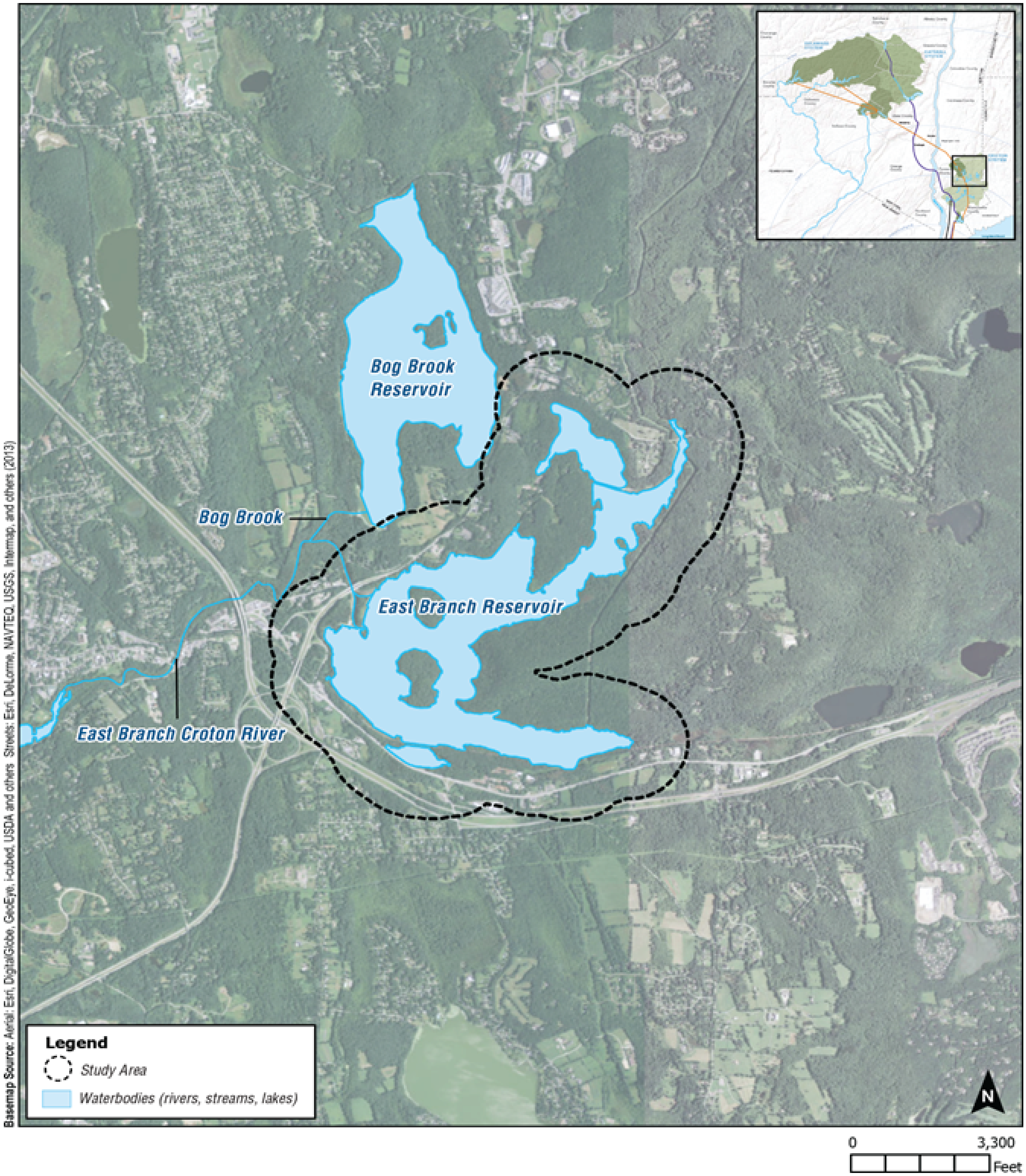


Figure 10.5-21: East Branch Reservoir Study Area

NYC Environmental Protection

Table 10.5-5: East Branch Reservoir Historical Drawdowns

Start Date	End Date	Max Drawdown Water Surface Elevation (Feet)	Average Drawdown Water Surface Elevation (Feet)	Duration (Months)
Jan-04	May-05	372	394	16
Sep-01	Feb-03	357	390	18
Jul-95	Jan-96	384	398	7
Jun-85	Jan-86	383	396	8
Sep-80	Apr-81	358	388	8
Note: Spillway water surface elevation is 416.50 feet; dead storage water surface elevation is 351.60 feet.				

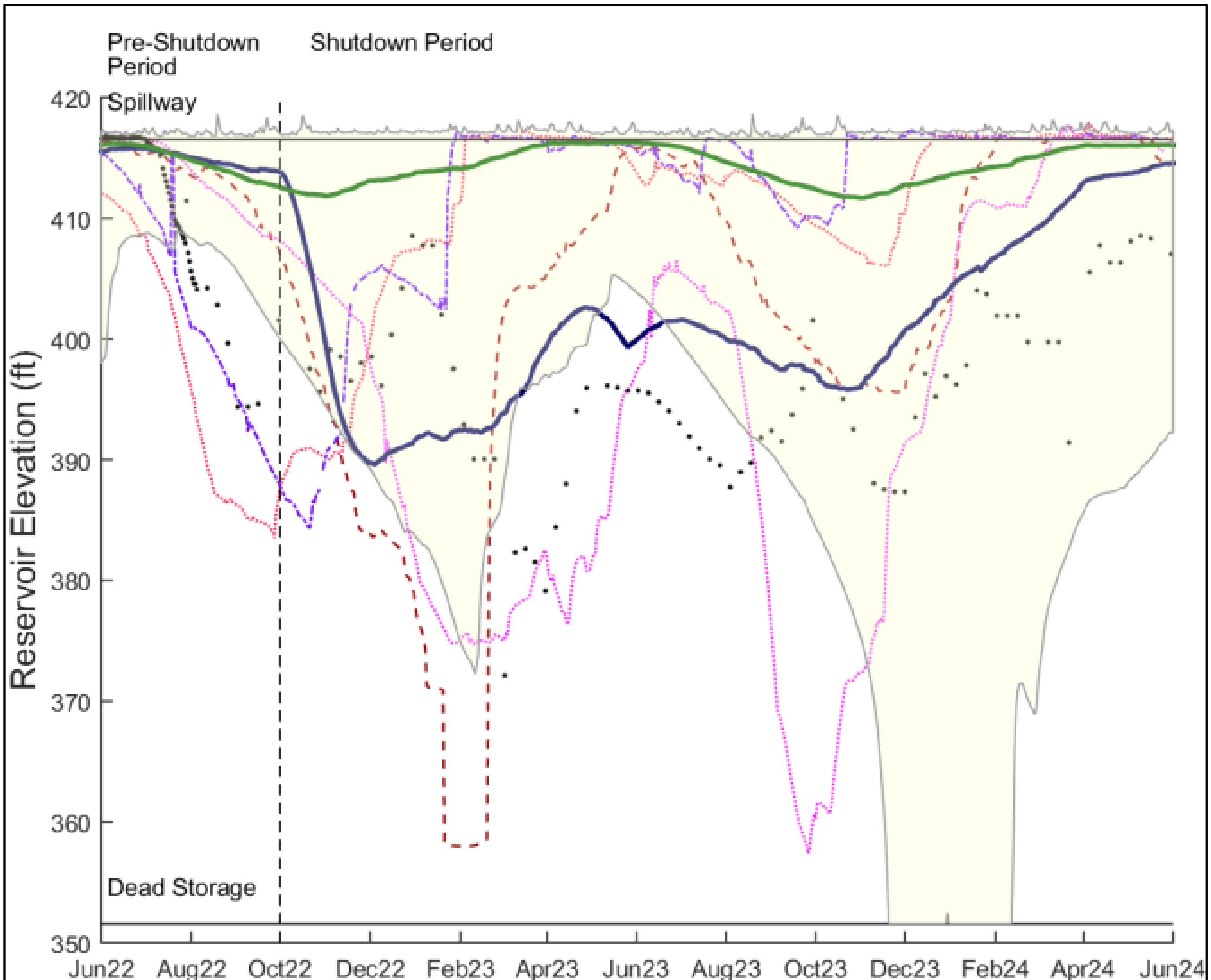
During pre-shutdown operations, water surface elevations would remain within 1 foot of typical operations (see **Figure 10.5-22**). During the temporary shutdown operations, DEP would utilize the Croton Falls Pump Station to augment flow to Kensico Reservoir. Therefore, East Branch Reservoir releases would be higher than typical to maintain water surface elevation in Croton Falls Diverting Reservoir and supply Croton Falls Reservoir. Due to higher releases, the reservoir would be drawn down up to approximately 22 feet more than typical based on comparison of the dataset means (see **Figure 10.5-22**). East Branch Reservoir would recharge gradually after the end of the temporary shutdown and would not return to typical conditions for up to approximately 10 months after the end of the temporary shutdown of the RWBT.

While the level of drawdown anticipated for East Branch Reservoir is not unprecedented, the reservoir has not experienced sustained drawdown in many years. Therefore, additional analysis of the potential for impacts was warranted for East Branch Reservoir.

10.5.8.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Water surface elevation changes from WSSO would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because changes in elevations would be temporary, WSSO activities would not physically displace or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning in the East Branch Reservoir Study Area and no further analysis is warranted.

The consistency of water surface elevation changes as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in reservoir water surface elevation. Therefore, WSSO would not result in significant adverse impacts to public policy in the East Branch Reservoir Study Area and no further analysis is warranted.



Note: DEP began recording East Branch Reservoir elevations weekly beginning in 2003.

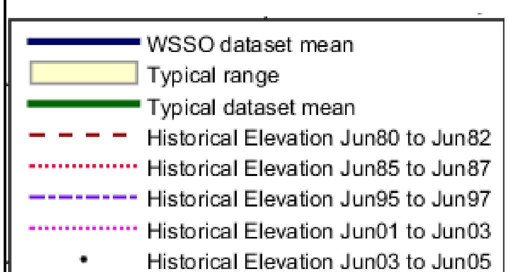


Figure 10.5-22: Elevation Dataset Mean and Range for Typical Operations and WSSO – East Branch Reservoir Study Area (Sheet 1)

		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	416	406	417	416	0
	July	415	409	417	415	0
	August	414	408	417	415	1
	September	413	403	417	414	1
Shutdown Period	October	412	397	417	408	-4
	November	412	392	417	393	-19
	December	413	386	417	391	-22
	January	414	380	417	392	-22
	February	415	379	417	393	-22
	March	416	396	417	396	-20
	April	416	398	417	402	-14
	May	416	405	417	401	-15
Post-shutdown Period	June	416	402	417	401	-15
	July	415	397	417	401	-14
	August	414	392	417	399	-15
	September	413	388	417	398	-15
	October	412	380	417	396	-16
	November	412	362	417	398	-14
	December	413	352	417	402	-11
	January	414	352	417	406	-8
	February	415	362	417	408	-7
	March	416	380	417	411	-5
	April	416	387	417	413	-3
	May	416	390	417	414	-2

Figure 10.5-22: Elevation Dataset Mean and Range for Typical Operations and WSSO – East Branch Reservoir Study Area (Sheet 2)

10.5.8.4 Socioeconomic Conditions

WSSO would not result in changes to socioeconomic conditions from direct or indirect population changes, displacement of residences and/or businesses, availability of housing stock, utility increases, or other changes to the regional economy. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.5 Community Facilities and Services

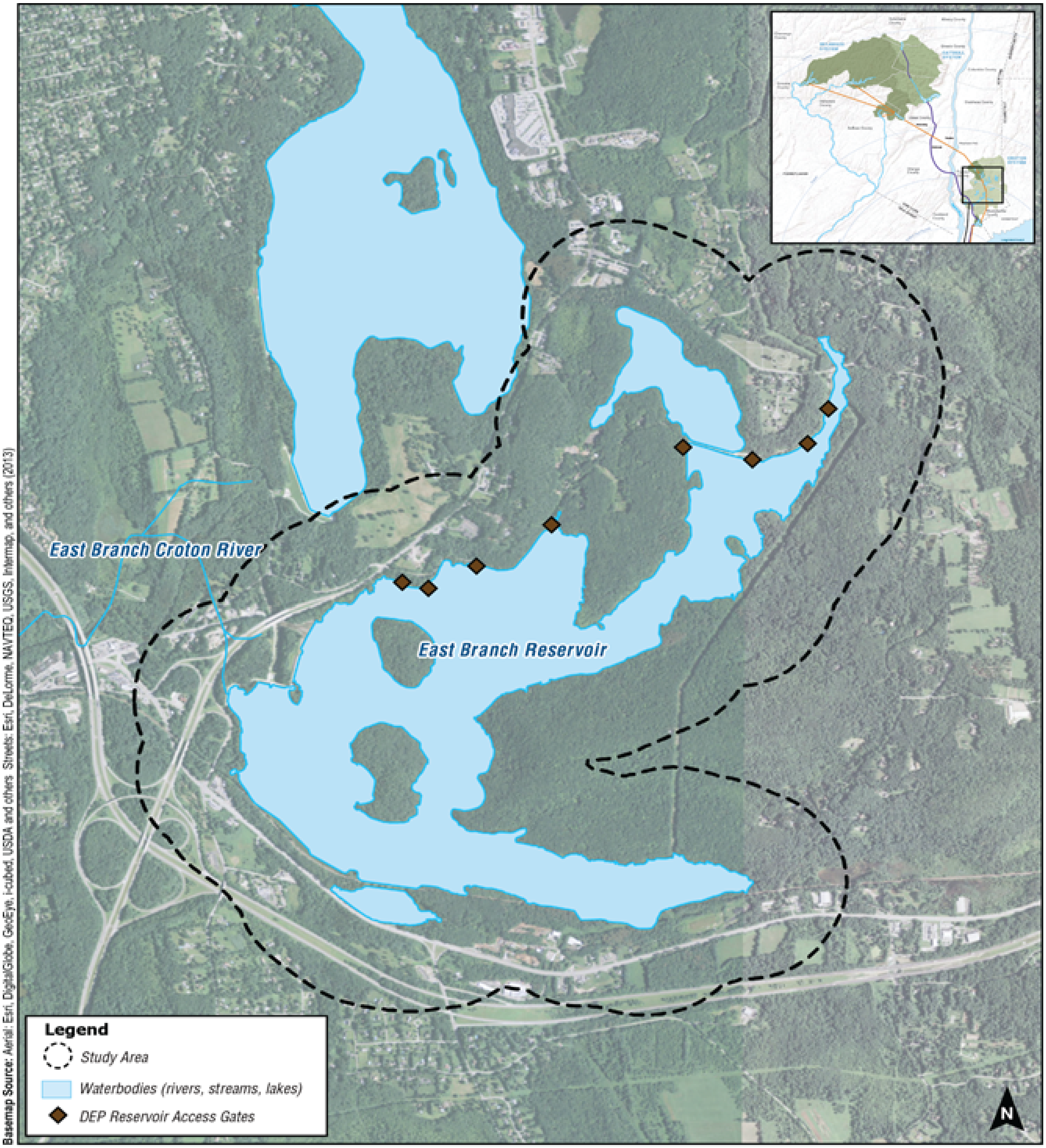
There would be no construction from WSSO in this study area. Further, reduced water surface elevations as a result of WSSO would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.6 Open Space and Recreation

East Branch Reservoir and surrounding watershed lands provide recreational opportunities in the form of fishing (boating is allowed for the purposes of fishing). Eight DEP-owned and operated gates provide recreational users year-round shoreline and water access for the approximately 525-acre reservoir (see **Figure 10.5-23**). The fish community is dominated by a mix of both coolwater and warmwater species and includes abundant species sought after by anglers (e.g., walleye [*Sander vitreus*], largemouth bass [*Micropterus salmoides*], smallmouth bass [*Micropterus dolomieu*], yellow perch [*Perca flavescens*], white perch [*Morone Americana*], black crappie [*Pomoxis nigromaculatus*], and bluegill [*Lepomis macrochirus*]). Fishing is conducted from both the shoreline and from non-motorized boats. DEP provides boat storage for use in the reservoirs at designated locations along the shoreline, and boats are launched from the shoreline or from designated boat launches. Combined, there are approximately 270 boats currently stored at East Branch Reservoir.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the East Branch Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Use of identified open spaces is anticipated to continue. Therefore, in the future without WSSO, it is assumed that the recreational and open space use of East Branch Reservoir would be the same as baseline conditions.

During the temporary shutdown, reservoir drawdown could create difficulties for launching and retrieving recreational boats, which could inhibit boating/fishing opportunities for anglers that have boats stored at East Branch Reservoir. However, fishing from the shore would still be possible under drawdown conditions. If permitted boat users wanted to move boats to another reservoir, they would need to follow DEP protocol for obtaining new permits and washing boats before moving boats to a different reservoir. Restrictions at some DEP reservoirs and the potential backlog from numerous users seeking new permits could also inconvenience anglers that have boats stored at East Branch Reservoir. Reservoir drawdown could affect ice formation,



Notes: Only Open spaces that immediately abut waterbodies were analyzed.
DEP has designated a narrow band of property along certain sections of the reservoir for fishing by permit, accessible only through designated access gates. Due to the map scale this open space is not shown.

Figure 10.5-23: Open Space and Recreation Resources – East Branch Reservoir Study Area

potentially restricting ice fishing opportunities during the winter of the RWBT temporary shutdown. Temporary inconveniences to boating for the purpose of fishing anticipated during WSSO would be similar to those that occurred during historical drawdowns of a similar magnitude (see **Table 10.5-5**).

DEP outreach efforts would serve to notify recreational users of potential changes to reservoir access in advance of the RWBT temporary shutdown, as is standard for planned changes at DEP reservoirs. Notifications would disclose any special regulations required during the temporary shutdown.

Reservoir drawdown could also adversely affect fish populations, which would in turn reduce the quality of angling for a similar duration of time (see Aquatic and Benthic Resources in Section 10.5.8.10, "Natural Resources"). This loss could involve sub-adult and adult fish, which are the size ranges regulated by NYSDEC and targeted by anglers.

During WSSO, temporary effects to open space and recreation are anticipated in the form of reduced recreational boat access and reduced fishing opportunities for up to 18 months of sustained drawdown. However, no significant adverse impacts to open space and recreation would be expected to fishing opportunities or long-term recreational usage. Therefore, WSSO would not result in significant adverse impacts to open space and recreation in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.7 Critical Environmental Areas

There is one CEA within the 0.25-mile buffer area around East Branch Reservoir, known as the Great Swamp. The Great Swamp is a low-lying area that captures groundwater and surface water from the surrounding watersheds. Its total drainage area is approximately 100 square miles. The East Branch Croton River is the lowest point in the CEA at the southerly edge of the Great Swamp, which terminates approximately 2,000 feet north of the northernmost edge of East Branch Reservoir (see **Figure 10.5-24**). While water surface elevations for the reservoir would be lower than typical, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.5.8.10, "Natural Resources"). Therefore, WSSO would not result in significant adverse impacts to CEAs in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.8 Historic and Cultural Resources

There would no construction from WSSO in the East Branch Reservoir Study Area. The potential mechanism for disturbing potential historic or cultural resources would be through erosion. While water surface elevations would be lower than typical, these changes are not anticipated to result in widespread erosion (see Geology and Soils in Section 10.5.8.10, "Natural Resources").

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no effect upon cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the East Branch Reservoir Study Area and no further analysis is warranted.

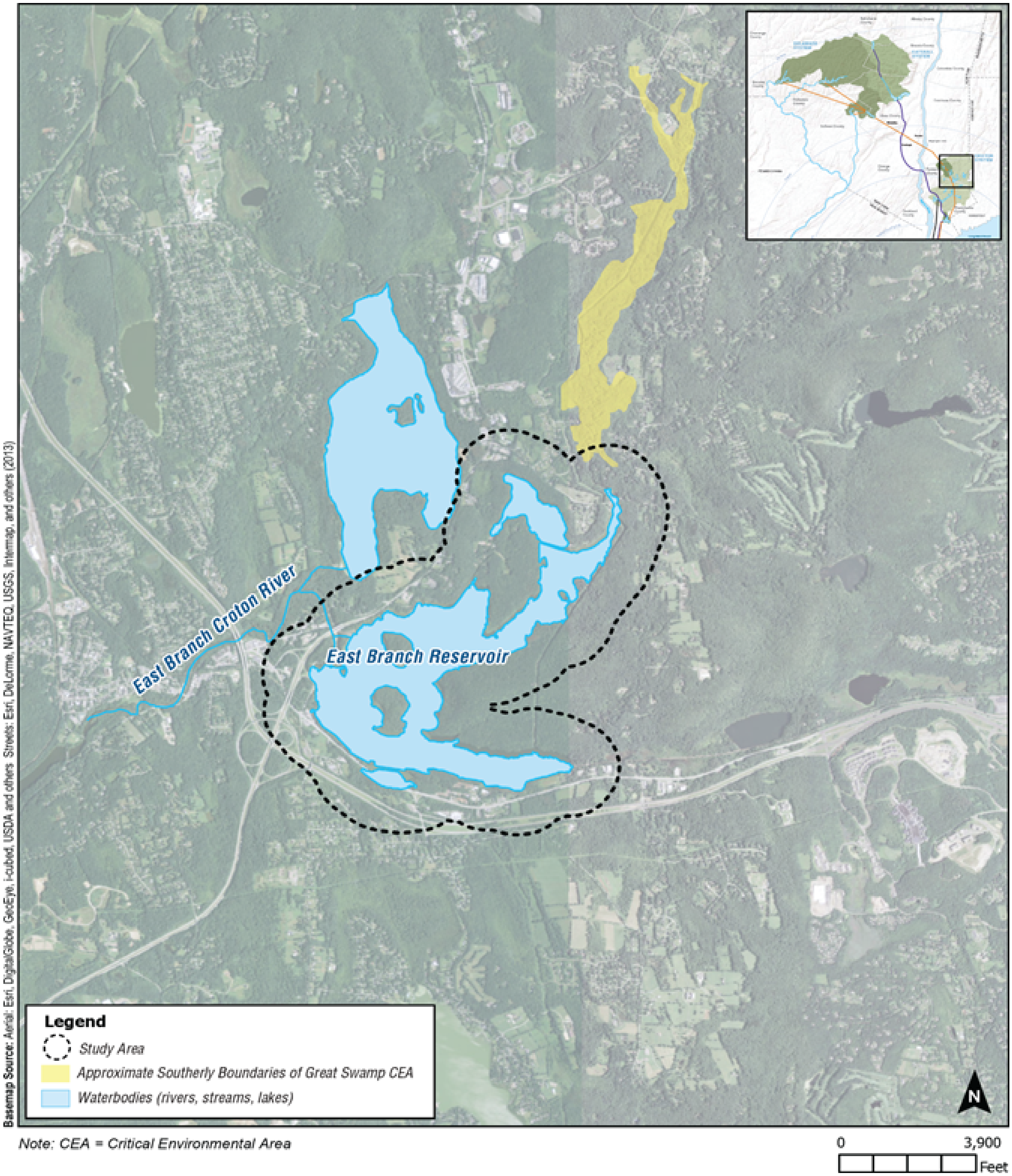


Figure 10.5-24: Critical Environmental Areas – East Branch Reservoir Study Area

10.5.8.9 Visual Resources

The boundaries of East Branch Reservoir Study Area extend 0.25 mile beyond the reservoir, but could also include view corridors to the reservoir beyond this radius. Based on these criteria, visual resources, consisting of: three sites eligible for listing on the National and/or State Register of Historic Places, two locally significant resources, four local landmarks, and two local historic districts were identified, as shown in **Figure 10.5-25** and described below.

The structures that are eligible for listing under the State or National Register of Historic Places are the Sodom Road Bridge, a Greek Revival Farmhouse (also known as the Yale House, a local landmark), and East Branch Reservoir Dam (also known as Sodom Reservoir Dam, part of the Croton System of the New York City Water Supply System). The four local landmarks include Budd's Tavern, Stonehenge-Howes Residence, Yale House, and the Edith Diehl House. The two local resources include two reservoirs, Bog Brook and East Branch. The two local historic districts are the Milltown Area Historic District, along Milltown Road (including Budd's Tavern) and the Starr Ridge Road Historic District, along Starr Ridge Road.

East Branch Reservoir is surrounded by forested watershed lands, limiting reservoir views from these visual resources. The East Branch Reservoir Dam is the only visual resource with unobstructed views of East Branch Reservoir. However, the dam is not open to the public and does not warrant further analysis. Recreational users with valid permits would have direct views of East Branch Reservoir.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP's understanding that no new developments or structures that would alter views from visual or aesthetic resources are anticipated within the East Branch Reservoir Study Area within the timeframe of the impact analysis. Natural processes such as changes in habitat due to natural vegetative succession, are anticipated to continue. Therefore, in the future without the temporary shutdown, it is assumed that visual resources within the East Branch Reservoir Study Area would be the same as baseline conditions.

As previously discussed, WSSO would result in lower than typical water surface elevations in the reservoir. These operations would be temporary in nature and, as noted above, the views from the Sodom Road Bridge, Yale House, Budd's Tavern, Stonehenge-Howes Residence, Edith Diehl House, and the Milltown Area and Starr Ridge Road Historic Districts would be limited and partially obstructed due to the mature forests surrounding the reservoir. Any temporary alterations to views of these resources are not anticipated to adversely impact the use or enjoyment of the visual resources.

As noted above, East Branch Reservoir is a local visual resource that provides recreational shoreline fishing and non-motorized boat fishing to the public with a DEP watershed access permit. Recreational users of the East Branch Reservoir would be expected to have unobstructed views of the reservoir with potential lower water levels. However, these would be temporary in nature, with views restored to baseline conditions following completion of WSSO activities. Temporary effects to visual resources anticipated during WSSO would be similar to those that occurred during historical drawdowns of a similar magnitude (see **Table 10.5-5**). Views during these events consisted of large expanses of dry, rocky soil around the edge of the reservoir.

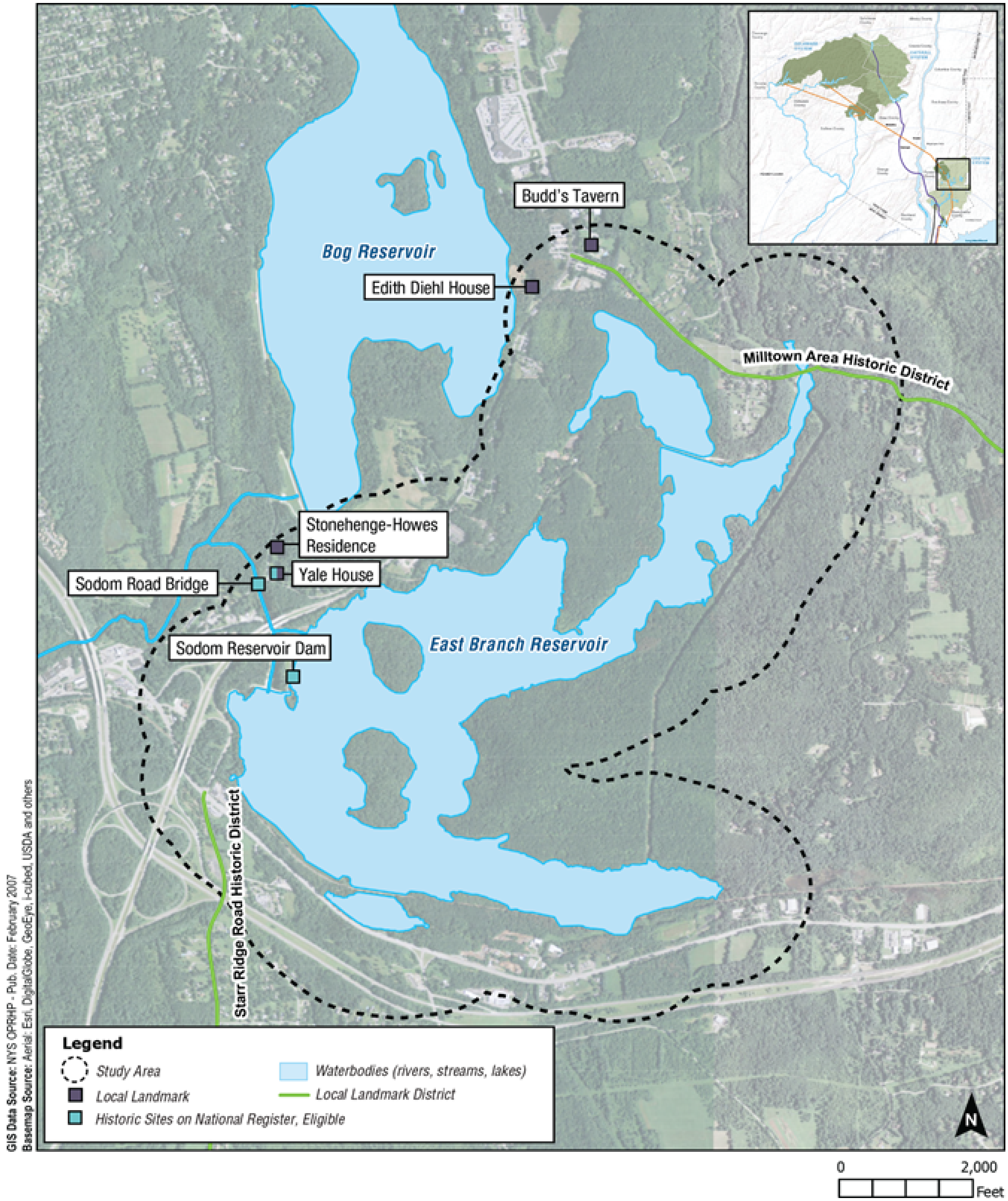


Figure 10.5-25: Visual Resources – East Branch Reservoir Study Area

Effects to visual resources would be temporary and minor. Therefore, WSSO would not result in significant adverse impacts to visual resources in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.10 Natural Resources

The potential for impacts to natural resources from WSSO within the East Branch Reservoir Study Area is discussed below.

Geology and Soils

The banks of East Branch Reservoir are rocky and reinforced with riprap in some locations to prevent erosion from frequent fluctuations in reservoir elevations under typical operations. Because of regular drawdown, deposited sediment is regularly transported to deeper sections of the reservoir during refill. Sustained drawdown during WSSO would not result in erosion above what could occur under typical reservoir operations. No changes to geology or soils at East Branch Reservoir are anticipated from the reservoir drawdown. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the East Branch Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities at the East Branch Reservoir Study Area were conducted. The NYNHP database results show one significant natural community, a red maple-hardwood swamp, as occurring in the study area. In the future without WSSO, it is assumed that ecological communities within the study area, including the red maple-hardwood swamp, would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession.

During the temporary shutdown when water surface elevations are low, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor but would not be anticipated to be significantly affected by the drawdown. Temporary effects to ecological communities anticipated during WSSO would be similar to those that occurred during historical drawdowns of a similar magnitude (see **Table 10.5-5**). Minor effects to ecological communities due to WSSO would be temporary and natural regenerative processes would be expected to be sufficient to re-establish baseline conditions. These temporary effects would also occur at the interface of the red maple-hardwood swamp and East Branch Reservoir. However, the hydrology of this swamp is primarily fed via the East Branch of the Croton River with a flow upstream of East Branch Reservoir would be unaffected. The temporary drawdown of the reservoir during WSSO would not result in changes to ecological communities in the vicinity of the East Branch Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the East Branch Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary drawdown of East Branch Reservoir would not result in significant changes within the study area to critical wildlife habitat, wildlife movement, or its ability to forage or breed. As discussed, the reservoir draw down would result in a temporarily altered shoreline. These temporary changes would not prevent terrestrial wildlife from using the reservoir for behaviors such as foraging or breeding. The drawdown is not anticipated to result in significant effects on the fish community (see Aquatic and Benthic Resources in Section 10.5.8.10, “Natural Resources”). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the reservoir would still have a source of prey in the reservoir. Therefore, WSSO would not result in significant adverse impacts to wildlife in the East Branch Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the East Branch Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the East Branch Reservoir Study Area include the following: Blocks 6158A, 6158B, 6158C, and 6158D. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the East Branch Reservoir Study Area include the Brewster Quadrangle. In total, these sources identified species with the potential to occur in the East Branch Reservoir Study Area. Baseline ecological information and assessments for the East Branch Study Area for federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species are shown in **Table 10.5-6**.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Amphibians and Reptiles				
Blue-spotted salamander (*Ambystoma laterale*)	None	Special Concern	Blue-spotted salamanders inhabit damp deciduous and deciduous/coniferous forests containing temporary ponds at a variety of elevations (Gibbs et al. 2007). They are often found where soils have high sand or loam content and can tolerate disturbance in suburban areas. Blue-spotted salamander do not inhabit open water environments. The blue-spotted salamander is an early breeder (i.e., March and April) and spends most of its lifecycle underground. Blue-spotted salamanders do not require large open water environments for any part of their natural history.	The habitat for blue-spotted salamander is forested habitat upland of East Branch Reservoir and would not be affected as a result of the drawdown. Therefore, no effects to blue-spotted salamanders are anticipated and no further analysis for blue-spotted salamanders is warranted for this study area.
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Bog turtles prefer fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and mucky. Vegetation commonly includes calciphile species. Vegetation is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of core bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require large open water environments for any part of their natural history.	Desktop assessments of wetlands occurring in the study area were conducted. Wetlands in the study area with a water table connected to the reservoir may experience minor temporary effects to wetland vegetation resulting from reservoir drawdown. Any wetlands that share a water table with the reservoir would have historically experienced fluctuating conditions. Fluctuating water tables are not typical of suitable bog turtle habitat (Feaga et al. 2012). Drawdown of the reservoir would not influence other wetlands in the study area that are not hydrologically connected to the reservoir and that potentially contain suitable bog turtle habitat. Therefore, no effects to bog turtles are anticipated and no further analysis for bog turtles is warranted for this study area.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats from forests with sandy, well-drained soils, dry open uplands such as meadows, pastures, open fields, and utility right-of-ways, to moist lowlands and wetlands. They are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtles do not require large open water environments for any part of their natural history.	Potential upland habitat adjacent to the reservoir would not be affected by the drawdown in East Branch Reservoir during WSSO. Therefore, no effects to eastern box turtles are anticipated and no further analysis for eastern box turtles is warranted for this study area.
Jefferson Salamander (*Ambystoma jeffersonianum*)	None	Special Concern	Jefferson salamanders inhabit large tracts of upland deciduous and mixed deciduous/coniferous forest with abundant stumps and logs, but also occur in bottomland forests that border agricultural or otherwise disturbed areas. The Jefferson salamander spends the majority of its lifecycle underground and relies on the tunnels created by burrowing small mammals. Jefferson salamanders breed early in the year (i.e., March and April). They are broadly distributed in south-central New York. Jefferson salamander do not require open water environments for any part of their natural history.	The upland forested habitat Jefferson salamander could inhabit would not be affected as a result of the drawdown. Therefore, no effects to Jefferson salamanders are anticipated and no further analysis for Jefferson salamanders is warranted for this study area.
Southern leopard frog (*Lithobates sphenocephala utricularius*)	None	Special Concern	Southern leopard frogs mostly inhabit open grasslands and wet meadows or shallow wetlands. After the breeding season, they could move to upland areas where shade is prevalent and where moisture is found in upland pools and puddles (Gibbs et al. 2007). Southern leopard frog do require open water environments for their natural history.	Southern leopard frog habitat could be present at the fringes of the reservoir where any unhardened habitats exist. These fringe areas could be affected by the drawdown of East Branch Reservoir. Therefore, potential impacts to southern leopard frogs were assessed for this study area.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Spotted turtle (*Clemmys guttata*)	None	Special Concern	Spotted turtle habitat consists of vernal pools in the spring, upland forest for part of summer after pools dry out, and wet meadows, forested swamps, or sphagnum bogs for overwintering. They are strongly associated with pools that are shallow, have clear water, and have a muddy substrate. In winter, spotted turtles could inhabit abandoned mammal lodges or burrows or under the roots of flooded shrubs and trees, and could congregate with bog turtles or snapping turtles during this time (Gibbs et al. 2007). Spotted turtle do not require large open water environments for any part of their natural history.	Wetlands that could contain suitable spotted turtle habitat occur adjacent to East Branch Reservoir. These wetlands could experience minor alteration to the water table if the water table is connected to the reservoir. A lowered water table could result in stressed herbaceous vegetation, thus WSSO could potentially have an effect on spotted turtle habitat. Therefore, potential impacts to spotted turtles were assessed for this study area.
Wood turtle (*Glyptemys insculpta*)	None	Special Concern	Wood turtles have large home ranges and typically inhabit riverside or streamside environments bordered by woodlands or meadows and utilize open sites with low canopy cover. Individuals bask along stream banks and hibernate in creeks (Gibbs et al. 2007). Wood turtles do not require large open water environments for any part of their natural history.	The drawdown would not affect the flow of any streams that are tributaries to East Branch Reservoir which could be potential suitable wood turtle habitat. Therefore, no effects to wood turtles are anticipated and no further analysis for wood turtles is warranted for this study area.
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments for their natural history.	The temporary East Branch Reservoir drawdown would have temporary effects on the reservoir's fishery and Bald Eagle foraging habitat. Therefore, potential impacts to Bald Eagles were assessed for this study area.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Cooper's Hawk (*Accipiter cooperii*)	None	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests, but they are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require open water environments for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to East Branch Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.
Northern Goshawk (*Accipiter gentilis*)	Protected - MBTA	Special Concern	Northern Goshawk habitat in New York consists of mature deciduous, coniferous, and mixed deciduous-coniferous forests with a relatively open understory. It is also found nesting in mature conifer plantations. Northern Goshawks prey primarily on mature birds and small mammals, but is also an opportunistic feeder and will take insects and fledglings depending on prey availability (Crocoll 2008). Northern Goshawk do not require open water environments for any part of their natural history.	Northern Goshawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to East Branch Reservoir would not affect any Northern Goshawk habitat, breeding, or foraging. Therefore, no effects to Northern Goshawks are anticipated and no further analysis for Northern Goshawks is warranted for this study area.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-shouldered Hawk (*Buteo lineatus*)	Protected - MBTA	Special Concern	In New York, Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas or flooded swamps/wetlands. Breeding Bird Atlas data show a steady increase in Red-shouldered Hawk populations, particularly in the Hudson River, as farmland reverts back to forest, resulting in increased habitat. Red-shouldered Hawks occasionally nest in suburban areas where forest cover is less contiguous. Migration and wintering habitats are similar to breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Crocoll 2008). Red-shouldered Hawks do not require open water environments for any part of their natural history.	Drawdown in East Branch Reservoir would not affect Red-shouldered Hawk habitat adjacent to the reservoir or affect any breeding or foraging behaviors. Therefore, no effects to Red-shouldered Hawks are anticipated and no further analysis for Red-shouldered Hawks is warranted for this study area.
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize open water environments for foraging and migrating when they are available.	Indiana bats have the potential to utilize East Branch Reservoir for migration and foraging purposes. Drawdown of East Branch Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.

Table 10.5-6: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the East Branch Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
New England Cottontail (*Sylvilagus transitionalis*)	None	Special Concern	New England cottontail is known only to occur east of the Hudson River. This species prefers early successional habitat with dense vegetation generally associated with abandoned agricultural fields, wetlands, clear cuts of woodlands, utility right-of-ways, and other disturbed areas with shrubs and early successional vegetation (Arbuthnot 2008). New England cottontail do not require open water environments for any part of their natural history.	The drawdown would not be anticipated to affect dense woody vegetation typical of New England cottontail habitat that occurs in areas adjacent to the reservoir. Woody vegetation could experience reduced vigor due to a lowered water table but would not lose its ability to provide cover and food for New England cottontail. Therefore, no effects to New England cottontails are anticipated and no further analysis for New England cottontails is warranted for this study area.
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees that are 3 inches or more in diameter. These bats are opportunistic and will also roost in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize open water environments for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize East Branch Reservoir for migration and foraging purposes. Drawdown of East Branch Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act
MBTA: Migratory Bird Treaty Act

Following the initial analysis, three species were identified as having the potential to be affected by changes in reservoir water surface elevations at East Branch Reservoir that would occur as a result of WSSO. Therefore, an impact analyses for each of these species is provided below.

Southern Leopard Frog (Lithobates sphenocephala utricularius)

Southern leopard frog (*Lithobates sphenocephala utricularius*) was identified as having the potential to occur in the study area by the NYSDEC Herp Atlas. Southern leopard frogs utilize a variety of aquatic habitats such as shallow emergent marshes, shrub swamps, sedge meadows, and eutrophic ponds (NYNHP 2015). Aquatic vegetation is usually associated with these habitats. The shoreline of East Branch Reservoir is primarily hardened with riprap. Southern leopard frogs would not be anticipated to utilize these hardened areas for foraging, resting, reproduction, or hibernation. Suitable habitats could be present at the softer fringe areas of the reservoir shoreline. In the future without WSSO, East Branch Reservoir would be operated under typical conditions and it is assumed that southern leopard frogs, if present, would continue to utilize the softened reservoir fringe for foraging, reproduction, resting, and hibernation.

In the future with WSSO, East Branch Reservoir would have a lower than typical surface water elevation for the duration of the temporary shutdown and the following growing season. The softened reservoir fringe areas would potentially have their hydrology affected by the drawdown of East Branch Reservoir. Southern leopard frog, if present, would be unable to use these habitats for this duration. However, ample suitable habitat occurs in the areas adjacent to East Branch Reservoir. The drawdown would occur prior to southern leopard frog hibernation and therefore southern leopard frogs, if present, would seek out other suitable habitat to hibernate in. This would cause southern leopard frogs to be more susceptible to predation. However, southern leopard frogs are known to frequently migrate between upland, mating, and hibernation sites. Therefore, WSSO may affect, but is not likely to adversely affect, southern leopard frog habitat, if present at the fringes of East Branch Reservoir, and no further analysis is warranted.

Spotted Turtle (Clemmys guttata)

Spotted turtle (*Clemmys guttata*) was identified as having the potential to occur in the study area by the NYSDEC Herp Atlas. Spotted turtles would not utilize the open water habitat of East Branch Reservoir or the hardened riprap shoreline, but they could inhabit small ponds or vernal pools, marshes, bogs, or small woodland streams if they occur in the study area. Herbaceous vegetation is typical of habitat surrounding these preferred aquatic systems and the substrates of the aquatic systems are typically soft or vegetated. There are wetlands around the perimeter of East Branch Reservoir in which suitable spotted turtle habitat could occur. These wetlands could share a water table with East Branch Reservoir. In the future without WSSO, East Branch Reservoir would be operated under typical conditions and spotted turtles, if present in the surrounding wetlands, would continue to utilize those habitats. In the future, it is assumed that these wetlands would largely remain the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession.

In the future with WSSO, East Branch Reservoir would have a lower than typical surface water elevation during the temporary shutdown and the following growing season. If the water table of the wetlands surrounding the reservoir were connected with the reservoir, then it could result in stresses to herbaceous vegetation in these wetlands such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. These changes to spotted turtle habitat would not result in direct, adverse effects to spotted turtles. There would still remain ample habitat in the wetlands for spotted turtles to forage, hibernate, mate, bask, and rest. Therefore, WSSO may affect, but is not likely to adversely affect, potential spotted turtle habitat and no further analysis is warranted.

Bald Eagle (Haliaeetus leucocephalus)

Breeding Bald Eagles (*Haliaeetus leucocephalus*) were identified by NYNHP as occurring within 1 mile of the East Branch Reservoir Study Area. East Branch Reservoir represents high quality habitat for Bald Eagles and provides ample foraging opportunities on the fisheries within the reservoir, as well as ample nesting, perching, and roosting habitat in the trees along the reservoir shoreline. In the future without WSSO, Bald Eagles, if present, would continue to utilize the reservoir and its surrounding area for foraging, mating and nesting, roosting, and perching.

In the future with WSSO, East Branch Reservoir would be drawn down beginning in the late fall when mating behaviors begin and would continue through the winter and following summer when Bald Eagles would be rearing eaglets. Bald Eagles most commonly forage in the shallows of open water environments such as East Branch Reservoir; however, in the winter they are known to forage more commonly over deeper open water. The drawdown would result in an altered shoreline, changing how the fish use the shallow areas of the reservoir. This drawdown would not cause significant adverse impacts to the fishery (see Aquatic and Benthic Resources in Section 10.5.8.10, “Natural Resources”). Both the shallows and open water areas of the reservoir would continue to be habitat for Bald Eagle prey species. If foraging in shallows during the drawdown, Bald Eagles would have a longer distance to locate prey and fly to from their shoreline perches. Therefore, drawdown as a result of WSSO at East Branch Reservoir may affect, but is not likely to adversely affect breeding, overwintering, or foraging Bald Eagles and no further analysis is warranted.

Based on the assessment results, there would be no significant adverse impacts to these species as a result of changes in reservoir water surface elevations at East Branch Reservoir. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the East Branch Reservoir Study Area and no further analysis is warranted.

Aquatic and Benthic Resources

East Branch Reservoir has a mean depth of approximately 33 feet and a maximum depth of approximately 60 feet in a small area near the dam. The reservoir has steep slopes within the basin near the dam and around islands, but extensive areas of shallow to moderate depths in coves. The reservoir has large islands which increase the total area of shoreline habitat.

The baseline fish community in the reservoir is dominated by a mix of coolwater and warmwater species and includes many species sought after by anglers. Walleye are common, but are not currently stocked by NYSDEC. Largemouth and smallmouth bass are abundant, as well as yellow perch, white perch, black crappie, and bluegill. Brown trout (*Salmo trutta*) also occur, but they are not among the most abundant species, because of limited coldwater habitat in the reservoir. Alewife (*Alosa pseudoharengus*) are abundant and provide forage for all of the predator fish in the reservoir.

In the future without WSSO, it is assumed that aquatic conditions in East Branch Reservoir would generally remain the same as baseline conditions and there would be no change from typical operations of the reservoir.

As described previously, changes could occur to the water surface elevation of the reservoir as a result of the temporary shutdown and drawdown of East Branch Reservoir. While water surface elevations would be lower than typical, they would be within the range of prior drawdown events (see **Table 10.5-5** and **Figure 10.5-22**). Drawdowns anticipated during WSSO could result in minor to moderate effects to aquatic resources due to the reduced habitat, partially exposed substrate, and reduced coldwater storage. This anticipated drawdown, which could persist for up to 18 months, would represent a seasonal reduction of habitat compared to typical operations. However, because East Branch Reservoir has modest drawdowns most years and extreme drawdowns occasionally, the drawdown anticipated during the temporary shutdown represents a minor change and temporary condition compared to typical operations.

During drawdown conditions under temporary shutdown scenarios, fish would be confined to a smaller area in the basin where they could be exposed to increased predation by piscivorous species because the small fish could be forced into unfavorable habitat conditions. Increased mortality could result during the winter because of colder temperatures in portions of the reservoir due to anoxic zones from the high concentration of fish, organic matter decomposition, and ice/snow cover, which prevents re-oxygenation of the smaller volume.

Many fish species, such as alewife, survive during winter in local reservoirs because they can retreat to deep water where temperatures stay at or above their low temperature tolerance limit. Fish mortality could occur if temperatures drop below these thresholds for survival. A temporary reduction of the alewife population, in particular, could in turn affect growth rates of the piscivorous species. Growth rates would return to typical as balanced fish and invertebrate communities are re-established The Great Swamp (upstream of East Branch Reservoir) would also likely be a source of many species to re-populate the reservoir.

Any benthic invertebrate community or habitat affected by the drawdown and subsequent partial exposure of the substrate would recover following a refill of the reservoir. This recovery has been observed in East Branch Reservoir following drawdown conditions comparable to those anticipated during the temporary shutdown. The benthic invertebrate community would recover at a faster rate than the fish populations due to faster growth rates.

The effects on fisheries and benthic species in the reservoir from WSSO would be similar to what has occurred historically under severe drawdown conditions in the reservoir under typical operations (see **Table 10.5-5** and **Figure 10.5-22**). Effects would be temporary, and natural regenerative processes would be expected to be sufficient to re-establish baseline conditions. Therefore, WSSO would not result in significant adverse impacts to aquatic resources in the East Branch Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.5.8.2, "Study Area Evaluation"), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the East Branch Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the East Branch Reservoir Study Area and no further analysis is warranted.

Floodplains

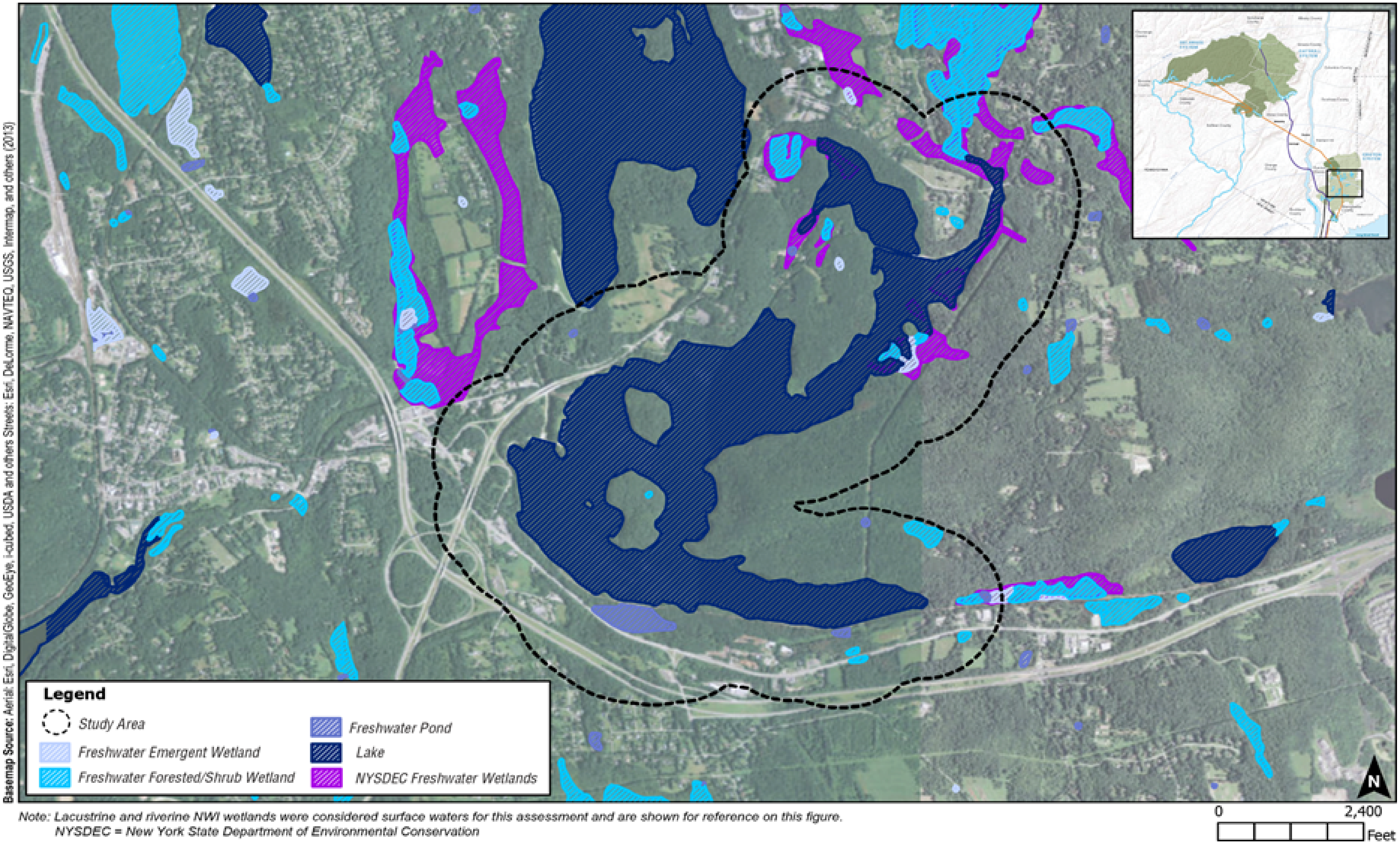
There would be no construction associated with WSSO in the East Branch Reservoir Study Area within existing floodplains. Lower than typical water surface elevations that would occur in the East Branch Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the East Branch Reservoir Study Area and no further analysis is warranted.

Groundwater

While the reservoir has the potential to be drawn down more than typical and for a longer duration, the reservoir can be drawn down similarly under typical operations. Further, based on USGS reports, the discharge from reservoirs to the groundwater system is small in comparison to the total groundwater recharge, indicating that reservoirs are not a major source of recharge (Wolcott and Snow 1995). Typically, groundwater movement is from hilltops to streams and reservoirs in the region. The hydraulic conductivity of the till deposits is small, and of the same order of magnitude or lower than reservoir bottom sediments. Therefore, it is likely that the flow rate of water to or from the reservoirs is primarily controlled by the properties of the underlying aquifers and not reservoir storage elevation (Mullaney 2004). Therefore, aside from minor changes to the surficial aquifer immediately adjacent to the reservoir, there would not be any widespread changes to groundwater from WSSO in the East Branch Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to groundwater in the East Branch Reservoir Study Area and no further analysis is warranted.

Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the East Branch Reservoir Study Area (see **Figure 10.5-26**). The study area extends 0.25 mile around the reservoir and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on East Branch Reservoir. There are 15 NYSDEC wetlands mapped within or intersecting the study area. The 15 NYSDEC wetlands cover approximately 485 acres and consist of 13 Class I wetlands and 2 Class II wetlands. There are 27 USFWS NWI-mapped wetlands within or intersecting the study area. The 27 USFWS NWI wetlands cover approximately 107 acres and consist of 4 emergent wetlands, 17 scrub/shrub or forested wetlands, and 6 ponds. Of the 485 acres of NYSDEC and 107 acres of NWI-mapped wetlands, approximately 82 acres overlap and contain both NYSDEC and NWI-mapped wetlands.



Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

Figure 10.5-26: Wetlands Resources – East Branch Reservoir Study Area

In the future without WSSO, there would be no change from typical operations and management of East Branch Reservoir. Adjacent and nearby wetlands would not be affected in the future without the project. Therefore, wetlands within the East Branch Reservoir Study Area in the future without WSSO are assumed to be the same as baseline conditions.

Wetlands along the tributary streams or located inland at higher elevations would be unaffected by reservoir drawdown during the shutdown because they are above the full pool elevation and are not influenced by reservoir water. Lowered reservoir elevations are not anticipated to impact groundwater that may source some of these wetlands. Most of the mapped wetlands in the East Branch Reservoir Study Area occur in landscape positions (i.e., separated from the reservoir by elevation or landform) that would not be influenced by the proposed drawdown of East Branch Reservoir. Some of the mapped wetlands are located in shallow areas along the reservoir edge, also referred to as fringe wetlands.

Drawdown at East Branch Reservoir is anticipated to begin in October of the shutdown, and extend through the following spring before starting to refill (see **Figure 10.5-26**). Drawdown of East Branch Reservoir is part of the normal operation of the water supply system. The level of drawdown anticipated for the temporary shutdown of the RWBT has been experienced during past operation of the reservoir, including the summers of 1985 and 1995, and the entire years of 2001 and 2004, and is anticipated under future typical operation of the Croton System.

Drawdowns that occur at different times of year can affect fringe wetland vegetation differently. Drawdowns in the middle of the growing season in summer would affect fringe wetland vegetation differently than reservoir drawdown in the spring when the growing season is beginning. During winter through spring drawdowns, under typical climactic conditions, early spring vegetation such as spring ephemerals may not emerge or would be stressed due to the different hydrologic conditions. Emergence of other vegetation may similarly be affected. During summer drawdowns, under typical climactic conditions, vegetation that has emerged may experience effects to vegetation growth, flowering, or fruit production. Regardless of season, stress to fringe wetland vegetation can be triggered by even small drawdowns of a foot or less depending on rooting depth and other characteristics of individual plants. Surface water fluctuations of this magnitude are typical for water supply reservoirs and are part of the typical hydrologic conditions for wetlands occurring on the fringes of water supply reservoirs. Furthermore, the seed bank and root stock of the fringe wetlands are typically robust and would not be anticipated to be permanently impacted by up to one growing season of lowered reservoir elevations.

Additionally, because the temporary shutdown of the RWBT would only commence in non-drought conditions, it is anticipated that East Branch Reservoir, its watershed, and the fringe wetlands of East Branch Reservoir would still receive rainfall and runoff in amounts consistent with typical (i.e., non-drought) conditions. Upon refilling of East Branch Reservoir, the fringe wetlands would be anticipated to return to their typical condition. Therefore, WSSO would not result in significant adverse impacts to wetlands in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (e.g., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. The potential mechanism for disturbing potentially existing hazardous materials within the East Branch Reservoir Study Area would be through excessive erosion. While reservoir elevations could vary temporarily from typical operations during the shutdown, erosion of reservoir banks is not anticipated (see Geology and Soils in Section 10.5.8.10, "Natural Resources"). Therefore, WSSO would not result in significant adverse impacts to hazardous materials in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls in the study area. While water surface elevations would be lower than during typical operations, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.5.8.10, "Natural Resources"). Further, WSSO would not include any construction that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.13 Energy

Water surface elevations at the East Branch Reservoir would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.14 Transportation

Water surface elevations in the East Branch Reservoir Study Area would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.15 Air Quality

While WSSO will result in reservoir drawdown, the reservoir is drawn down regularly under typical operations. Regular drawdown limits the growth of macrophytes and aquatic vegetation, which would typically inhabit the reservoir shallows to about the top 10 feet of depth. Therefore, the banks are generally rocky with little vegetation. Vegetation is limited in deeper areas by low light conditions. Drawdown of the reservoir during temporary operations would not result in objectionable odors or other air quality effects from decaying vegetation. Therefore, WSSO would not result in significant adverse impacts to air quality in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.16 Noise

Water surface elevations at the East Branch Reservoir Study Area would have no effect on noise levels in the vicinity of the reservoir. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.17 Neighborhood Character

The character of the East Branch Reservoir Study Area is largely defined by public service/utility, residential, commercial, transportation corridors, and vacant land uses, as well as its physical setting within a rural area (see **Figure 10.5-21**). The reservoir receives water from the East Branch Croton River.

DEP has consulted with the Town of Southeast and Putnam County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the East Branch Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the study area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the East Branch Reservoir Study Area was not warranted. As described in Section 10.5.8.3, "Land Use, Zoning, and Public Policy" Section 10.5.8.4, "Socioeconomic Conditions," Section 10.5.8.8, " Historic and Cultural Resources," Section 10.5.8.14, "Transportation," and Section 10.5.8.16, "Noise," an impact analysis for the East Branch Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; transportation; or noise.

As described in Section 10.5.8.6, "Open Space and Recreation," WSSO activities would be short-term and would result in a temporary change in open space and recreation during the RWBT temporary shutdown and during WSSO operations. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the East Branch Reservoir Study Area and no further analysis is warranted. As described in Section 10.5.8.9, "Visual Resources," WSSO activities effects to visual resources would be temporary and minor.

Water surface elevations at the East Branch Reservoir Study Area would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.8.18 Public Health

While East Branch Reservoir would be drawn down lower than typical, the reservoir would not be stagnant. Flow would continue through the reservoir from inflows into the reservoir and releases downstream to meet minimum releases and supply drinking water for the City. There would be no increase in potential for mosquito breeding at the reservoir. Additionally, East Branch Reservoir is a headwater reservoir in the Croton System and as such, removed from the terminal reservoir (New Croton Reservoir). While an increase in turbidity associated with the drawdown is not anticipated, any turbid water would have time to dissipate as it makes its way down through the system. In addition, water would be treated at the Croton Water Filtration Plant. Additionally, there would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from water surface elevations at the East Branch Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to public health in the East Branch Reservoir Study Area and no further analysis is warranted.

10.5.9 EAST BRANCH CROTON RIVER DOWNSTREAM OF EAST BRANCH RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.9.1 Study Area Location and Description

East Branch Croton River downstream of East Branch Reservoir flows approximately 2.4 miles through the Town of Southeast, Putnam County, New York (see **Figure 10.5-27**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, including wild trout, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the East Branch Croton River is Class A(T).

10.5.9.2 Study Area Evaluation

Under typical operations, DEP releases the required minimum flow of 25 mgd as required under 6 NYCRR Part 672-3, and may occasionally release more when hydrologic conditions are dry to provide additional water to Croton Falls Reservoir. When hydrologic conditions are wet, the reservoir spills as necessary.

Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 25 mgd up to approximately 95 mgd (see **Figure 10.5-28**). The monthly average daily spills can reach approximately 477 mgd (see **Figure 10.5-29**). Spills can occur during any month but are more frequent and of larger magnitude in the spring and fall.

During the pre-shutdown period, releases into the East Branch Croton River downstream of East Branch Reservoir would be marginally lower than typical conditions by up to 1 mgd (see **Figure 10.5-28**. During this period, spills into the East Branch Croton River downstream of East Branch Reservoir would be marginally higher than typical conditions by up to approximately 6 mgd (see **Figure 10.5-29**). During the temporary shutdown of the RWBT, releases into the East Branch Croton River downstream of East Branch Reservoir would be higher than typical conditions by up to approximately 99 mgd (see **Figure 10.5-28**). During this period, spills into East Branch Croton River downstream of East Branch Reservoir would be lower than typical conditions by up to approximately 91 mgd (see **Figure 10.5-29**). While the dataset mean for releases during October, November, and May of the shutdown are anticipated to exceed the typical range, releases are well below the typical range of spills that could be experienced by the waterbody. Further, the dataset mean of the combination of releases and spills from East Branch Reservoir would be well within the typical range for the combined releases and spills (see **Figure 10.5-30**). Essentially, water that would typically spill would be released

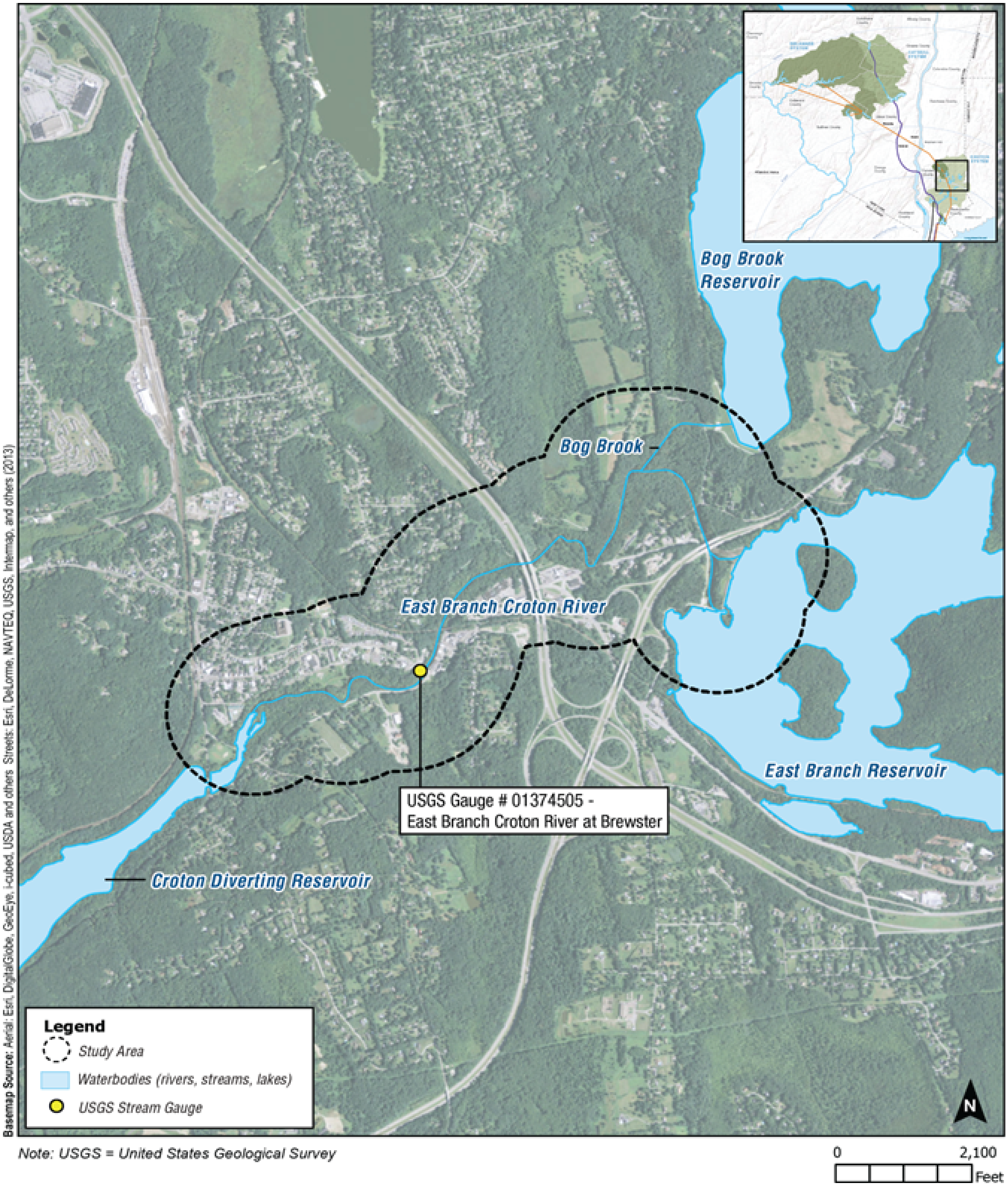
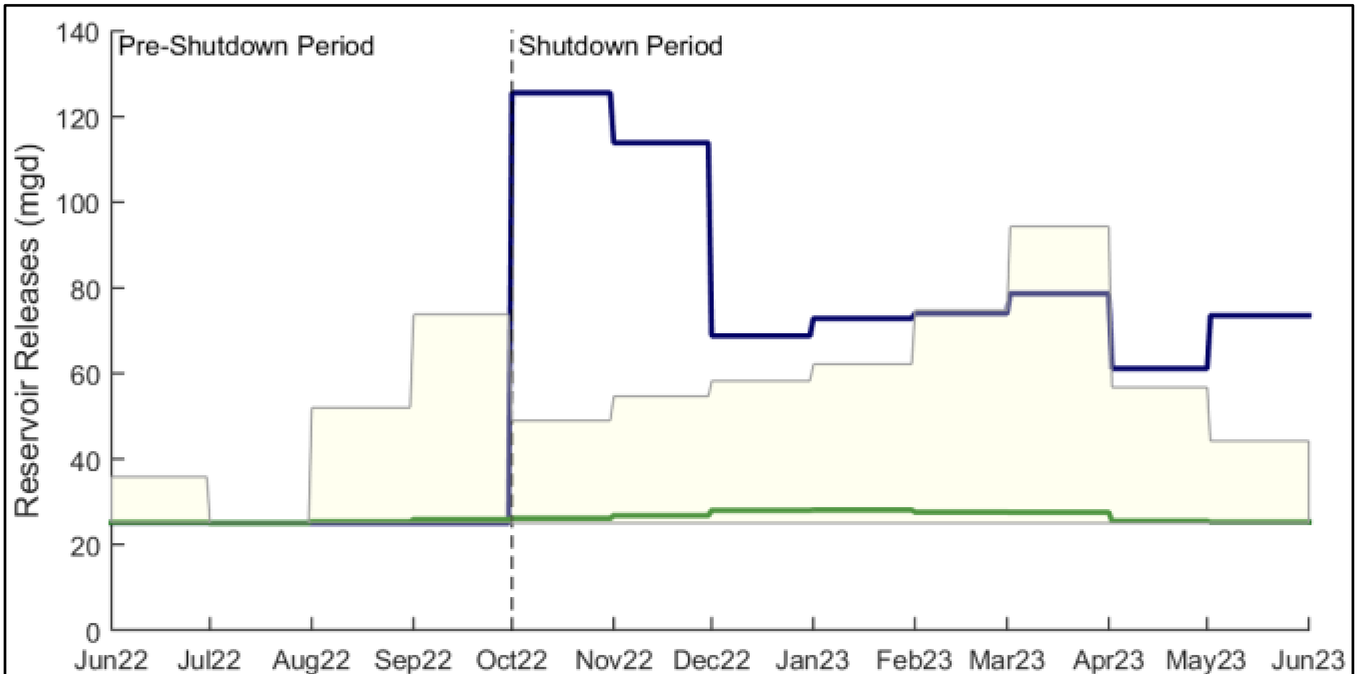


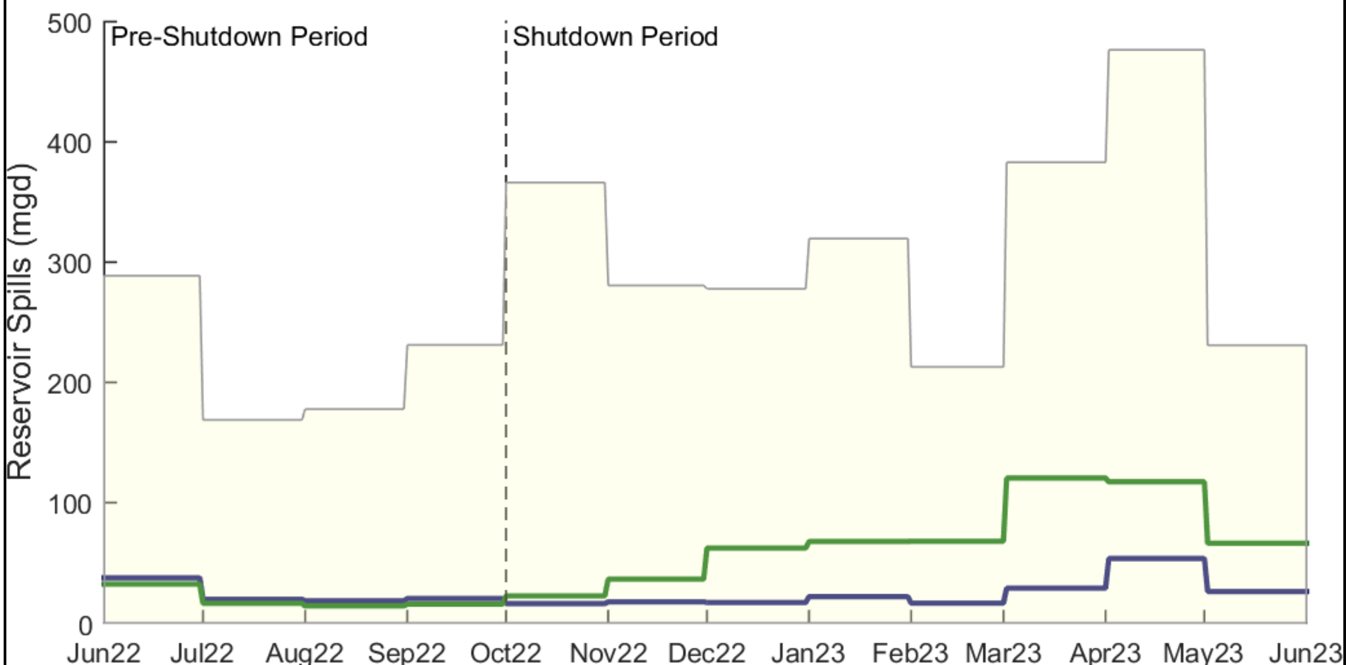
Figure 10.5-27: East Branch Croton River Downstream of East Branch Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	25	25	36	25	0
	July	25	25	25	25	0
	August	25	25	52	25	0
	September	26	25	74	25	-1
Shutdown Period	October	26	25	49	126	99
	November	27	25	55	114	87
	December	28	25	58	69	41
	January	28	25	62	73	45
	February	28	25	75	74	46
	March	28	25	95	79	51
	April	26	25	57	62	36
	May	25	25	45	74	49

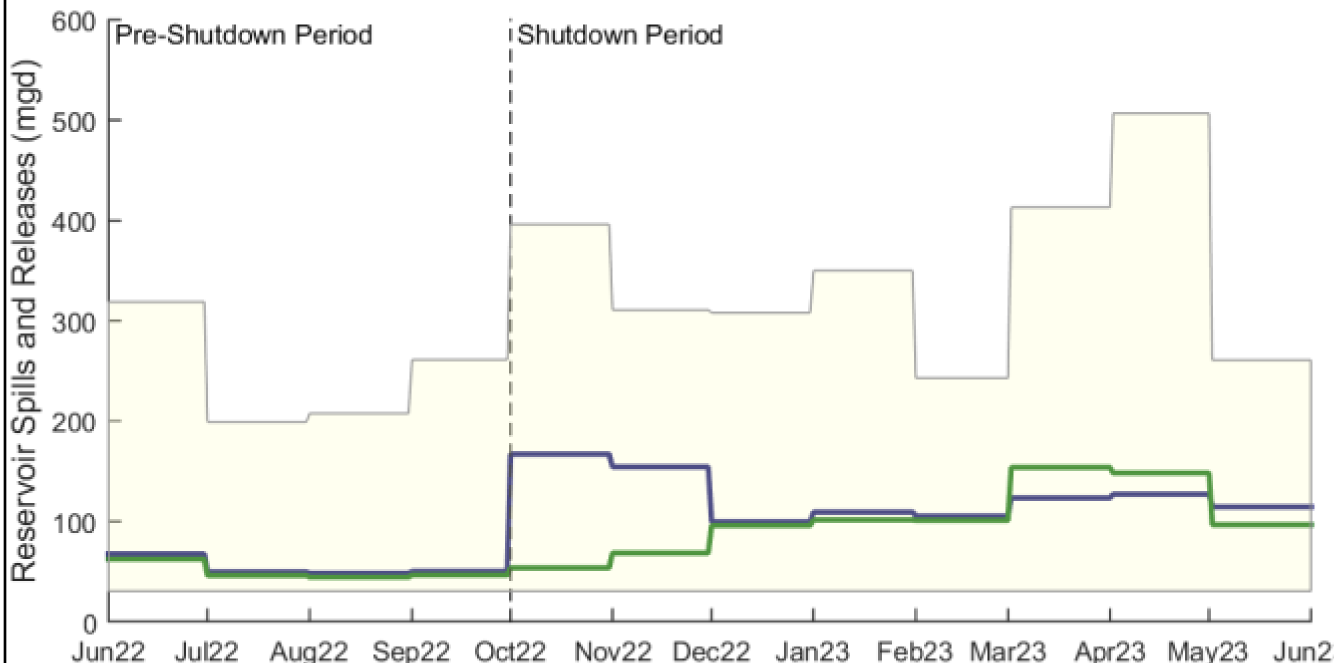
Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.5-28: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – East Branch Croton River Downstream of East Branch Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	32	0	289	38	6
	July	16	0	169	20	4
	August	14	0	178	18	4
	September	16	0	231	20	4
Shutdown Period	October	22	0	366	16	-6
	November	36	0	281	18	-18
	December	62	0	278	17	-45
	January	68	0	320	22	-46
	February	67	0	219	17	-50
	March	119	0	377	28	-91
	April	119	0	477	54	-65
	May	67	0	228	27	-40

Figure 10.5-29: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – East Branch Croton River Downstream of East Branch Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	62	30	319	68	6
	July	46	30	199	50	4
	August	45	30	208	48	3
	September	47	30	261	50	3
Shutdown Period	October	54	30	396	167	113
	November	69	30	311	154	85
	December	96	30	308	100	4
	January	102	30	350	109	7
	February	100	30	249	106	6
	March	152	30	407	123	-29
	April	150	30	507	128	-22
	May	98	30	258	116	18

Figure 10.5-30: Combined Release and Spill Dataset Mean and Range of Combined Release and Spill Predicted under Typical Operations and WSSO – East Branch Croton River Downstream of East Branch Reservoir Study Area

under the RWBT temporary shutdown. For the other months of WSSO, releases and spills would remain within the typical range during pre-shutdown and shutdown operations. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be lower than typical (see **Figure 10.5-31**). There would be no potential for significant adverse impacts to East Branch Croton River downstream of East Branch Reservoir from WSSO. Therefore, no further analysis of East Branch Croton River downstream of East Branch Reservoir is warranted.

10.5.10 CROTON FALLS DIVERTING RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.10.1 Study Area Location and Description

Croton Diverting Reservoir is located in the Town of Southeast, Putnam County, New York, south of the Village of Brewster, and is formed by impounding the East Branch Croton River, which continues southwest to the Muscoot Reservoir (see **Figure 10.5-32**).

The primary purpose of the Croton Falls Diverting Reservoir is to redirect flow from the East Branch Croton River, which includes releases from East Branch Reservoir and Bog Brook Reservoir, to Croton Falls Reservoir. Croton Falls Diverting Reservoir is connected to Croton Falls Reservoir via a channel and dividing weir. Water flows freely between the two reservoirs when reservoir water surface elevations are above the weir (elevation 305 feet). Water surface elevations in Croton Falls Diverting Reservoir are maintained above the elevation of the weir to maintain flows into Croton Falls Reservoir during most conditions. Releases and spills from the Croton Falls Diverting Reservoir flow into the continuation of the East Branch Croton River. While Croton Falls Diverting Reservoir serves the City's customers as part of the larger Croton System, no local communities draw directly from the reservoir.

Croton Falls Diverting Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Croton Falls Diverting Reservoir. The water quality classification for Croton Falls Diverting Reservoir is Class AA throughout its entire length.

10.5.10.2 Study Area Evaluation

Under typical operations, the minimum regulated flow is released, water flows between Croton Falls Diverting Reservoir and Croton Falls Reservoir based on water surface elevations, and the Croton Falls Diverting Reservoir spills as necessary.[54,55] Croton Falls Diverting Reservoir is operated to maintain water surface elevations above approximately 305 feet to maintain flows between the two reservoirs.

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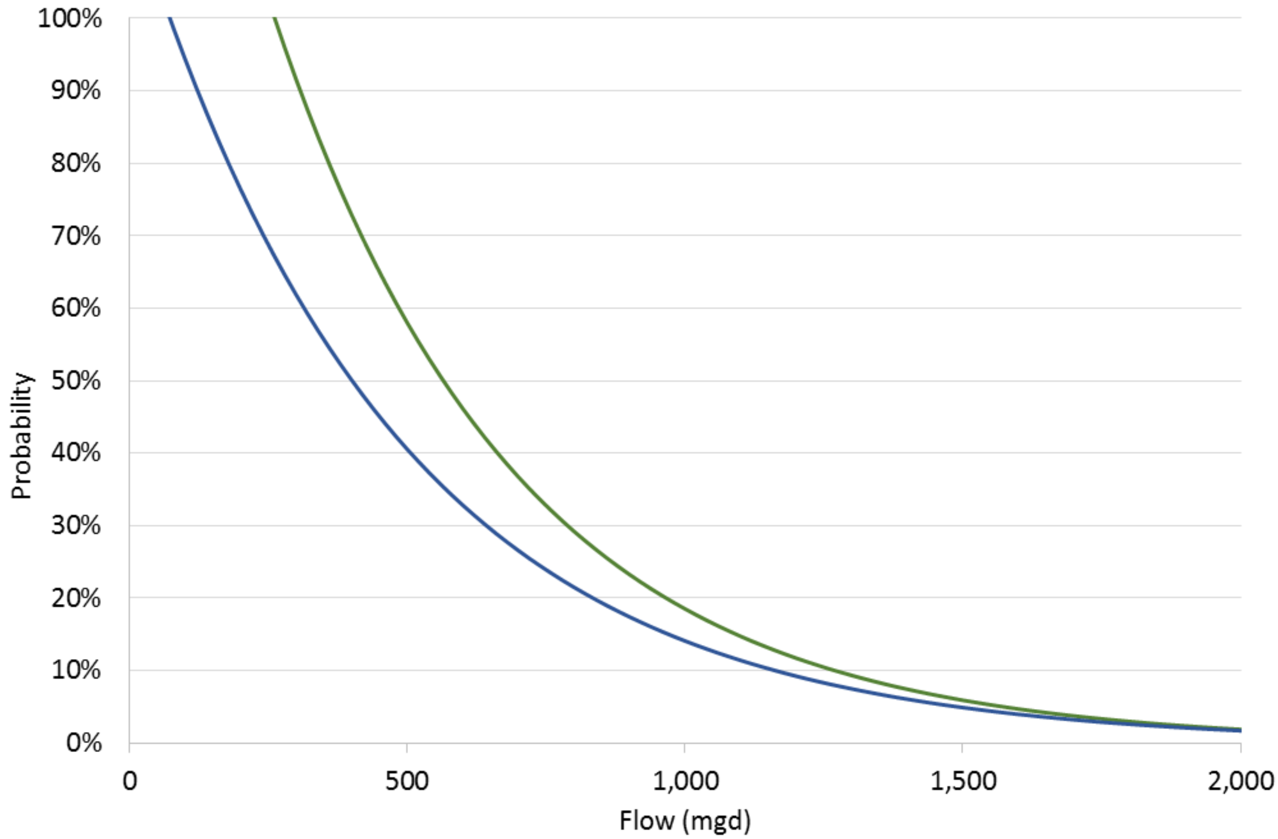
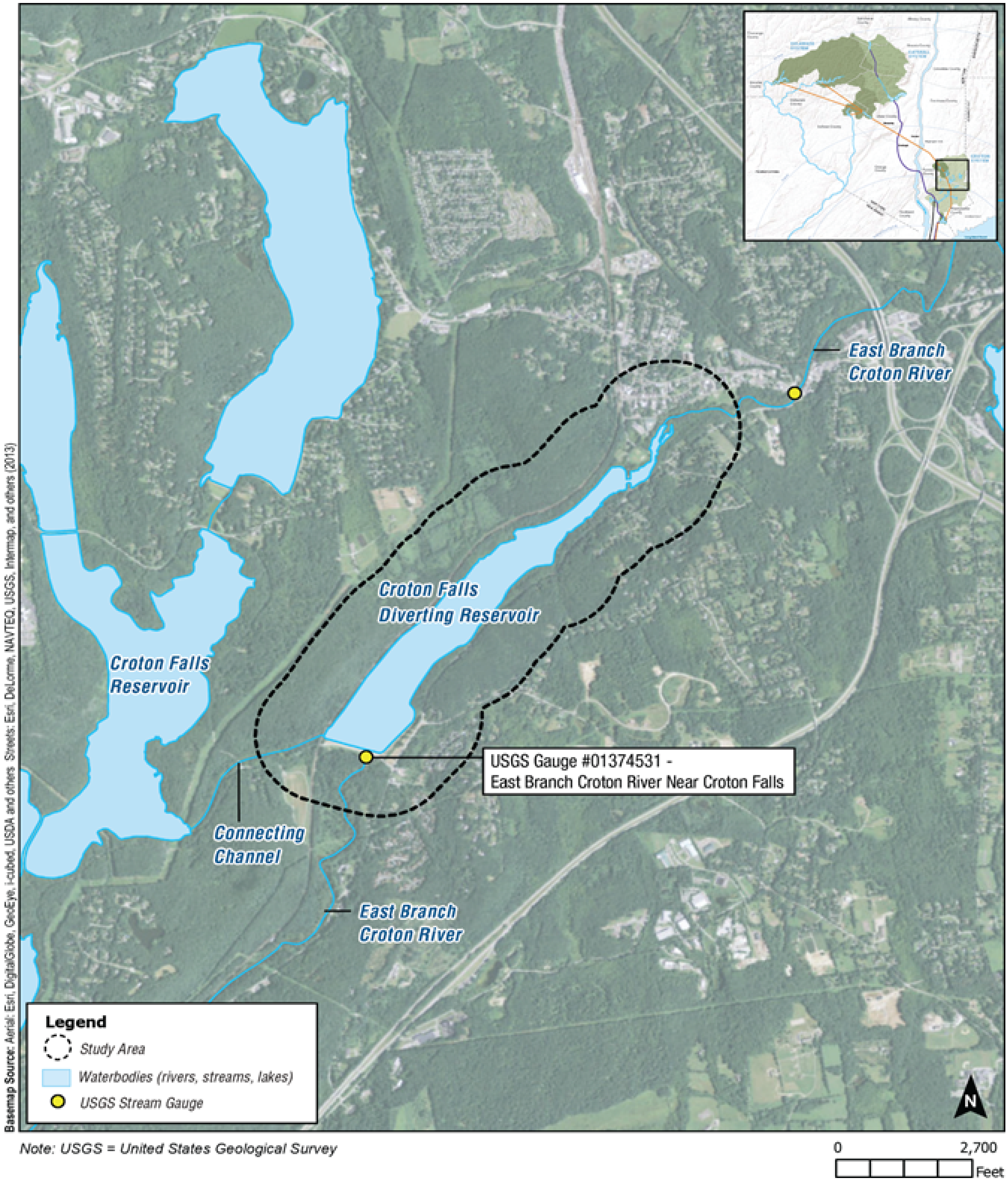
[54] Per 6 NYCRR Part 672-3, the combined minimum regulated flow that Croton Falls Diverting Reservoir receives from East Branch and Bog Brook Reservoirs (30 mgd) is released downstream to the East Branch Croton River.

[55] Water flows from the reservoir with the higher water surface elevation to the reservoir with the lower water surface elevation.



Note: There are no USGS gauges with National Weather Service flood stage delineations along the East Branch Croton River.

Figure 10.5-31: Annual Probability of High Flows from Spills and Releases – East Branch Croton River Downstream of East Branch Reservoir Study Area



Note: USGS = United States Geological Survey

Figure 10.5-32: Croton Falls Diverting Reservoir Study Area

During the pre-shutdown period, water surface elevations in Croton Falls Diverting Reservoir would be unchanged from typical conditions (see **Figure 10.5-33**). During the temporary shutdown of the RWBT, water surface elevations in Croton Falls Diverting Reservoir would be marginally lower than typical conditions by up to 3 feet (see **Figure 10.5-33**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Croton Falls Diverting Reservoir. Therefore, no further analysis is warranted for the Croton Falls Diverting Reservoir Study Area.

10.5.11 EAST BRANCH CROTON RIVER DOWNSTREAM OF CROTON FALLS DIVERTING RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.11.1 Study Area Location and Description

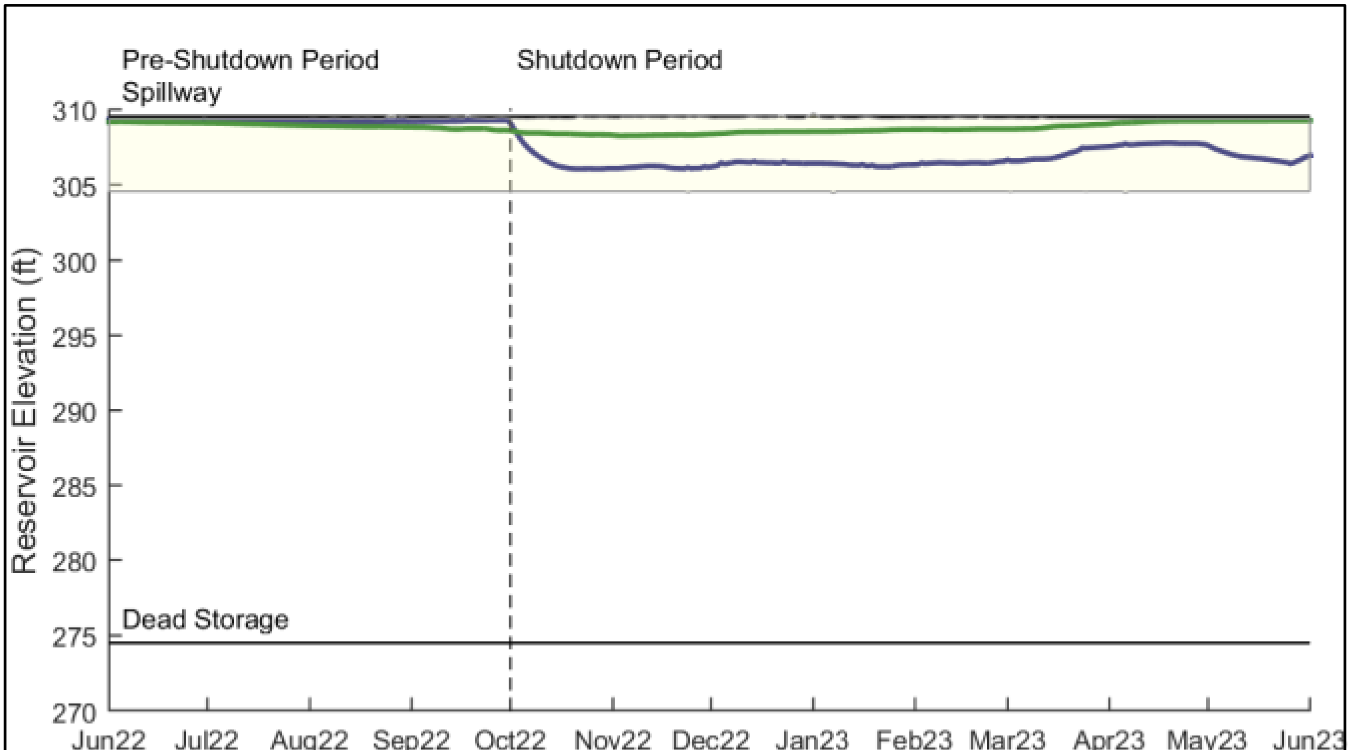
East Branch Croton River downstream of Croton Falls Diverting Reservoir flows approximately 2.5 miles through the Town of Southeast, Putnam County, New York, and the Town of North Salem, Westchester County, New York (see **Figure 10.5-34**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the East Branch Croton River is Class A(T).

10.5.11.2 Study Area Evaluation

Under typical operations, DEP releases from Croton Falls Diverting Reservoir are the combined 30 mgd minimum flow that it receives from both East Branch and Bog Brook Reservoirs per 6 NYCRR Part 672-3. DEP does not typically release more than 30 mgd from Croton Falls Diverting Reservoir and allows the reservoir to spill as necessary. When conditions are dry and water surface elevations are above the weir, water flows via a connecting channel to Croton Falls Reservoir to augment supplies for the Croton Falls Pump Station.

Based on modeling analyses, under typical operations, monthly average daily releases rarely differ from the minimum combined release of 30 mgd from East Branch and Bog Brook Reservoirs (see **Figure 10.5-35**). The monthly average daily spills can reach approximately 500 mgd (see **Figure 10.5-36**). Spills can occur during any month but are more frequent and of larger magnitude in the spring and fall.

During the pre-shutdown period, releases into the East Branch Croton River downstream of Croton Falls Diverting Reservoir would be unchanged from typical conditions (see **Figure 10.5-35**). During this period, spills into the East Branch Croton River would not change compared to typical conditions by more than -3 mgd to +1 mgd (see **Figure 10.5-36**). During the temporary shutdown of the RWBT, releases into the East Branch Croton River downstream of Croton Falls Diverting Reservoir would be marginally higher than typical conditions by up to 3 mgd (see **Figure 10.5-35**). Spills occurring during the same period would be lower than typical conditions by up to approximately 100 mgd (see **Figure 10.5-36**). The dataset mean for both spills and releases during

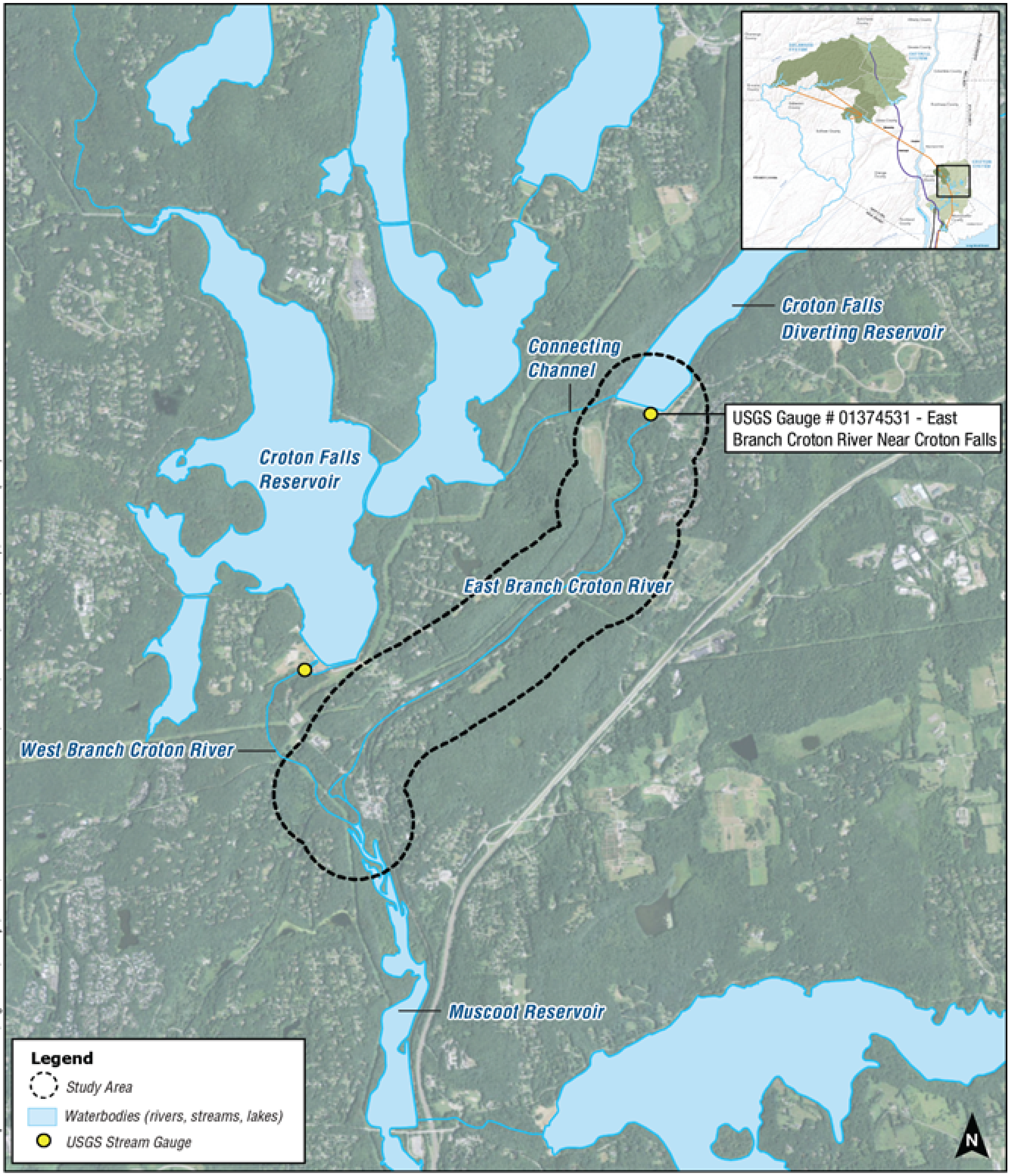


		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	309	305	309	309	0
	July	309	305	309	309	0
	August	309	305	309	309	0
	September	309	305	309	309	0
Shutdown Period	October	308	305	309	307	-1
	November	308	305	309	306	-2
	December	308	305	309	306	-2
	January	309	305	309	306	-3
	February	309	305	309	306	-3
	March	309	305	309	307	-2
	April	309	305	309	308	-1
	May	309	305	309	307	-2

Note: There are no water utility intakes for drawing water directly from the reservoir.

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.5-33: Elevation Dataset Mean and Range for Typical Operations and WSSO – Croton Falls Diverting Reservoir Study Area



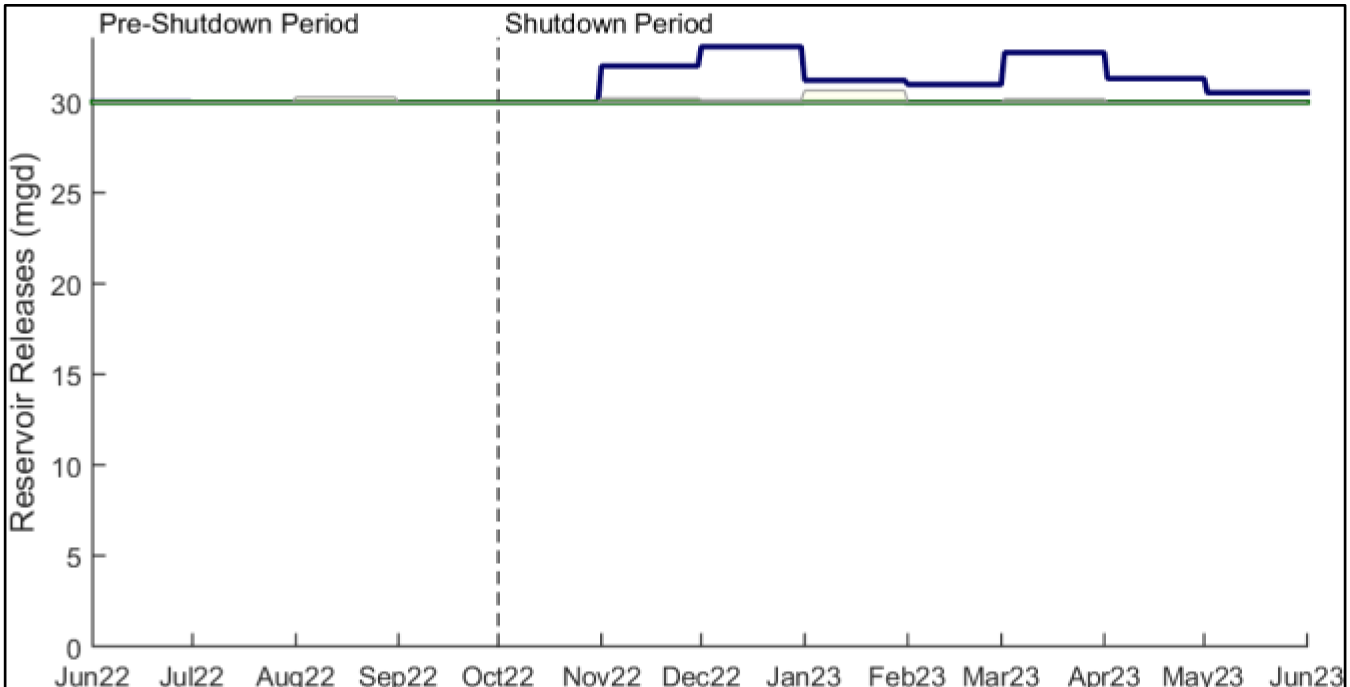
Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Note: USGS = United States Geological Survey

0 3,300 Feet

Figure 10.5-34: East Branch Croton River Downstream of Croton Falls Diverting Reservoir Study Area

Environmental Protection

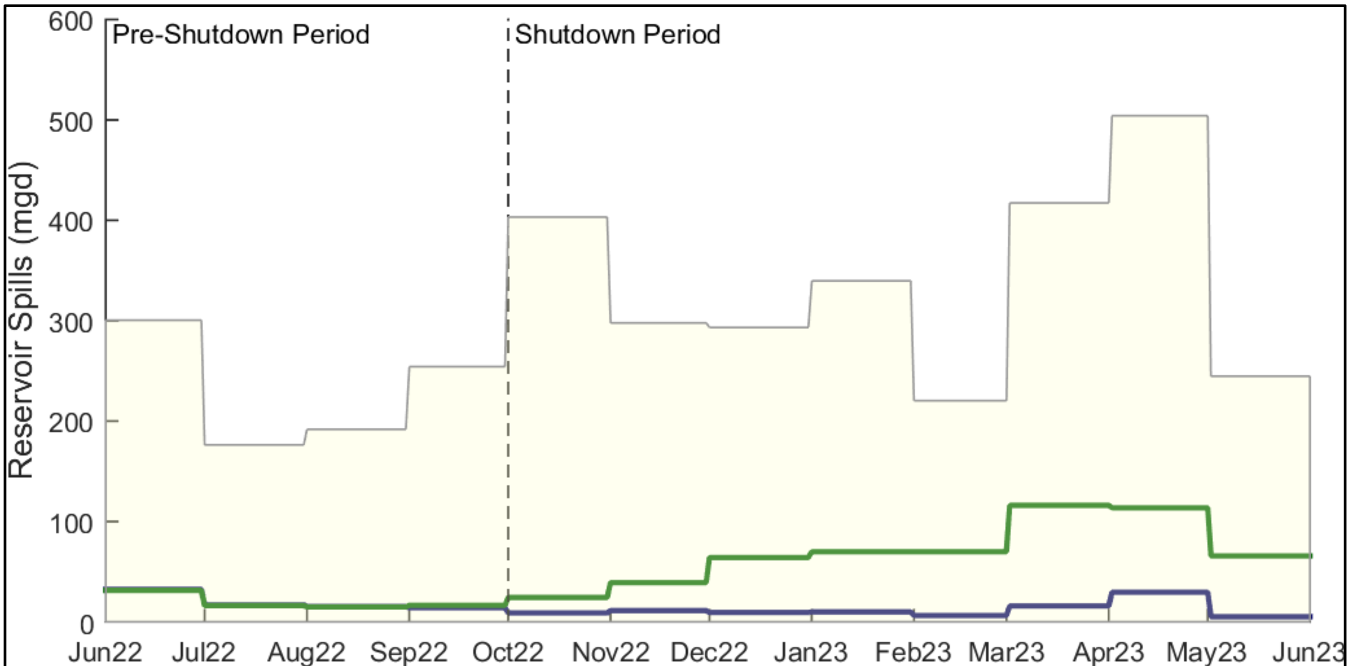


		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	30	30	30	30	0
	July	30	30	30	30	0
	August	30	30	30	30	0
	September	30	30	30	30	0
Shutdown Period	October	30	30	30	30	0
	November	30	30	30	32	2
	December	30	30	30	33	3
	January	30	30	31	31	1
	February	30	30	30	31	1
	March	30	30	30	33	3
	April	30	30	30	31	1
	May	30	30	30	31	1

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.5-35: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – East Branch Croton River Downstream of Croton Falls Diverting Reservoir Study Area

NYC Environmental Protection



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	31	0	301	32	1
	July	16	0	176	17	1
	August	15	0	192	15	0
	September	17	0	254	14	-3
Shutdown Period	October	24	0	403	9	-15
	November	39	0	298	11	-28
	December	64	0	293	9	-55
	January	70	0	340	10	-60
	February	69	0	226	7	-62
	March	115	0	412	15	-100
	April	115	0	504	30	-85
	May	67	0	242	5	-62

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-36: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – East Branch Croton River Downstream of Croton Falls Diverting Reservoir Study Area

WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be lower than typical (see **Figure 10.5-37**). There would be no potential for significant adverse impacts to East Branch Croton River downstream of Croton Falls Diverting Reservoir from WSSO. Therefore, no further analysis of East Branch Croton River downstream of Croton Falls Diverting Reservoir is warranted.

10.5.12 CROTON FALLS RESERVOIR STUDY AREA IMPACT ANALYSIS

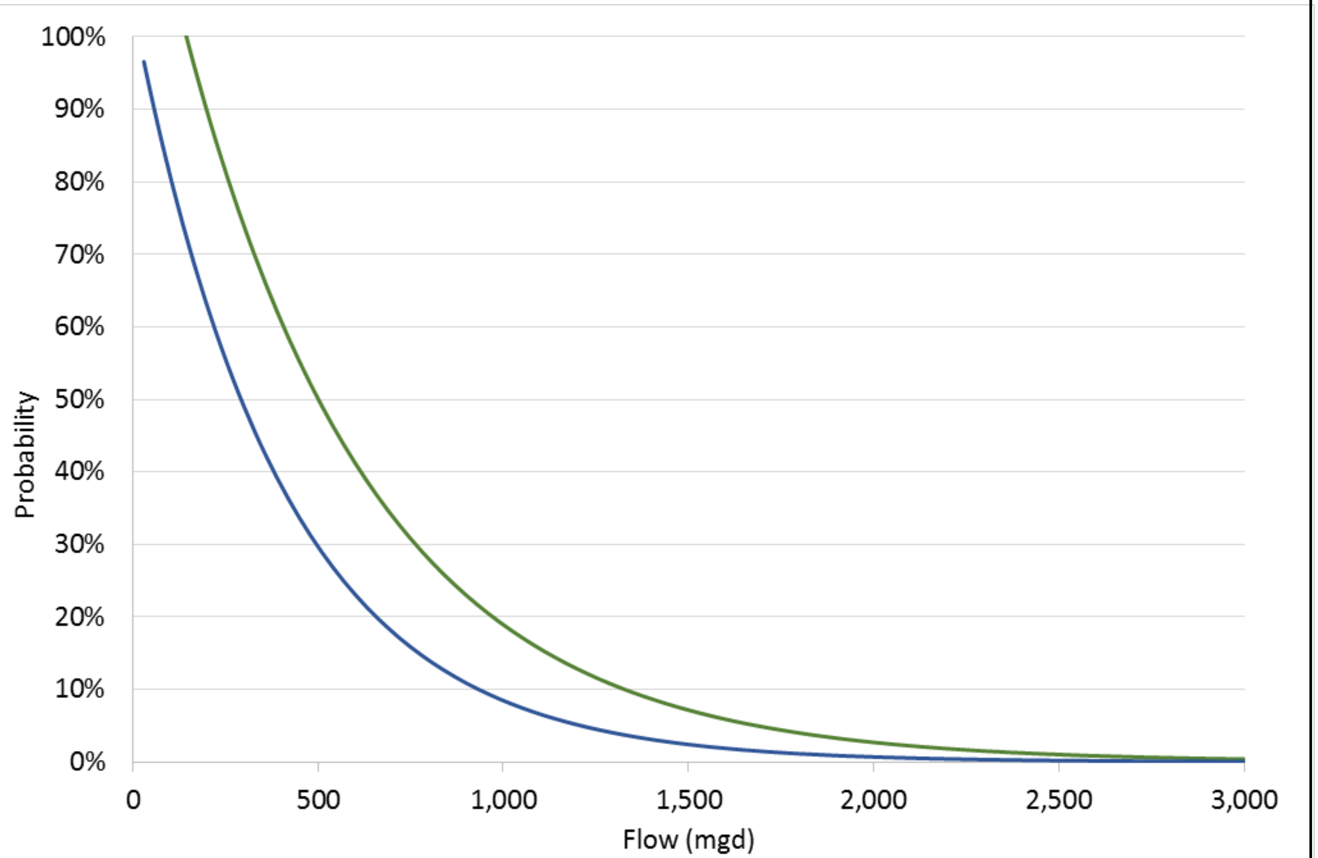
10.5.12.1 Study Area Location and Description

Croton Falls Reservoir is located in the Towns of Carmel and Southeast, Putnam County, New York and formed by impounding the West and Middle Branches of the Croton River (see **Figure 10.5-38**). Spills and releases from the reservoir flow into the continuation of the West Branch Croton River, which joins the East Branch Croton River, and flows into Muscoot Reservoir. During water supply emergencies, as approved by NYSDEC and NYSDOH, DEP could pump water from Croton Falls Reservoir into Shaft 11 of the Delaware Aqueduct and send water to Kensico Reservoir. Croton Falls Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Croton Falls Reservoir. The water quality classification for Croton Falls Reservoir is Class A(T) or Class AA(T) throughout its entire length. While Croton Falls Reservoir serves the City’s customers as part of the larger Croton System, no local communities draw directly from the reservoir.

10.5.12.2 Study Area Evaluation

Under typical operations, the minimum regulated flow is released (20 mgd per 6 NYCRR Part 672-3) and the reservoir spills as necessary based on inflows. When conditions are dry, or during other water supply emergencies, additional water can be diverted from the Croton Falls Reservoir to Kensico Reservoir via the Delaware Aqueduct through the use of the Croton Falls Pump Station. Under these conditions, the reservoir can be drawn down substantially by up to approximately 30 feet (see **Figure 10.5-39**).

During the pre-shutdown period, water surface elevations in Croton Falls Reservoir would be unchanged from typical conditions (see **Figure 10.5-39**). During the temporary shutdown of the RWBT, water surface elevations in Croton Falls Reservoir would be lower than typical by up to 7 feet due to operation of the Croton Falls Pump Station (see **Figure 10.5-39**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Croton Falls Reservoir. Therefore, no further analysis is warranted for the Croton Falls Reservoir Study Area.



Note: There are no USGS gauges with National Weather Service flood stage delineations along the East Branch Croton River.

Legend
WSSO
Typical

Figure 10.5-37: Annual Probability of High Flows from Spills and Releases – East Branch Croton River Downstream of Croton Falls Diverting Reservoir Study Area

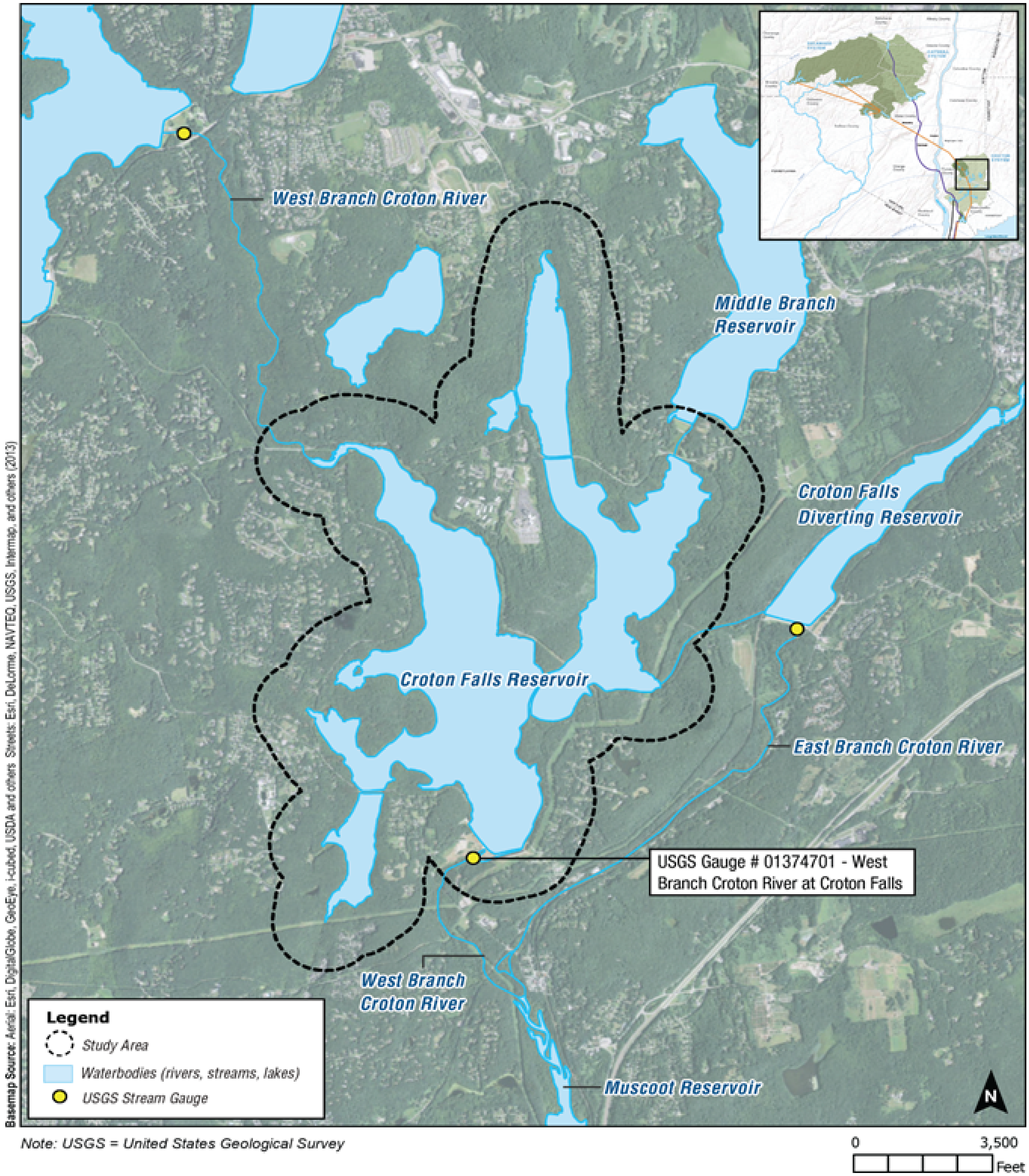
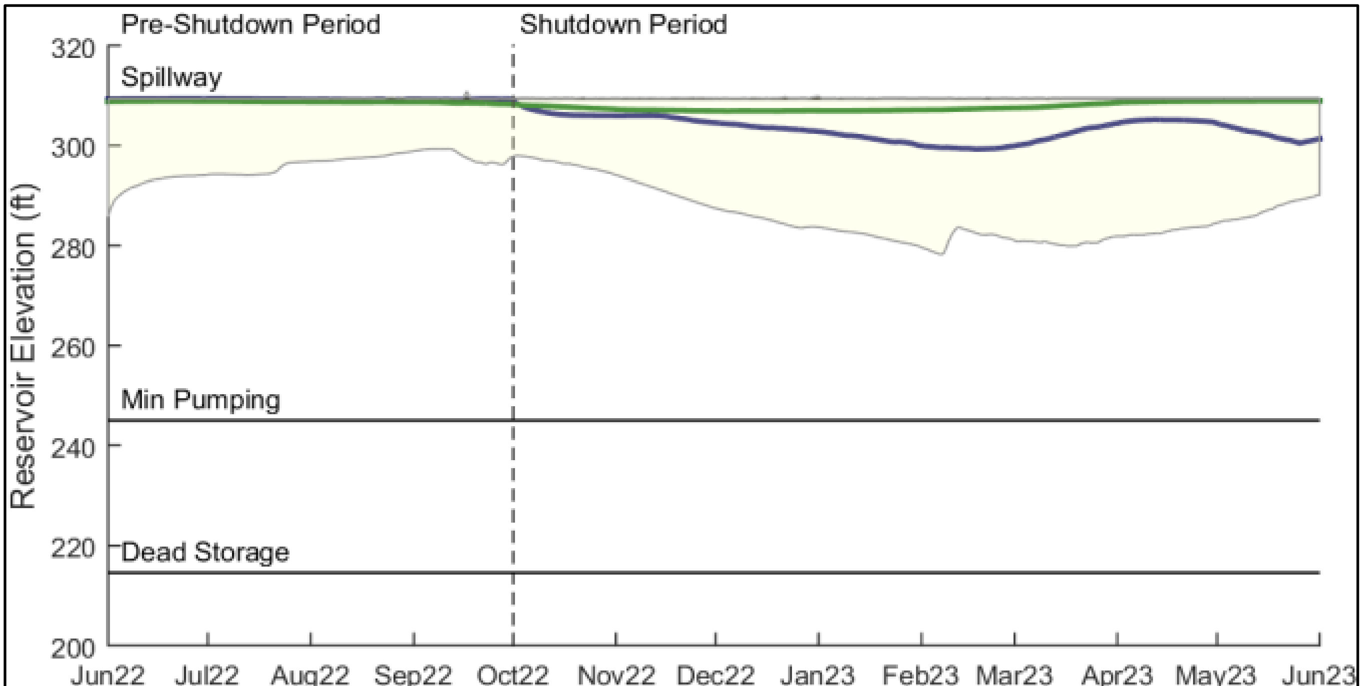


Figure 10.5-38: Croton Falls Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	309	292	309	309	0
	July	309	295	309	309	0
	August	309	298	309	309	0
	September	309	298	309	309	0
Shutdown Period	October	308	296	309	307	-1
	November	307	291	309	306	-1
	December	307	285	309	304	-3
	January	307	282	309	301	-6
	February	307	283	309	300	-7
	March	308	281	309	302	-6
	April	309	283	309	305	-4
	May	309	287	309	302	-7

Note: There are no water utility intakes for drawing water directly from the reservoir.

Figure 10.5-39: Elevation Dataset Mean and Range for Typical Operations and WSSO – Croton Falls Reservoir Study Area

10.5.13 WEST BRANCH CROTON RIVER DOWNSTREAM OF CROTON FALLS RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.13.1 Study Area Location and Description

West Branch Croton River downstream of Croton Falls Reservoir flows approximately 1 mile through the Town of Carmel, Putnam County, New York, and the Town of Somers, Westchester County, New York (see **Figure 10.5-40**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, including wild trout, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the West Branch Croton River is Class A(TS).

10.5.13.2 Study Area Evaluation

Under typical operations, DEP releases the required minimum flow of 20 mgd, per 6 NYCRR Part 672-3, and may occasionally release more when hydrologic conditions are dry. When hydrologic conditions are wet, the reservoir spills as necessary.

Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 20 mgd up to approximately 170 mgd (see **Figure 10.5-41**). The monthly average daily spills can reach approximately 400 mgd (see **Figure 10.5-42**). Spills can occur during any month but are more frequent and of larger magnitude in the spring.

During the pre-shutdown period, releases into the West Branch Croton River downstream of Croton Falls Reservoir would be lower than typical conditions by up to approximately 7 mgd (see **Figure 10.5-41**). During this period, spills into the West Branch Croton River would be higher than typical by up to approximately 6 mgd (see **Figure 10.5-42**). During the temporary shutdown of the RWBT, releases into the West Branch Croton River downstream of Croton Falls Reservoir would be lower than typical conditions by up to approximately 16 mgd (see **Figure 10.5-41**). Spills occurring during the same period would be lower than typical conditions by up to approximately 47 mgd (see **Figure 10.5-42**). The dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would not be substantially higher than typical (see **Figure 10.5-43**). There would be no potential for significant adverse impacts to West Branch Croton River downstream of Croton Falls Reservoir from WSSO. Therefore, no further analysis of West Branch Croton River downstream of Croton Falls Reservoir is warranted.

10.5.14 AMAWALK RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.14.1 Study Area Location and Description

Amawalk Reservoir is located in north central Westchester County and is formed by impounding the Muscoot River, a tributary of the Croton River (see **Figure 10.5-44**). Spills and releases from the reservoir continue along the Muscoot River into Muscoot Reservoir. Amawalk Reservoir is a

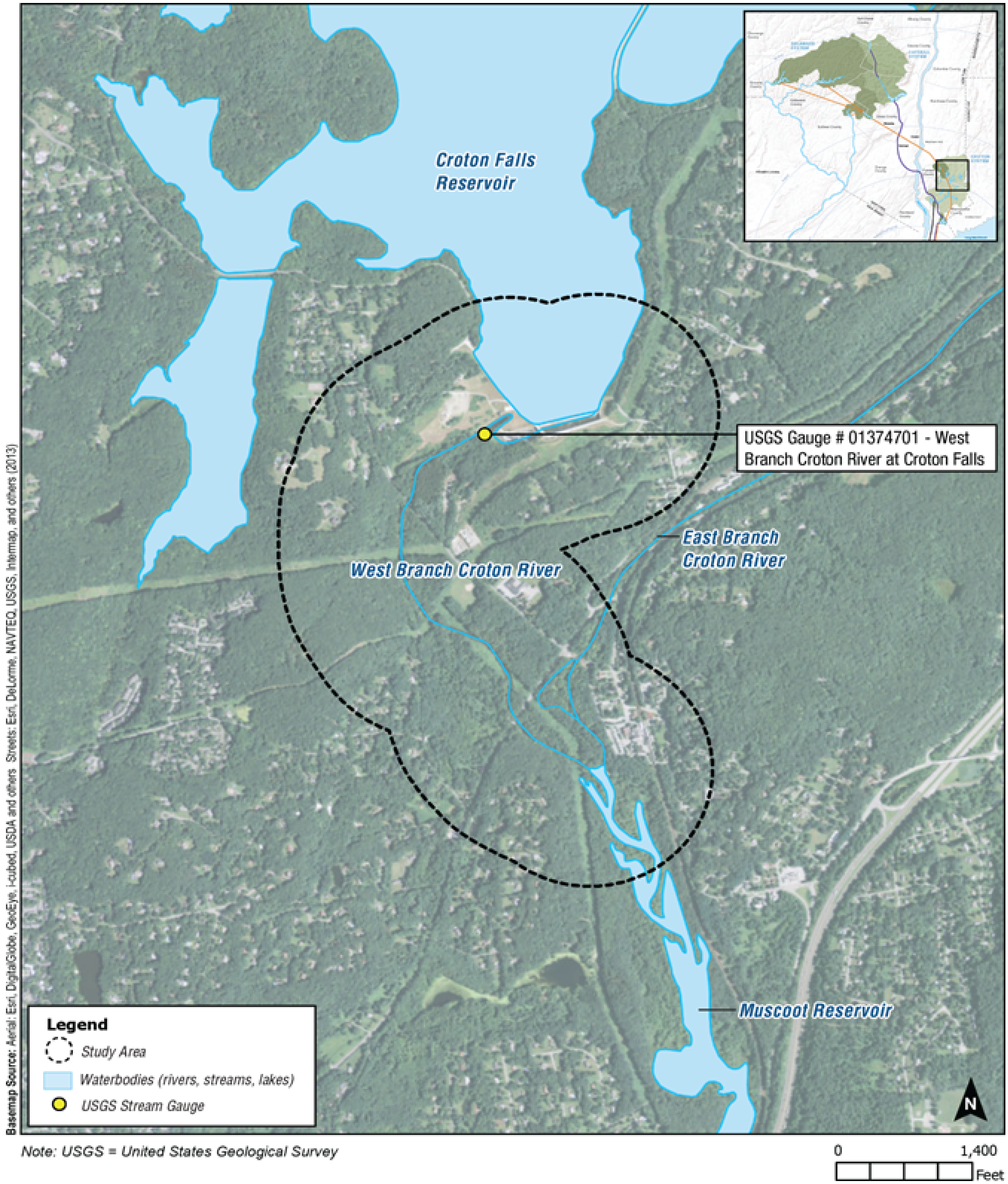
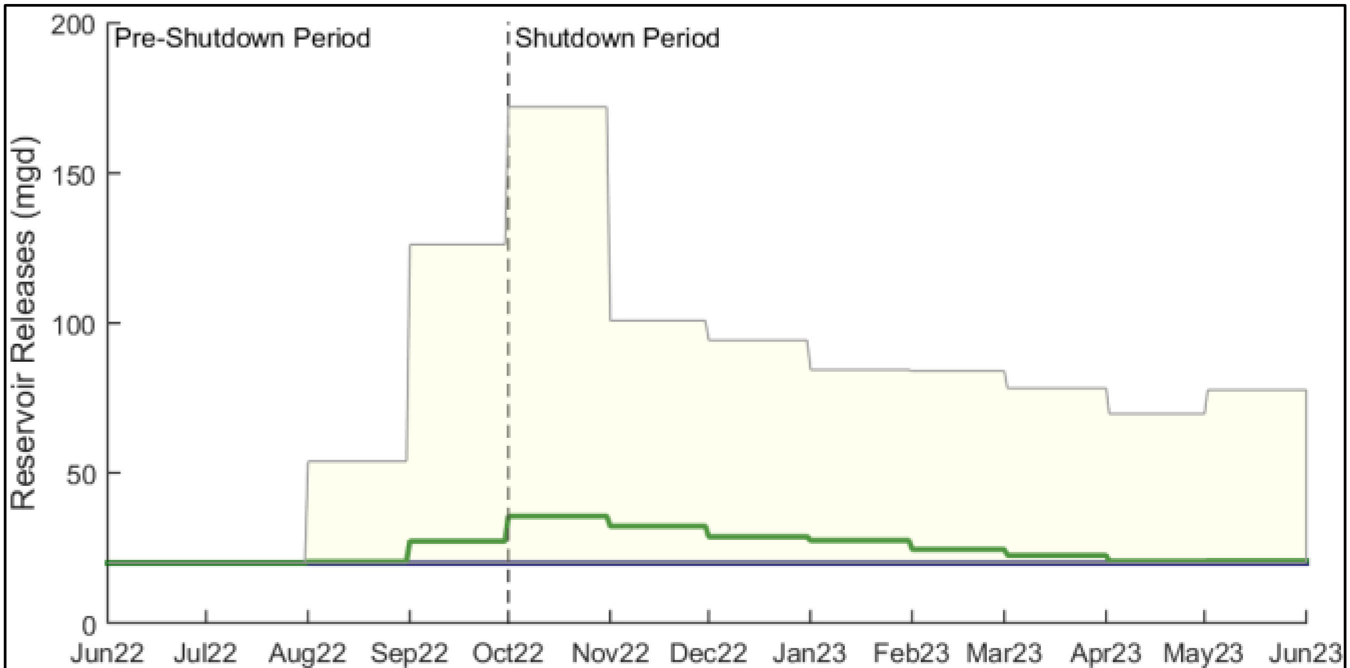


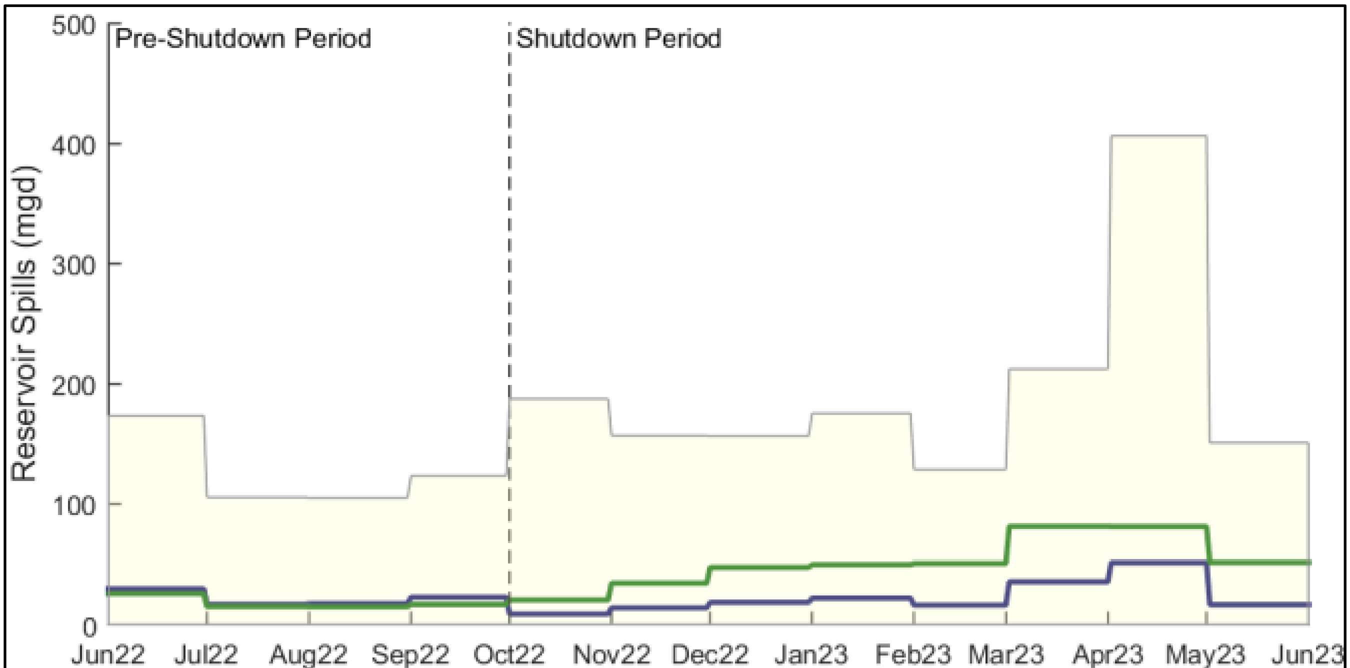
Figure 10.5-40: West Branch Croton River Downstream of Croton Falls Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	20	20	20	20	0
	July	20	20	20	20	0
	August	20	20	54	20	0
	September	27	20	126	20	-7
Shutdown Period	October	36	20	172	20	-16
	November	32	20	101	20	-12
	December	29	20	94	20	-9
	January	28	20	84	20	-8
	February	25	20	83	20	-5
	March	23	20	78	20	-3
	April	21	20	70	20	-1
	May	21	20	78	20	-1

Legend
WSSO dataset mean
Typical dataset mean
Typical range

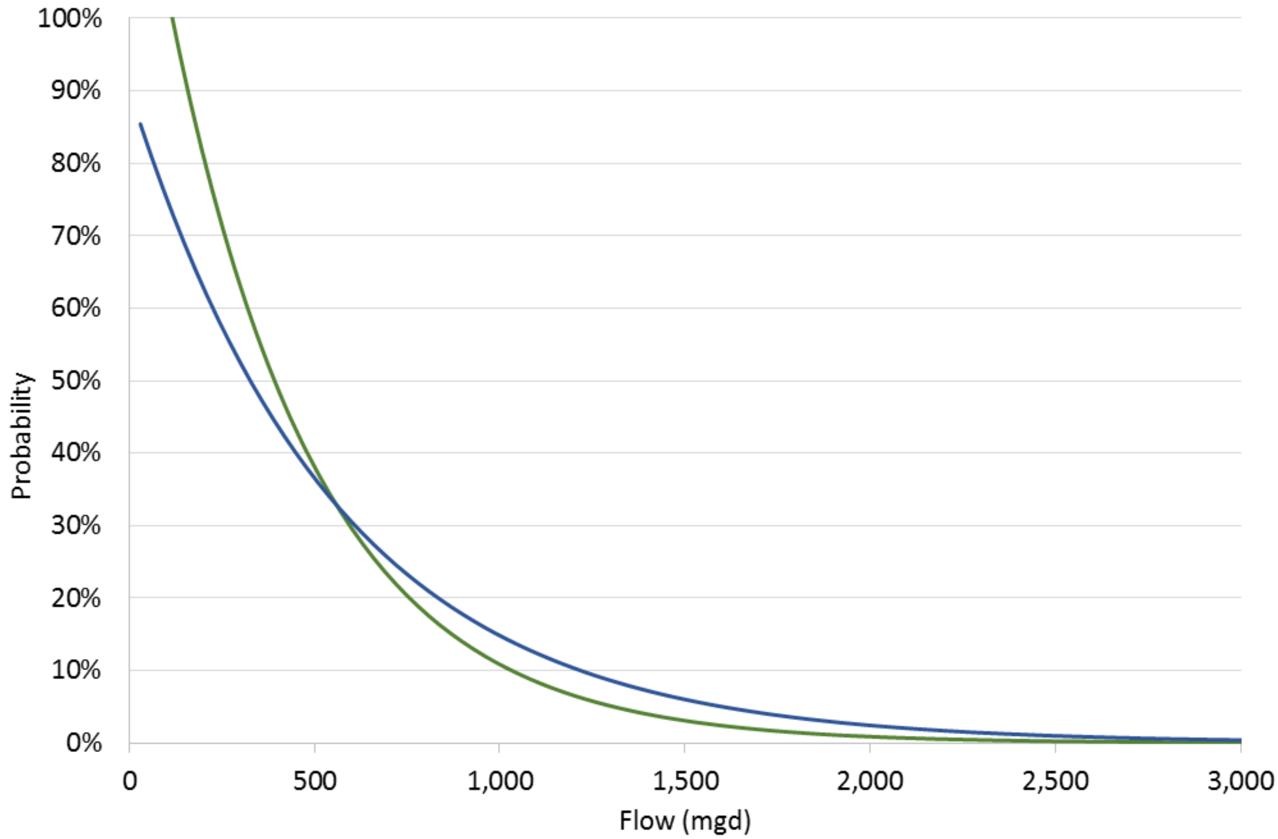
Figure 10.5-41: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – West Branch Croton River Downstream of Croton Falls Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	26	0	174	30	4
	July	15	0	106	17	2
	August	15	0	105	18	3
	September	17	0	124	23	6
Shutdown Period	October	20	0	188	9	-11
	November	34	0	157	14	-20
	December	48	0	157	18	-30
	January	50	0	176	22	-28
	February	50	0	132	16	-34
	March	81	0	210	34	-47
	April	82	0	409	52	-30
	May	52	0	147	17	-35

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-42: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – West Branch Croton River Downstream of Croton Falls Reservoir Study Area



Note: There are no USGS gauges with National Weather Service flood stage delineations along the West Branch Croton River.

Figure 10.5-43: Annual Probability of High Flows from Spills and Releases – West Branch Croton River Downstream of Croton Falls Reservoir Study Area

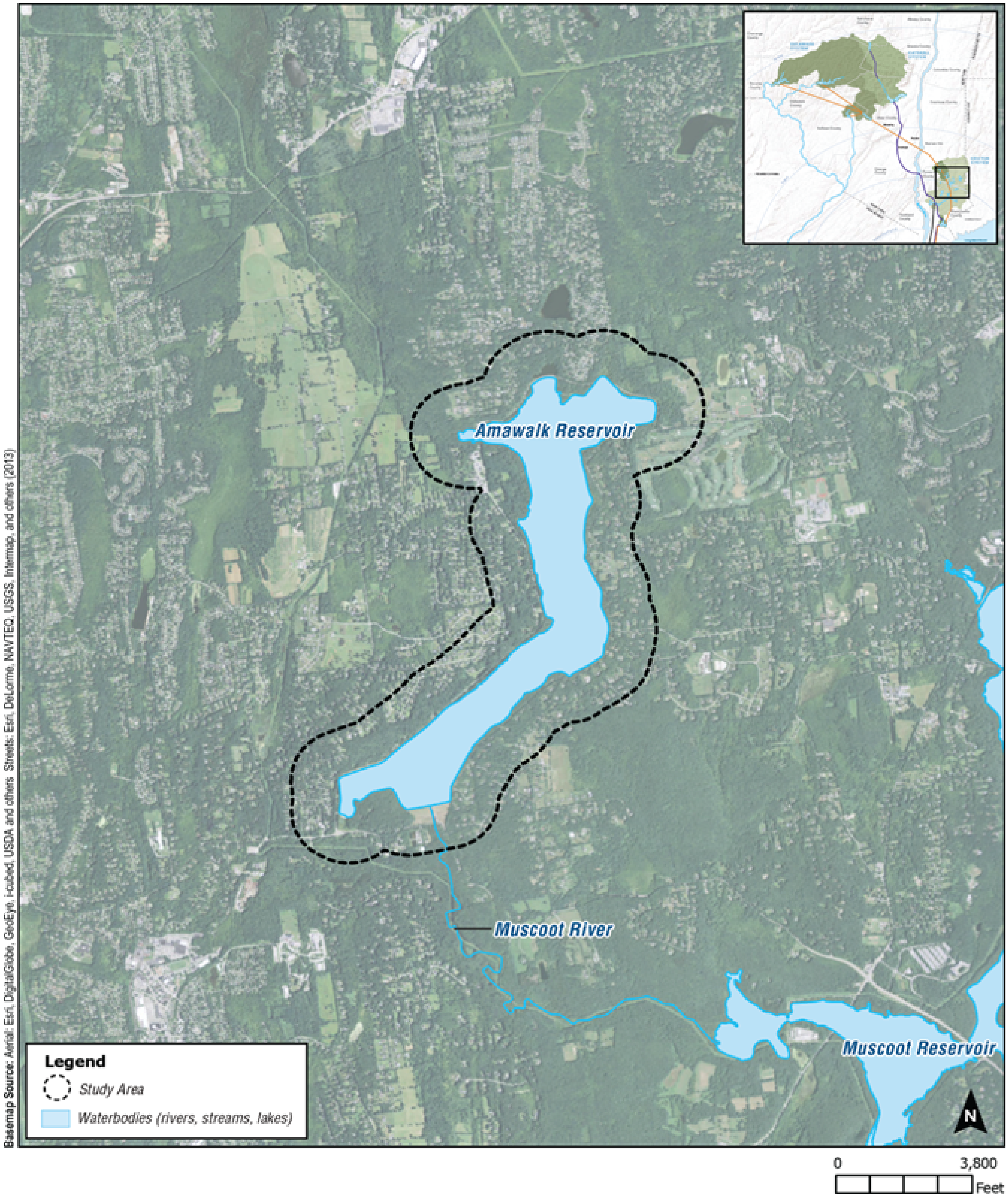


Figure 10.5-44: Amawalk Reservoir Study Area

high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Amawalk Reservoir. The water quality classification for Amawalk Reservoir is Class A throughout its entire length. In addition to supplying the City's customers as part of the larger Croton System, Northern Westchester Joint Waterworks has an intake at Amawalk Reservoir.

10.5.14.2 Study Area Evaluation

Under typical operations, the minimum regulated flow is released (see **Table 10.5-7**), and the reservoir spills as necessary based on inflows. Releases increase for water supply purposes, and the reservoir can be drawn down approximately 15 feet when conditions are dry (see **Figure 10.5-45**).

Table 10.5-7: Amawalk Reservoir Regulated Releases per 6 NYCRR Part 672-3

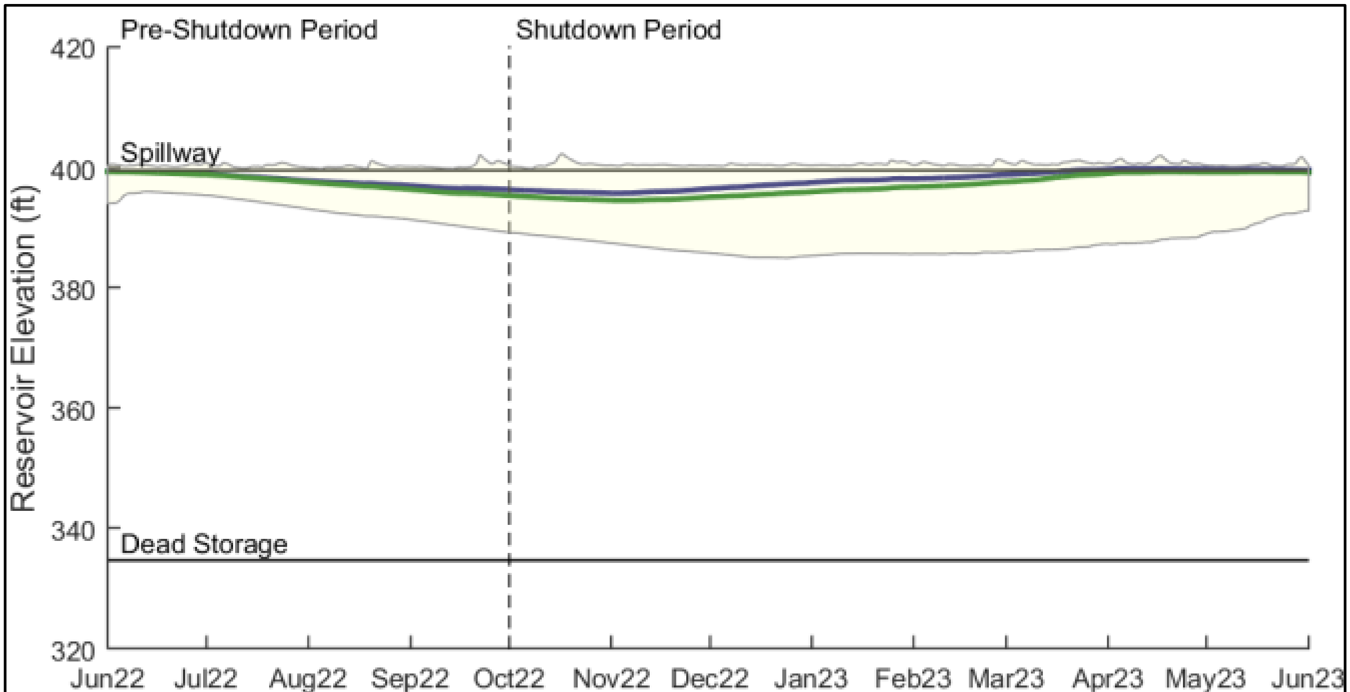
Reservoir Storage Condition	Stream Flow Condition		
	Above Normal	Normal	Below Normal
Above Normal	10 mgd (15.5 cfs)	10 mgd (15.5 cfs)	10 mgd (15.5 cfs)
Normal	10 mgd (15.5 cfs)	10 mgd (15.5 cfs)	5 mgd (7.7 cfs)
Below Normal	5 mgd (7.7 cfs)	5 mgd (7.7 cfs)	5 mgd (7.7 cfs)

During WSSO, water surface elevations in Amawalk Reservoir would be marginally higher than typical conditions by up to 2 feet (see **Figure 10.5-45**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Amawalk Reservoir. Therefore, no further analysis is warranted for the Amawalk Reservoir Study Area.

10.5.15 MUSCOOT RIVER DOWNSTREAM OF AMAWALK RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.15.1 Study Area Location and Description

Muscoot River downstream of Amawalk Reservoir flows approximately 2.7 miles through the Town of Somers, Westchester County, New York (see **Figure 10.5-46**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, including wild trout, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the West Branch Croton River is Class A(TS).



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	399	396	400	399	0
	July	398	394	400	398	0
	August	397	392	400	397	0
	September	396	390	400	397	1
Shutdown Period	October	395	388	400	396	1
	November	395	387	400	396	1
	December	396	385	400	397	1
	January	396	386	400	398	2
	February	397	386	400	398	1
	March	398	386	400	399	1
	April	399	388	401	400	1
	May	399	391	400	400	1

Note: There is an outside community connection for the Northern Westchester Joint Waterworks at elevation 327.55 feet, approximately three feet below the DEP intake.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-45: Elevation Dataset Mean and Range for Typical Operations and WSSO – Amawalk Reservoir Study Area

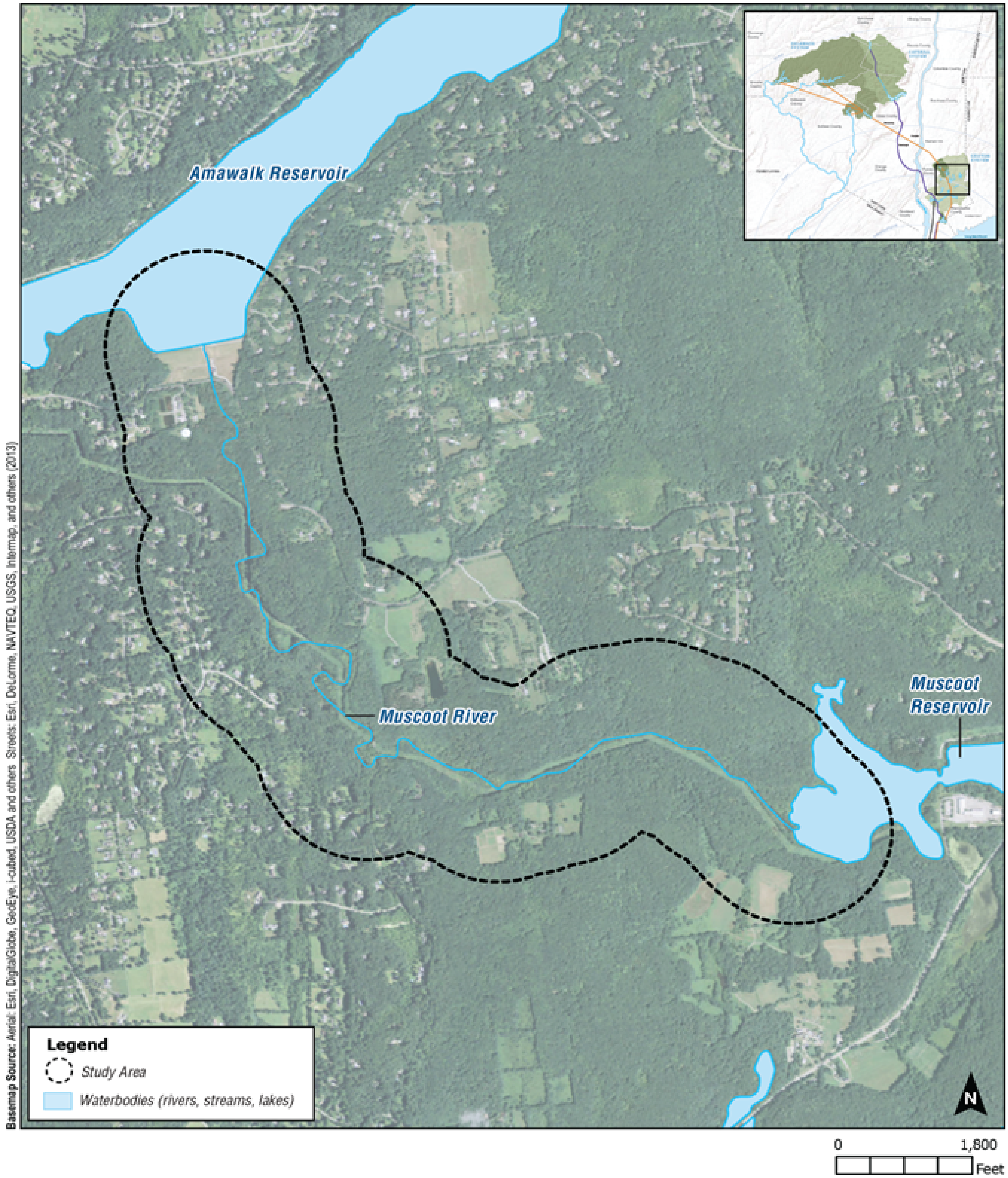


Figure 10.5-46: Muscoot River Downstream of Amawalk Reservoir Study Area

10.5.15.2 Study Area Evaluation

Under typical operations, DEP releases the required minimum flow per 6 NYCRR Part 672-3 (see **Table 10.5-7**), and may occasionally release more when hydrologic conditions are dry. When hydrologic conditions are wet, the reservoir spills as necessary.

During WSSO, releases and spills would be marginally different from typical conditions by approximately -1 to +2 mgd (see **Figure 10.5-47** and **Figure 10.5-48**). The dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be unchanged from typical conditions (see **Figure 10.5-49**). There would be no potential for significant adverse impacts to Muscoot River downstream of Amawalk Reservoir from WSSO. Therefore, no further analysis of Muscoot River downstream of Amawalk Reservoir is warranted.

10.5.16 TITICUS RESERVOIR STUDY AREA IMPACT ANALYSIS

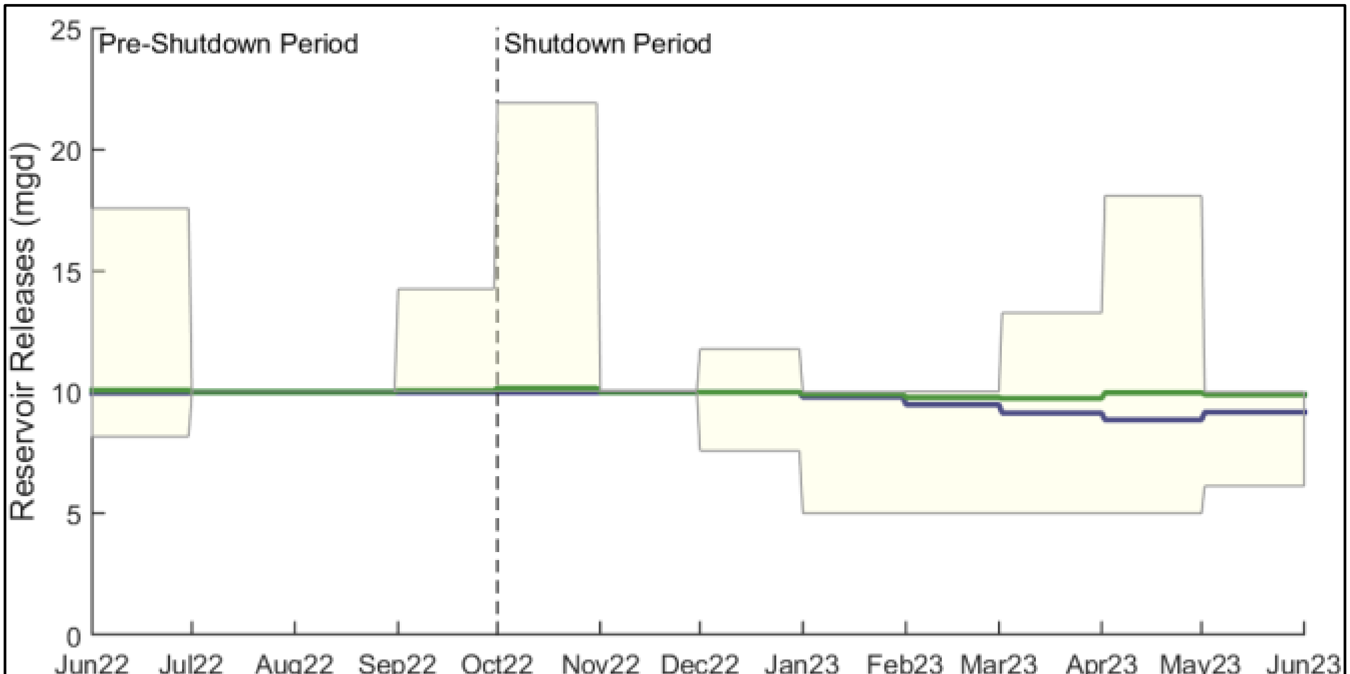
10.5.16.1 Study Area Location and Description

Titicus is located in the northeast corner Westchester County in the Town of North Salem and is formed by impounding the Titicus River (see **Figure 10.5-50**). Spills and releases from the reservoir continue along the Titicus River into Muscoot Reservoir. Titicus Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Titicus Reservoir. The water quality classification for Titicus Reservoir is Class AA(T) throughout its entire length. While Titicus Reservoir serves the City’s customers as part of the larger Croton System, no local communities draw directly from the reservoir.

10.5.16.2 Study Area Evaluation

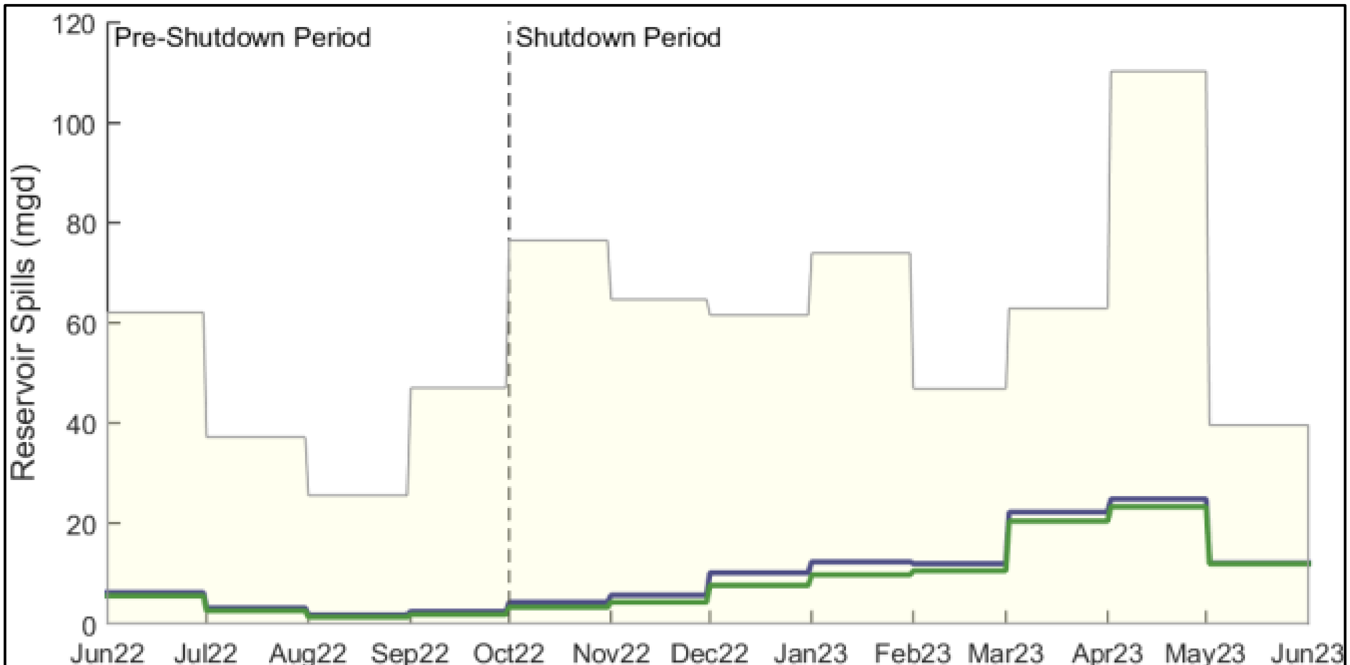
Under typical operations, the minimum regulated flow is released (5 mgd per 6 NYCRR Part 672-3) and the reservoir spills as necessary based on inflows. Releases increase for water supply purposes, and the reservoir can be drawn down approximately 35 feet when conditions are dry (see **Figure 10.5-51**).

During the pre-shutdown period, water surface elevations in Titicus Reservoir would be unchanged from typical conditions (see **Figure 10.5-51**). During the temporary shutdown of the RWBT, water surface elevations in Titicus Reservoir would be marginally higher than typical conditions by up to 2 feet (see **Figure 10.5-51**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Titicus Reservoir. Therefore, no further analysis is warranted for the Titicus Reservoir Study Area.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	10	8	18	10	0
	July	10	10	10	10	0
	August	10	10	10	10	0
	September	10	10	14	10	0
Shutdown Period	October	10	10	22	10	0
	November	10	10	10	10	0
	December	10	8	12	10	0
	January	10	5	10	10	0
	February	10	5	10	9	-1
	March	10	5	13	9	-1
	April	10	5	18	9	-1
	May	10	6	10	9	-1

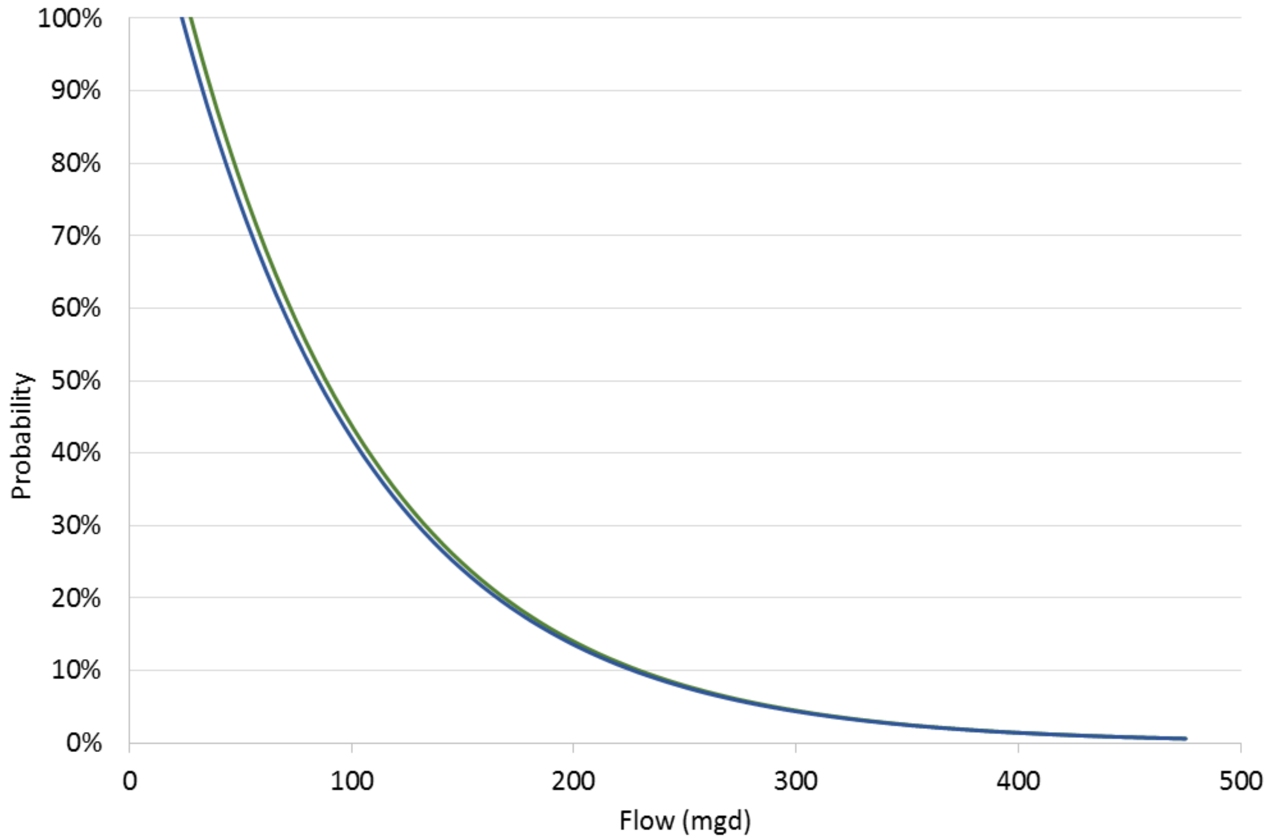
Figure 10.5-47: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Muscoot River Downstream of Amawalk Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	6	0	62	6	0
	July	3	0	37	3	0
	August	1	0	26	2	1
	September	2	0	47	2	0
Shutdown Period	October	3	0	77	4	1
	November	4	0	65	6	2
	December	8	0	62	10	2
	January	10	0	74	12	2
	February	10	0	48	12	2
	March	20	0	62	22	2
	April	24	0	110	25	1
	May	12	0	38	12	0

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-48: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Muscoot River Downstream of Amawalk Reservoir Study Area



Note: There are no USGS gauges with National Weather Service flood stage delineations along the Muscoot River.

Legend
WSSO
Typical

Figure 10.5-49: Annual Probability of High Flows from Spills and Releases – Muscoot River Downstream of Amawalk Reservoir Study Area

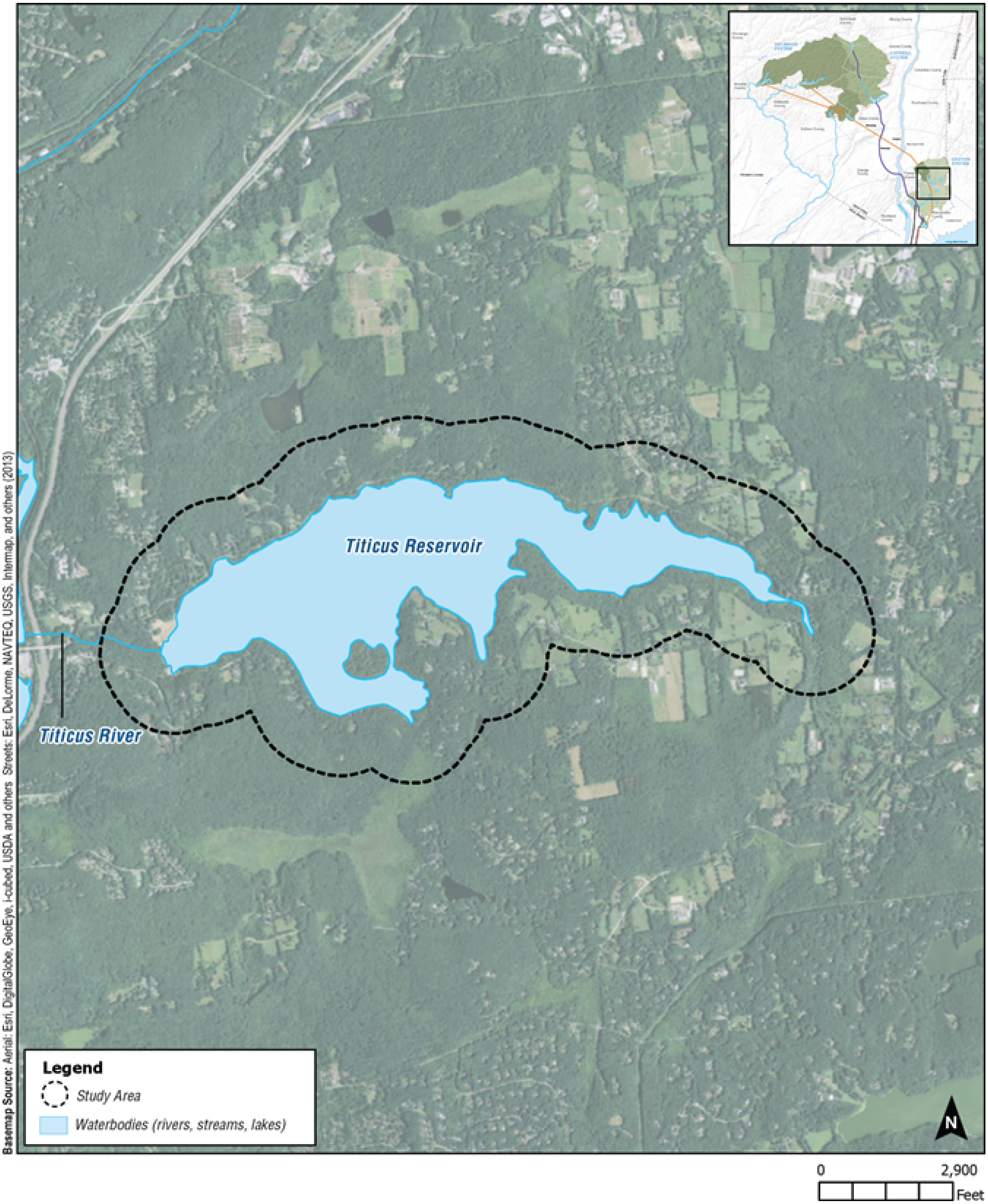
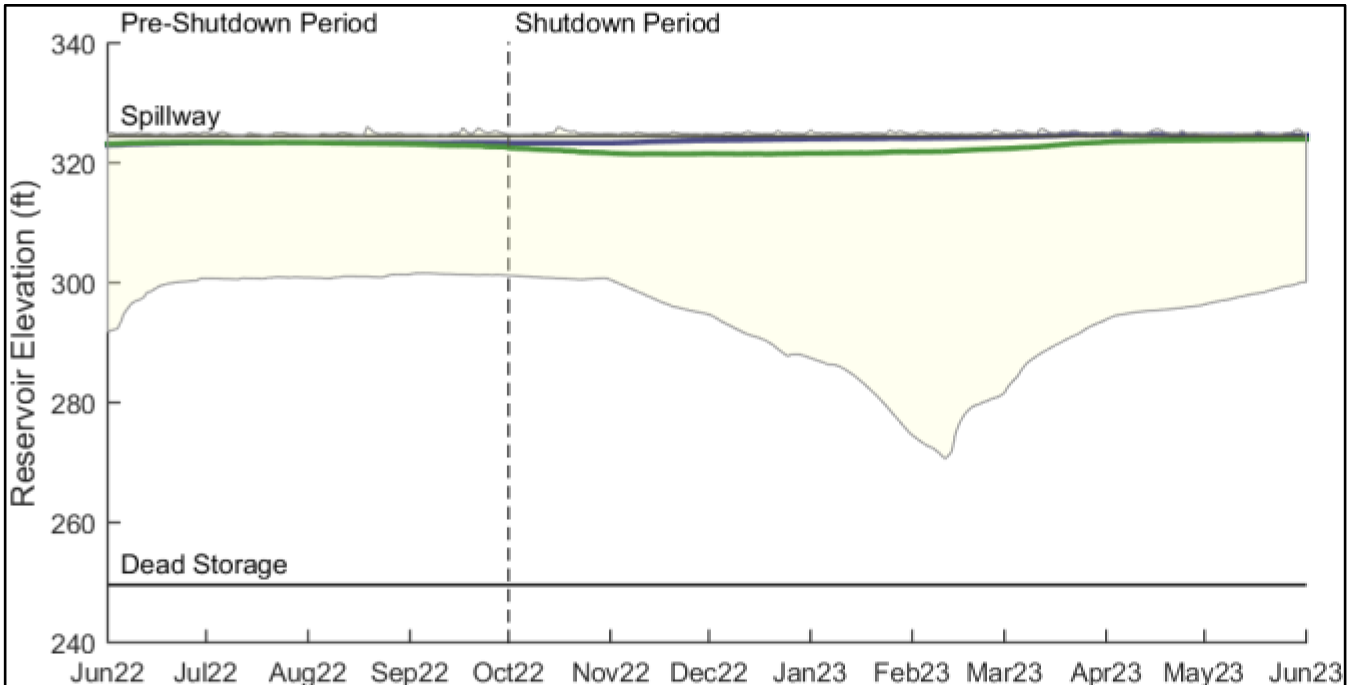


Figure 10.5-50: Titicus Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	323	298	325	323	0
	July	323	301	325	323	0
	August	323	301	325	323	0
	September	323	301	325	323	0
Shutdown Period	October	322	301	325	323	1
	November	322	297	325	324	2
	December	322	291	325	324	2
	January	322	283	325	324	2
	February	322	276	325	324	2
	March	323	289	325	325	2
	April	324	295	325	325	1
	May	324	298	325	325	1

Note: There are no water utility intakes for drawing water directly from the reservoir.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-51: Elevation Dataset Mean and Range for Typical Operations and WSSO – Titicus Reservoir Study Area

10.5.17 TITICUS RIVER BELOW TITICUS RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.17.1 Study Area Location and Description

Titicus River downstream of Titicus Reservoir flows approximately 0.5 mile through the Town of North Salem, Westchester County, New York (see **Figure 10.5-52**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the Titicus River is Class A(T).

10.5.17.2 Study Area Evaluation

Under typical operations, DEP releases the required minimum flow of 5 mgd as required under 6 NYCRR Part 672-3, and may occasionally release more when hydrologic conditions are dry. When hydrologic conditions are wet, the reservoir spills as necessary.

Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 5 mgd up to approximately 80 mgd (see **Figure 10.5-53**). The monthly average daily spills can reach approximately 140 mgd (see **Figure 10.5-54**). Spills can occur during any month but are more frequent and of larger magnitude in the spring and fall.

During the pre-shutdown period, releases into the Titicus River downstream of Titicus Reservoir would be marginally lower than typical conditions by up to approximately 3 mgd (see **Figure 10.5-53**). During this period, spills into the Titicus River would be marginally higher than typical by up to approximately 2 mgd (see **Figure 10.5-54**). During the temporary shutdown of the RWBT, releases into the Titicus River downstream of Titicus Reservoir would be lower than typical conditions by up to approximately 7 mgd (see **Figure 10.5-53**). Spills occurring during the same period would be higher than typical conditions by up to approximately 7 mgd (see **Figure 10.5-54**). The dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be lower than typical (see **Figure 10.5-55**).

There would be no potential for significant adverse impacts to Titicus River downstream of Titicus Reservoir from WSSO. Therefore, no further analysis of Titicus River downstream of Titicus Reservoir is warranted.

10.5.18 CROSS RIVER RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.18.1 Study Area Location and Description

Cross River Reservoir is located east of the Village of Katonah, Westchester County, New York and is formed by impounding the Cross River (see **Figure 10.5-56**). Releases and spills from the Cross River Reservoir flow into Muscoot Reservoir via the Cross River. During water supply emergencies, as approved by NYSDEC and NYSDOH, DEP could pump water from Cross River

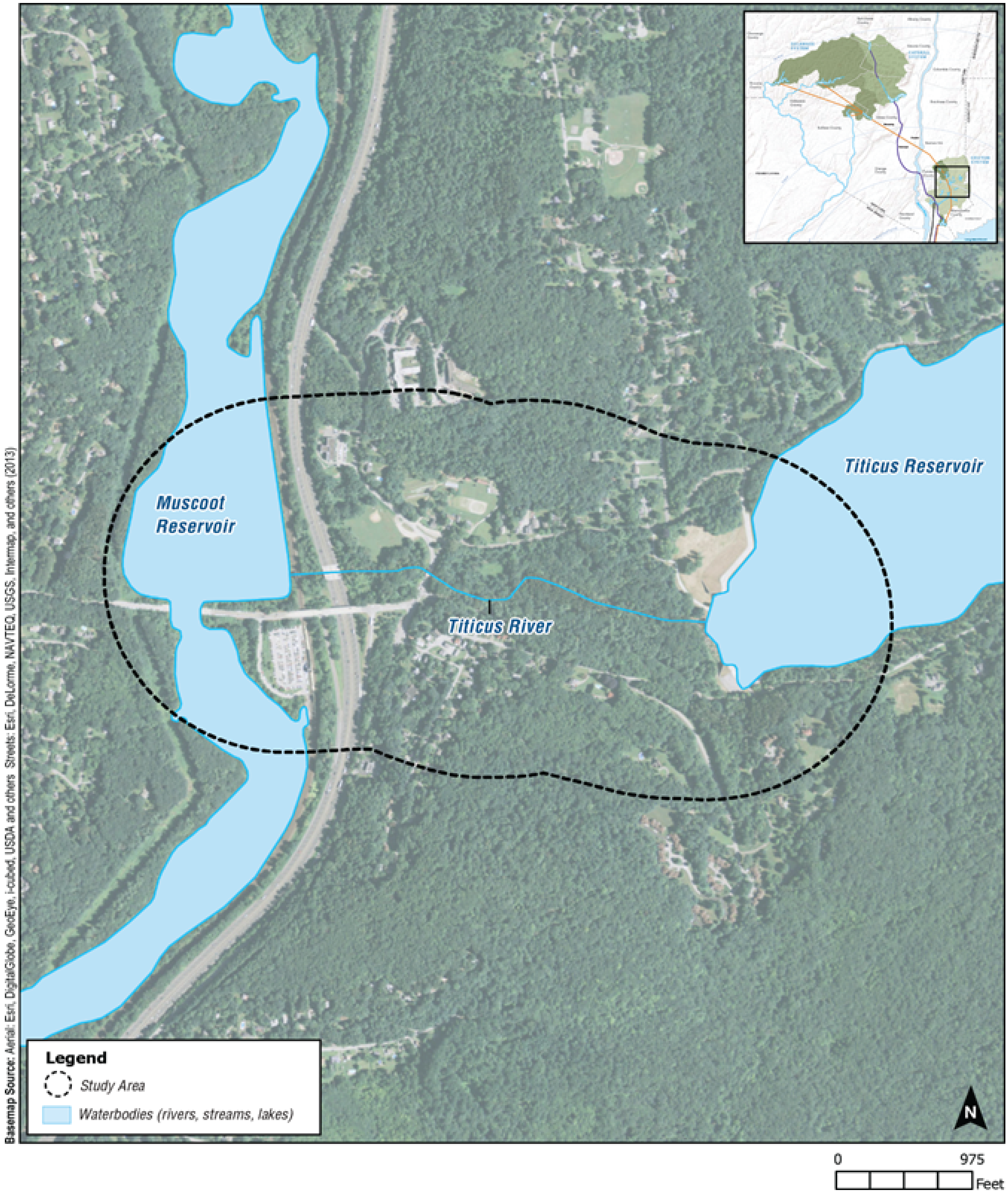
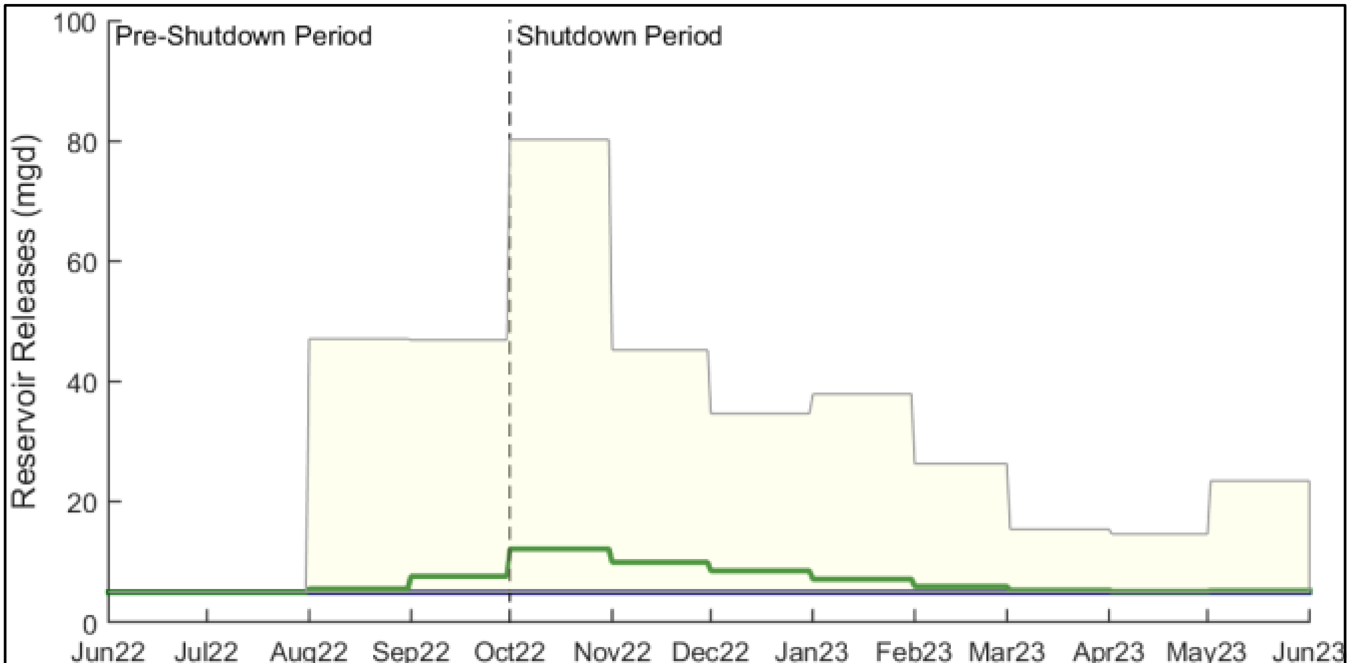


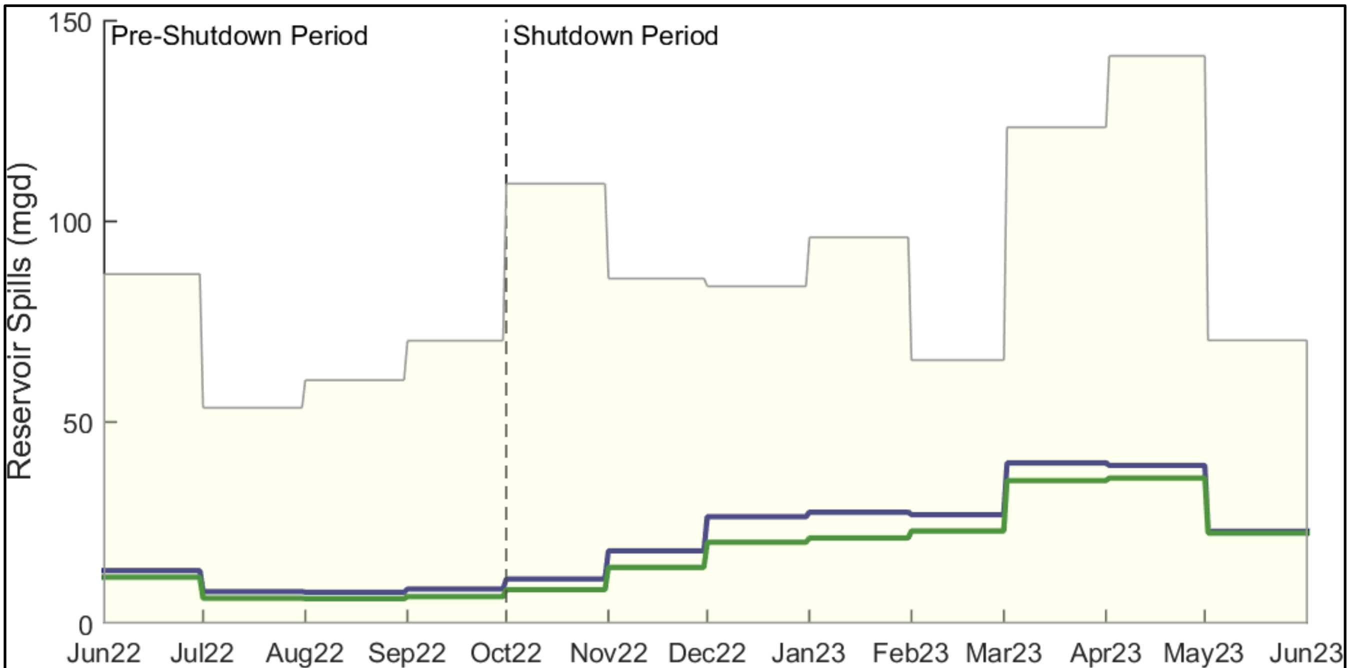
Figure 10.5-52: Titicus River Downstream of Titicus Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	5	5	5	5	0
	July	5	5	5	5	0
	August	6	5	47	5	-1
	September	8	5	47	5	-3
Shutdown Period	October	12	5	80	5	-7
	November	10	5	45	5	-5
	December	9	5	35	5	-4
	January	7	5	38	5	-2
	February	6	5	26	5	-1
	March	5	5	16	5	0
	April	5	5	15	5	0
	May	5	5	23	5	0

Legend
WSSO dataset mean — Typical dataset mean — Typical range

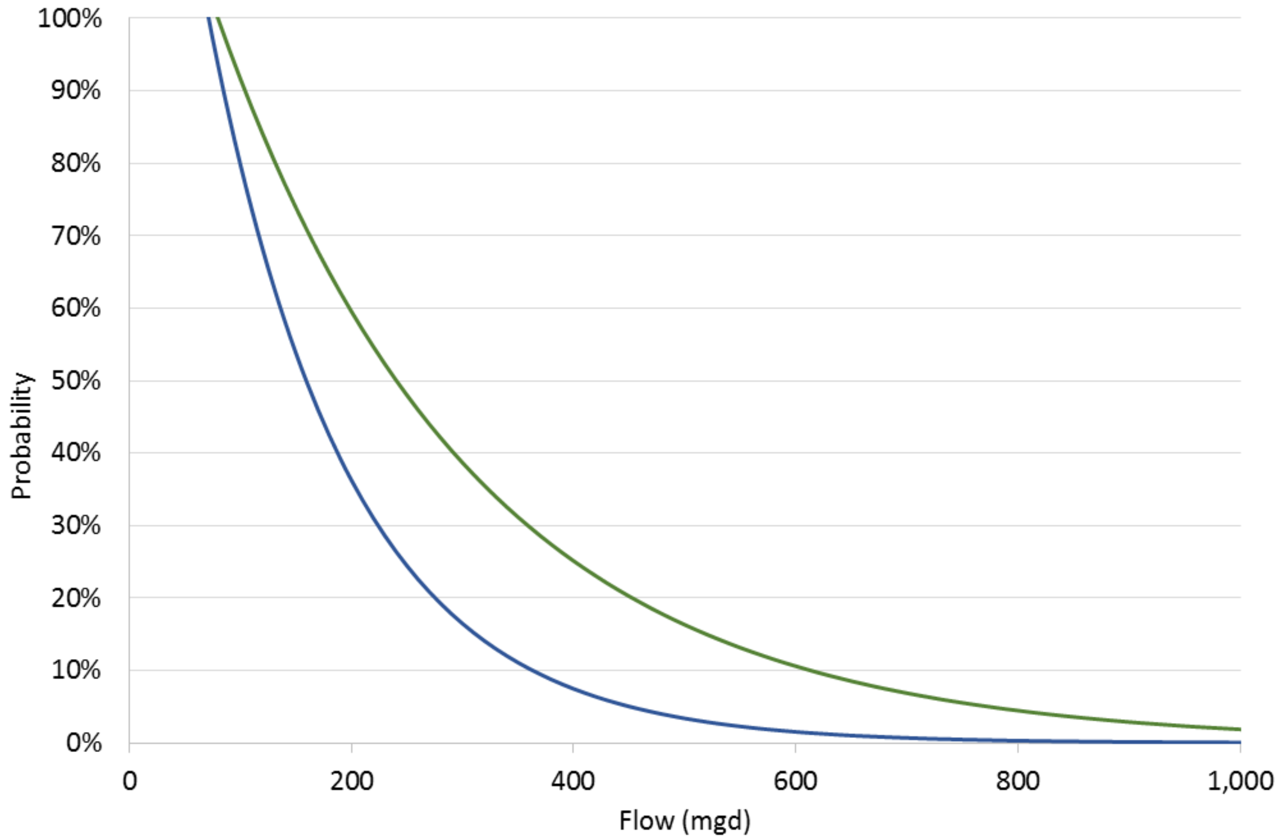
Figure 10.5-53: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Titicus River Downstream of Titicus Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	11	0	87	13	2
	July	6	0	54	8	2
	August	6	0	60	8	2
	September	7	0	70	8	1
Shutdown Period	October	8	0	109	11	3
	November	14	0	86	18	4
	December	20	0	84	26	6
	January	21	0	96	28	7
	February	23	0	67	27	4
	March	35	0	123	39	4
	April	37	0	141	40	3
	May	23	0	70	23	0

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.5-54: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Titicus River Downstream of Titicus Reservoir Study Area



Note: There are no USGS gauges with National Weather Service flood stage delineations along the Titicus River.

Legend
WSSO
Typical

Figure 10.5-55: Annual Probability of High Flows from Spills and Releases – Titicus River Downstream of Titicus Reservoir Study Area

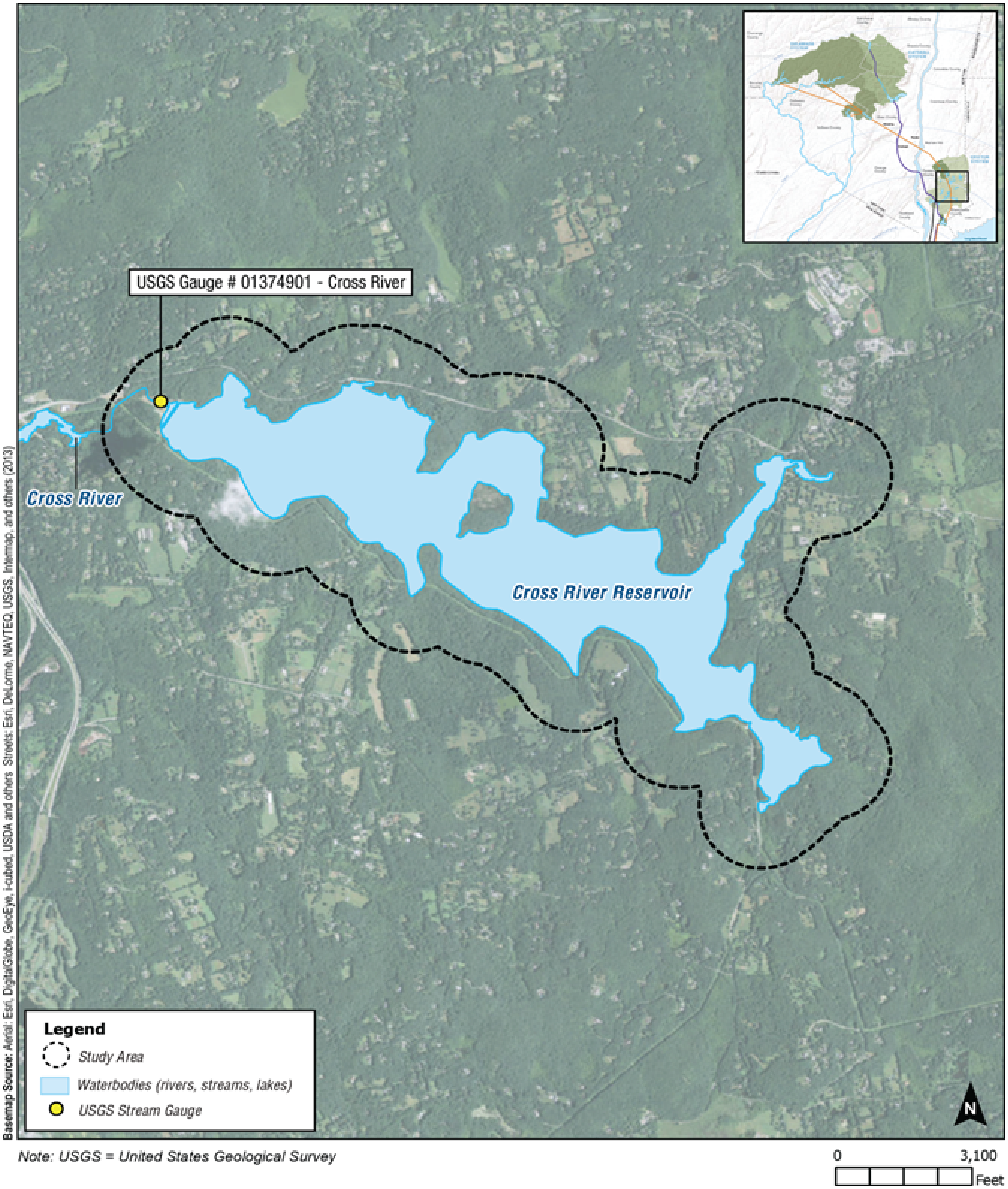


Figure 10.5-56: Cross River Reservoir Study Area

Reservoir into Shaft 13 of the Delaware Aqueduct and send water to Kensico Reservoir. Cross River Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Cross River Reservoir. The water quality classification for Cross River Reservoir is AA(T) or A(T) throughout its entire length. In addition to supplying the City's customers as part of the larger Croton System, the Town of Bedford Consolidated Water District has a number of intakes at Cross River Reservoir.

10.5.18.2 Study Area Evaluation

Under typical operations, DEP releases the minimum regulated flow of 5 mgd, as required by 6 NYCRR Part 672-3, and the reservoir spills as necessary based on inflows. When conditions are dry, or during other water supply emergencies, additional water can be diverted from the Cross River Reservoir to Kensico Reservoir via the Delaware Aqueduct through the use of the Cross River Pump Station. Under these conditions, the reservoir can be drawn down substantially up to approximately 50 feet (see **Figure 10.5-57**).

During the pre-shutdown period, water surface elevations in Cross River Reservoir would be unchanged from typical conditions (see **Figure 10.5-57**). During the temporary shutdown of the RWBT, water surface elevations in Cross River Reservoir would be lower than typical conditions by up to 7 feet due to operation of the Cross River Pump Station (see **Figure 10.5-57**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Cross River Reservoir. Therefore, no further analysis is warranted for the Cross River Reservoir Study Area.

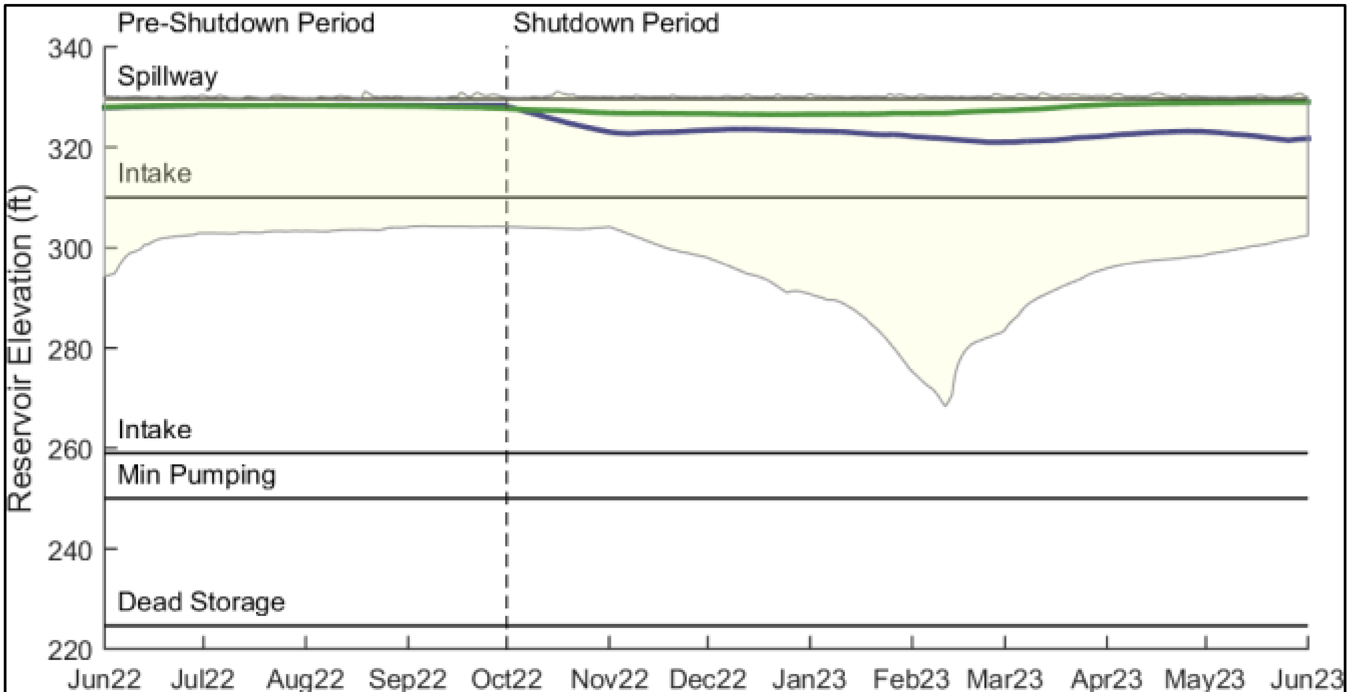
10.5.19 CROSS RIVER DOWNSTREAM OF CROSS RIVER RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.19.1 Study Area Location and Description

Cross River downstream of Cross River Reservoir flows approximately 0.4 mile through the Town of Bedford, Westchester County, New York (see **Figure 10.5-58**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, could also occur along the river, but to a more limited extent. The water quality classification for this section of the Cross River is Class A(T).

10.5.19.2 Study Area Evaluation

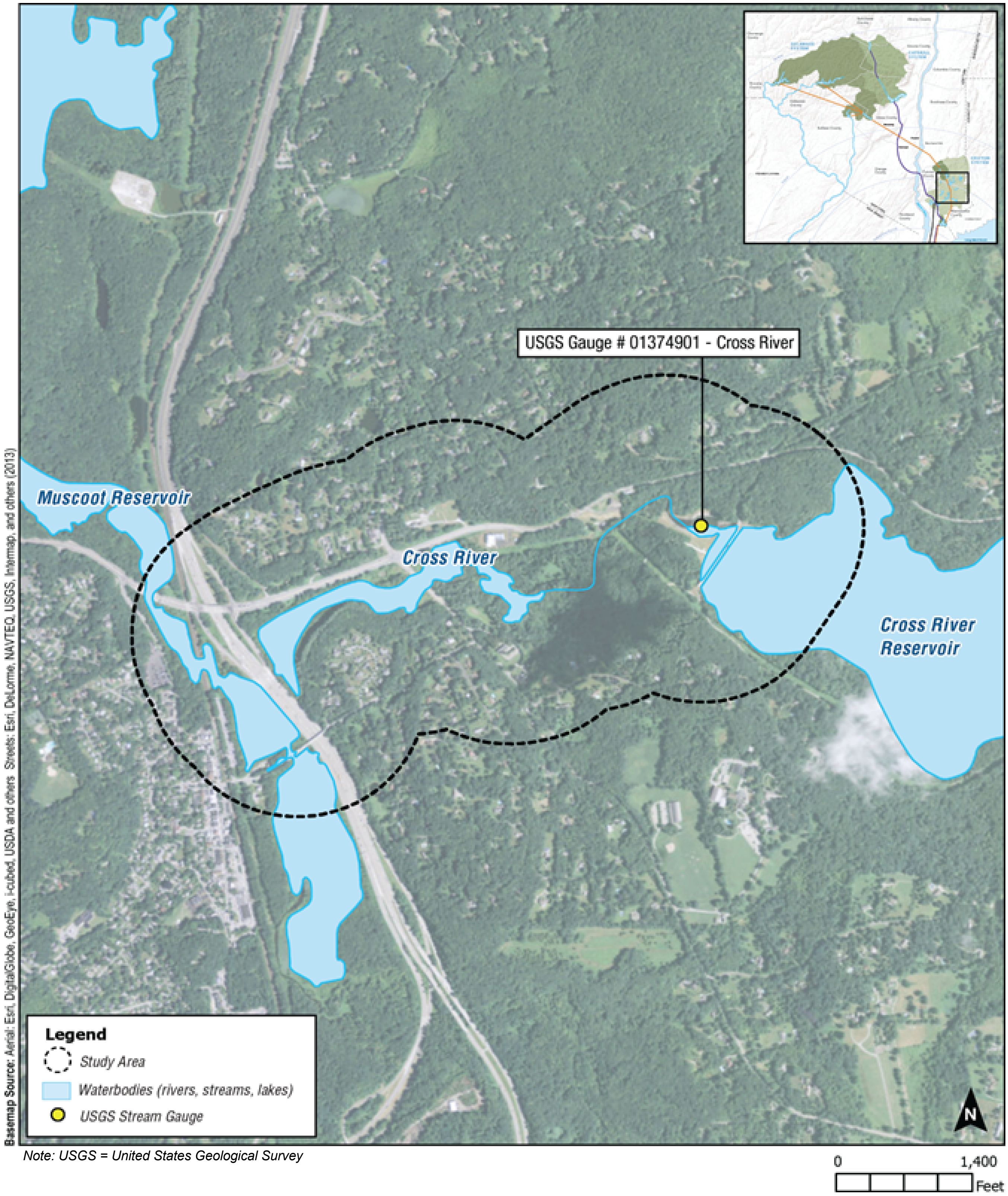
Under typical operations, DEP releases the required minimum flow of 5 mgd, as required under 6 NYCRR Part 672-3, and may occasionally release more when hydrologic conditions are dry. When hydrologic conditions are wet, the reservoir spills as necessary.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	328	300	330	328	0
	July	328	303	330	328	0
	August	328	304	330	328	0
	September	328	304	330	328	0
Shutdown Period	October	327	304	330	326	-1
	November	327	301	330	323	-4
	December	327	294	330	323	-4
	January	327	285	330	323	-4
	February	327	277	330	321	-6
	March	328	291	330	322	-6
	April	329	297	330	323	-6
	May	329	300	330	322	-7

Note: There are multiple water utility intakes for the Town of Bedford Consolidated Water District at Cross River Reservoir.

Figure 10.5-57: Elevation Dataset Mean and Range for Typical Operations and WSSO – Cross River Reservoir Study Area



Note: USGS = United States Geological Survey

Figure 10.5-58: Cross River Downstream of Cross River Reservoir Study Area

Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 5 mgd up to approximately 74 mgd (see **Figure 10.5-59**). The monthly average daily spills can reach approximately 181 mgd (see **Figure 10.5-60**). Spills can occur during any month but are more frequent and of larger magnitude in the spring and fall.

Reservoir would be marginally lower than typical conditions by up to approximately 4 mgd (see **Figure 10.5-59**). During this period, spills into the Cross River would be marginally higher than typical by up to approximately 2 mgd (see **Figure 10.5-60**). During the temporary shutdown of the RWBT, releases into the Cross River downstream of Cross River Reservoir would be lower than typical conditions by up to approximately 9 mgd (see **Figure 10.5-59**). Spills occurring during the same period would be lower than typical conditions by up to approximately 34 mgd (see **Figure 10.5-60**). The dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. In addition, the minimum required flows would be met for the duration of WSSO, and the probability of high flows would be lower than typical (see **Figure 10.5-61**). There would be no potential for significant adverse impacts to Cross River downstream of Cross River Reservoir from WSSO. Therefore, no further analysis of Cross River downstream of Cross River Reservoir is warranted.

10.5.20 MUSCOOT RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.20.1 Study Area Location and Description

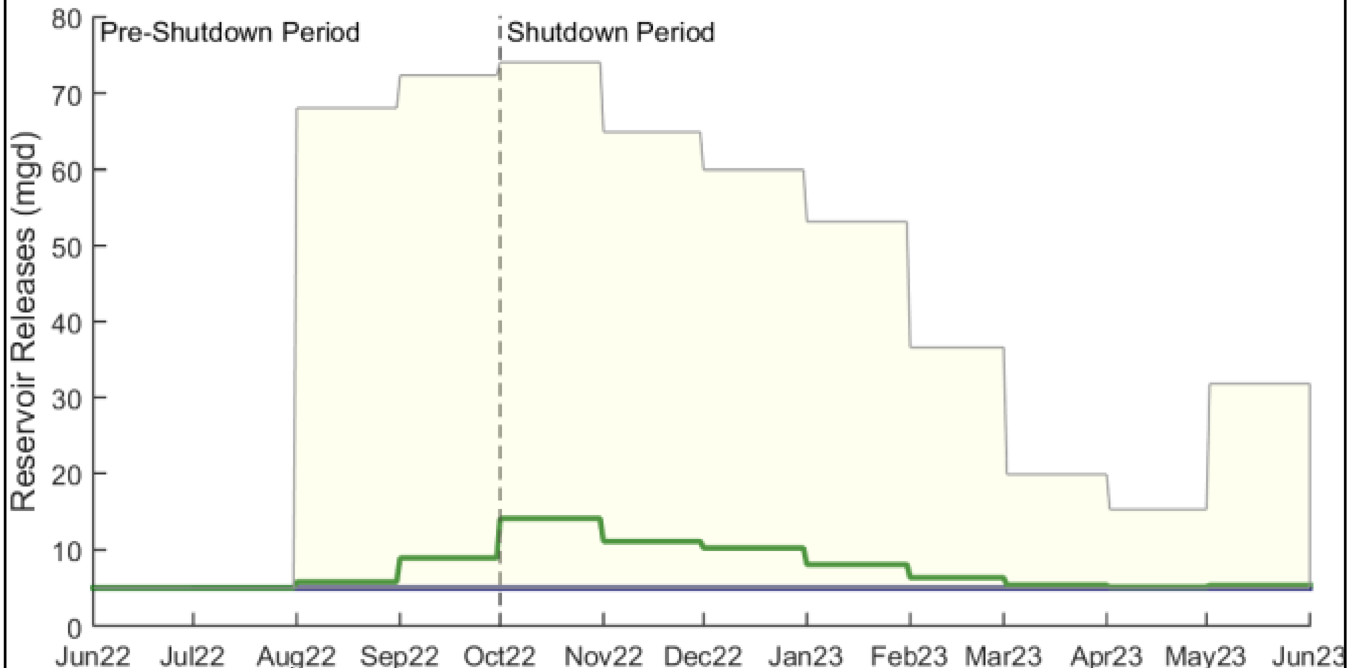
Muscoot Reservoir is located north of the Village of Katonah, Westchester County, New York and is formed by impounding the upper half of the Croton River (see **Figure 10.5-62**). Muscoot Reservoir receives water from all other Croton System reservoirs with the exception of New Croton Reservoir. Spills and releases from Muscoot Reservoir flow directly to the New Croton Reservoir. Muscoot Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is also allowed at Muscoot Reservoir. The water quality classification for Muscoot Reservoir is Class A throughout its entire length.

10.5.20.2 Study Area Evaluation

Under typical operations, Muscoot Reservoir spills as necessary based on inflows to the reservoir. There is no regulation for releases from Muscoot Reservoir to New Croton Reservoir.[56] Releases occur for water supply purposes, and when conditions are dry, the reservoir can be drawn down substantially, nearly to dead storage (see **Figure 10.5-63**).

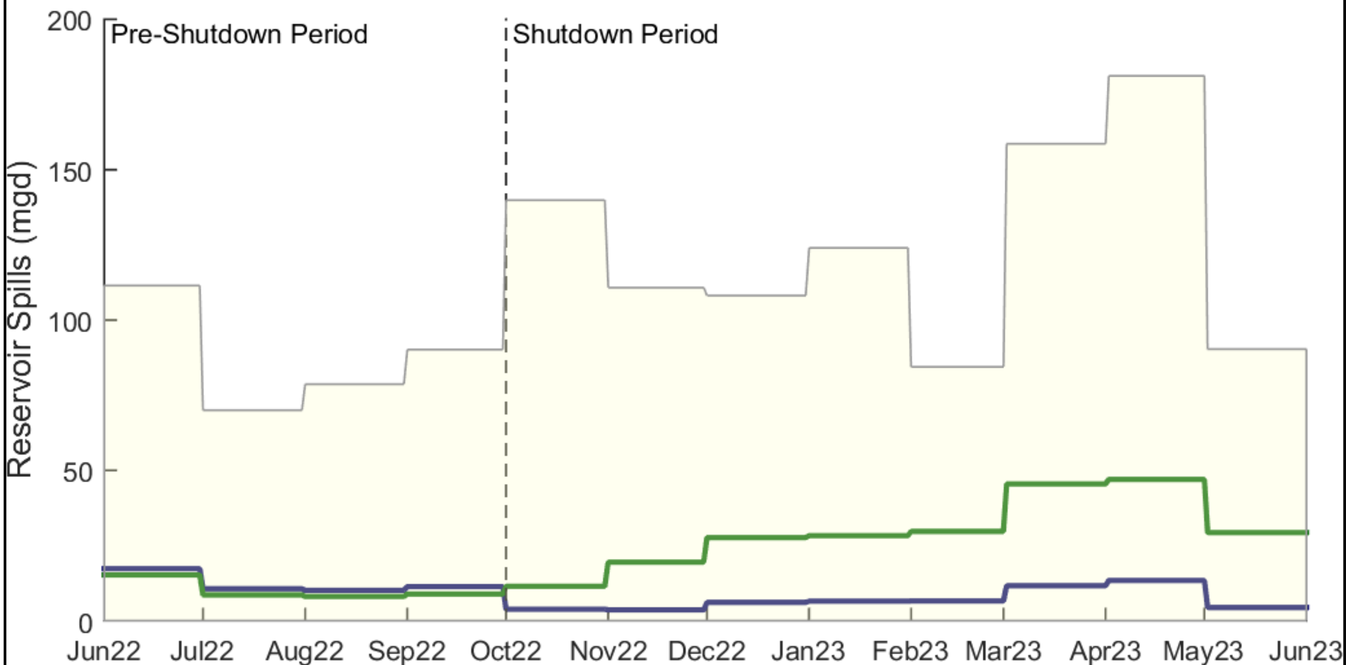
During the pre-shutdown period, water surface elevations in Muscoot Reservoir would be marginally higher than typical conditions by up to 4 feet (see **Figure 10.5-63**). During the temporary shutdown of the RWBT, water surface elevations in Muscoot Reservoir would be

[56] Because releases and spills flow directly to New Croton Reservoir and there are no regulated minimum releases, spills and releases from Muscoot Reservoir were not assessed.



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	5	5	5	5	0
	July	5	5	5	5	0
	August	6	5	68	5	-1
	September	9	5	72	5	-4
Shutdown Period	October	14	5	74	5	-9
	November	11	5	65	5	-6
	December	10	5	60	5	-5
	January	8	5	53	5	-3
	February	6	5	36	5	-1
	March	5	5	21	5	0
	April	5	5	15	5	0
	May	5	5	31	5	0

Figure 10.5-59: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Cross River Downstream of Cross River Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	15	0	111	17	2
	July	9	0	70	11	2
	August	8	0	79	10	2
	September	9	0	90	11	2
Shutdown Period	October	11	0	140	4	-7
	November	19	0	111	4	-15
	December	28	0	108	6	-22
	January	28	0	124	7	-21
	February	29	0	86	7	-22
	March	45	0	157	11	-34
	April	48	0	181	14	-34
	May	30	0	89	4	-26

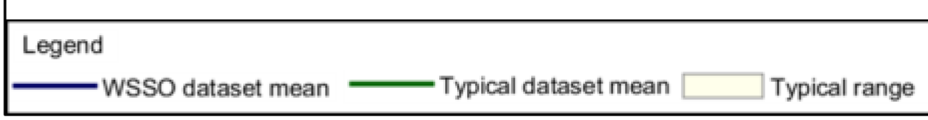
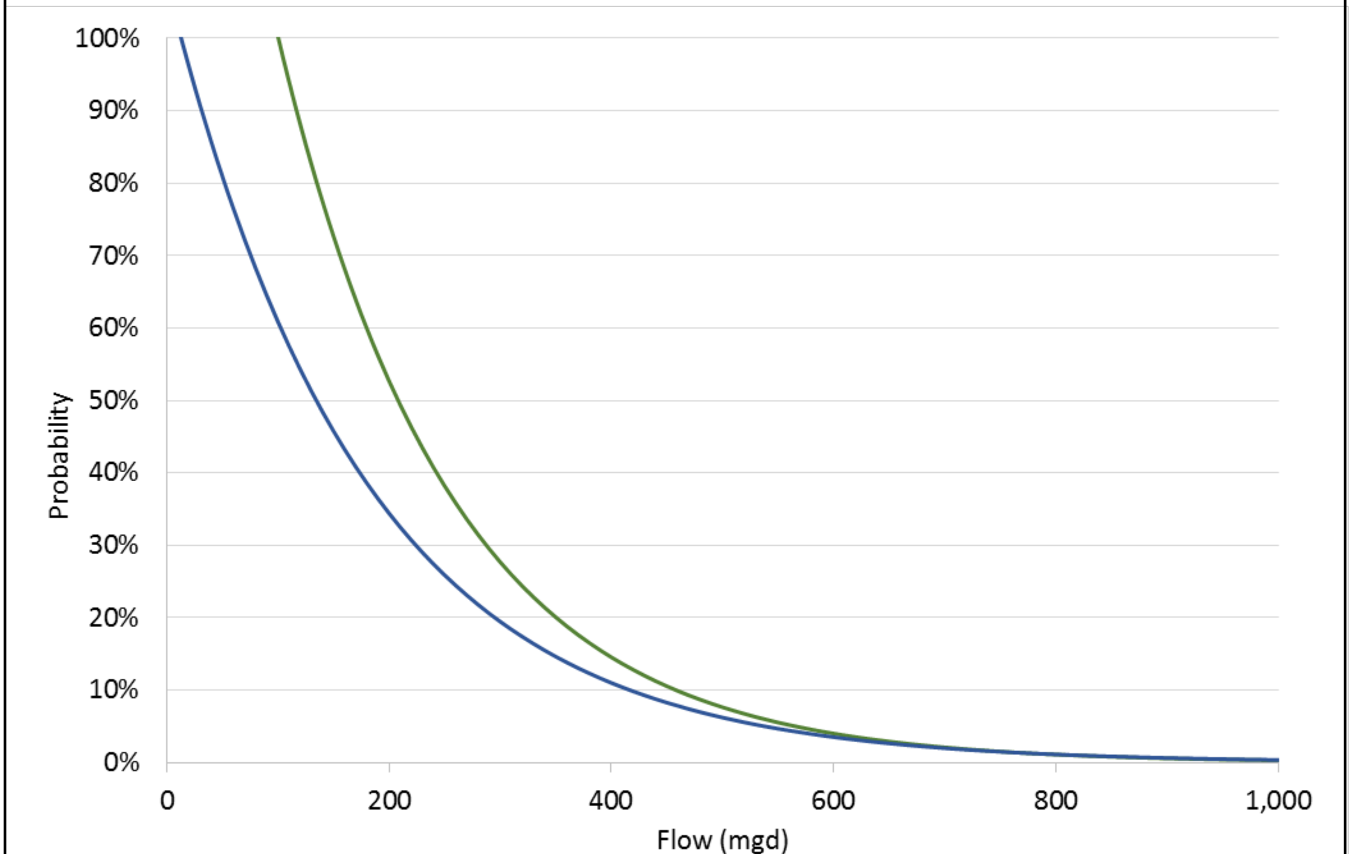


Figure 10.5-60: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Cross River Downstream of Cross River Reservoir Study Area



Note: There are no USGS gauges with National Weather Service flood stage delineations along the Cross River.

Figure 10.5-61: Annual Probability of High Flows from Spills and Releases – Cross River Downstream of Cross River Reservoir Study Area

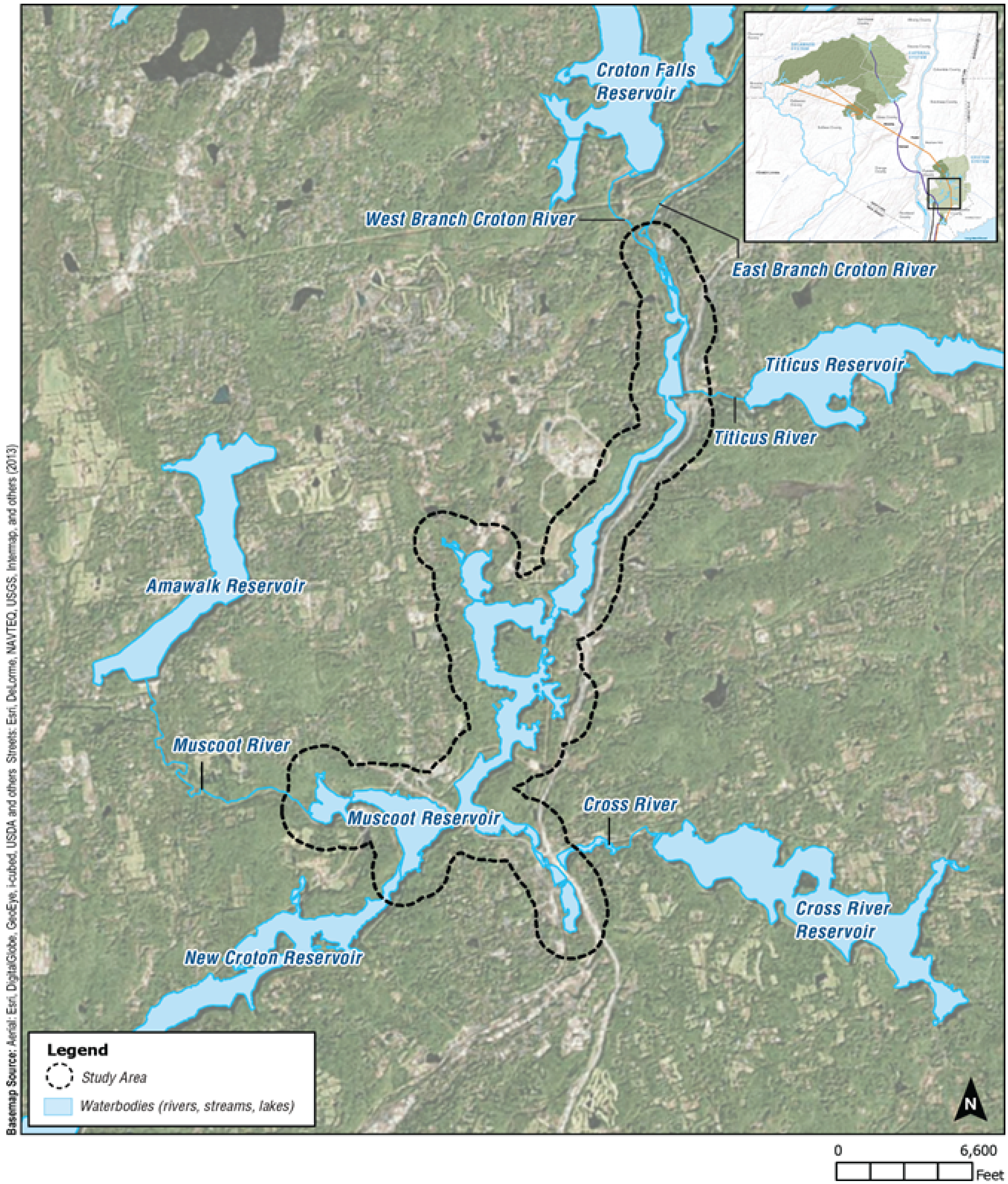
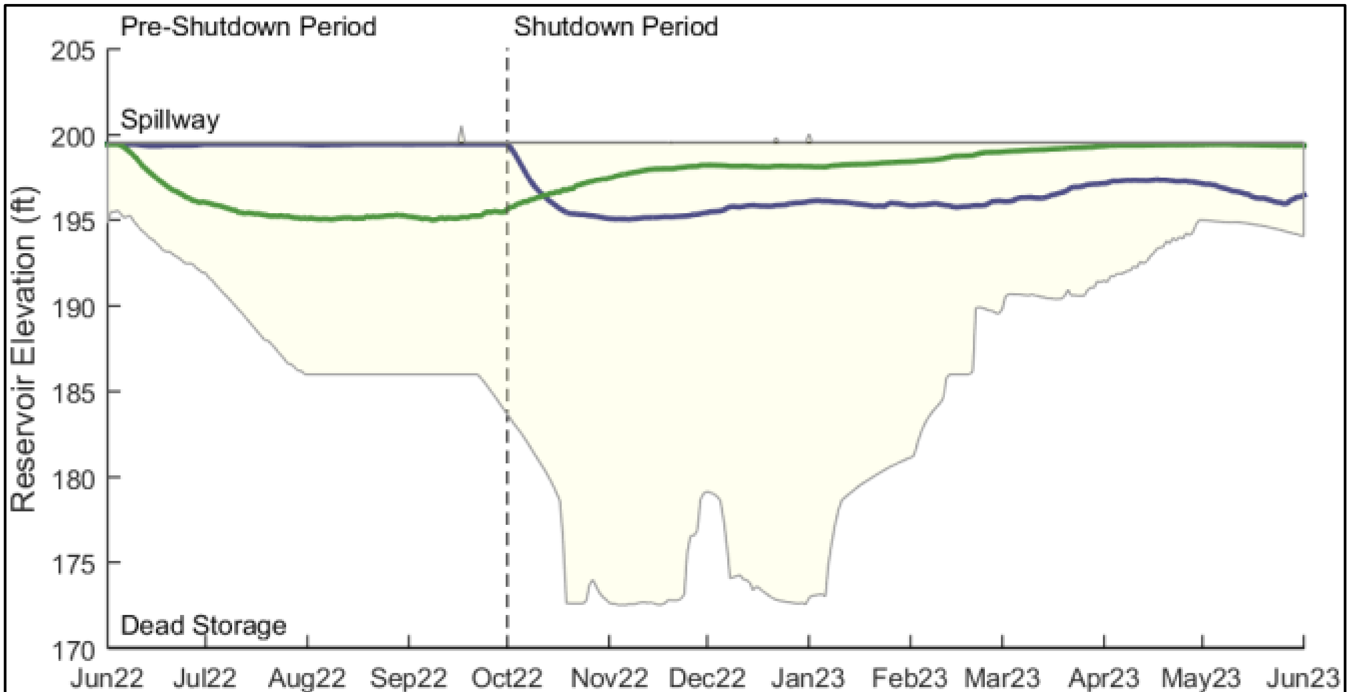


Figure 10.5-62: Muscoot Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	198	194	200	199	1
	July	195	189	200	199	4
	August	195	186	200	199	4
	September	195	186	200	199	4
Shutdown Period	October	197	178	200	196	-1
	November	198	174	200	195	-3
	December	198	174	200	196	-2
	January	198	178	200	196	-2
	February	199	188	200	196	-3
	March	199	191	200	197	-2
	April	199	193	200	197	-2
	May	199	195	200	197	-2

Note: There are no water utility intakes for drawing water directly from the reservoir.

Legend
WSSO dataset mean   Typical dataset mean   Typical range

Figure 10.5-63: Elevation Dataset Mean and Range for Typical Operations and WSSO – Muscoot Reservoir Study Area

marginally lower than typical conditions by up to 3 feet (see **Figure 10.5-63**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project. There would be no potential for significant adverse impacts from WSSO to Muscoot Reservoir. Therefore, no further analysis is warranted for the Muscoot Reservoir Study Area.

10.5.21 NEW CROTON RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.21.1 Study Area Location and Description

New Croton Reservoir is located in the Towns of Cortlandt, Yorktown, Somers, Bedford and New Castle, Westchester County, New York, and is formed by impounding the Croton River by the New Croton Dam, also known as the Cornell Dam (see **Figure 10.5-64**). New Croton Reservoir is the terminal reservoir of the Croton System and receives water from all other Croton System reservoirs. Up to 290 mgd can be diverted from the reservoir to the Croton Water Filtration Plant via the New Croton Aqueduct, while spills and releases continue down the Croton River to the Hudson River. In addition to supplying water for the City, there are a number of intakes for other utilities at New Croton Reservoir.

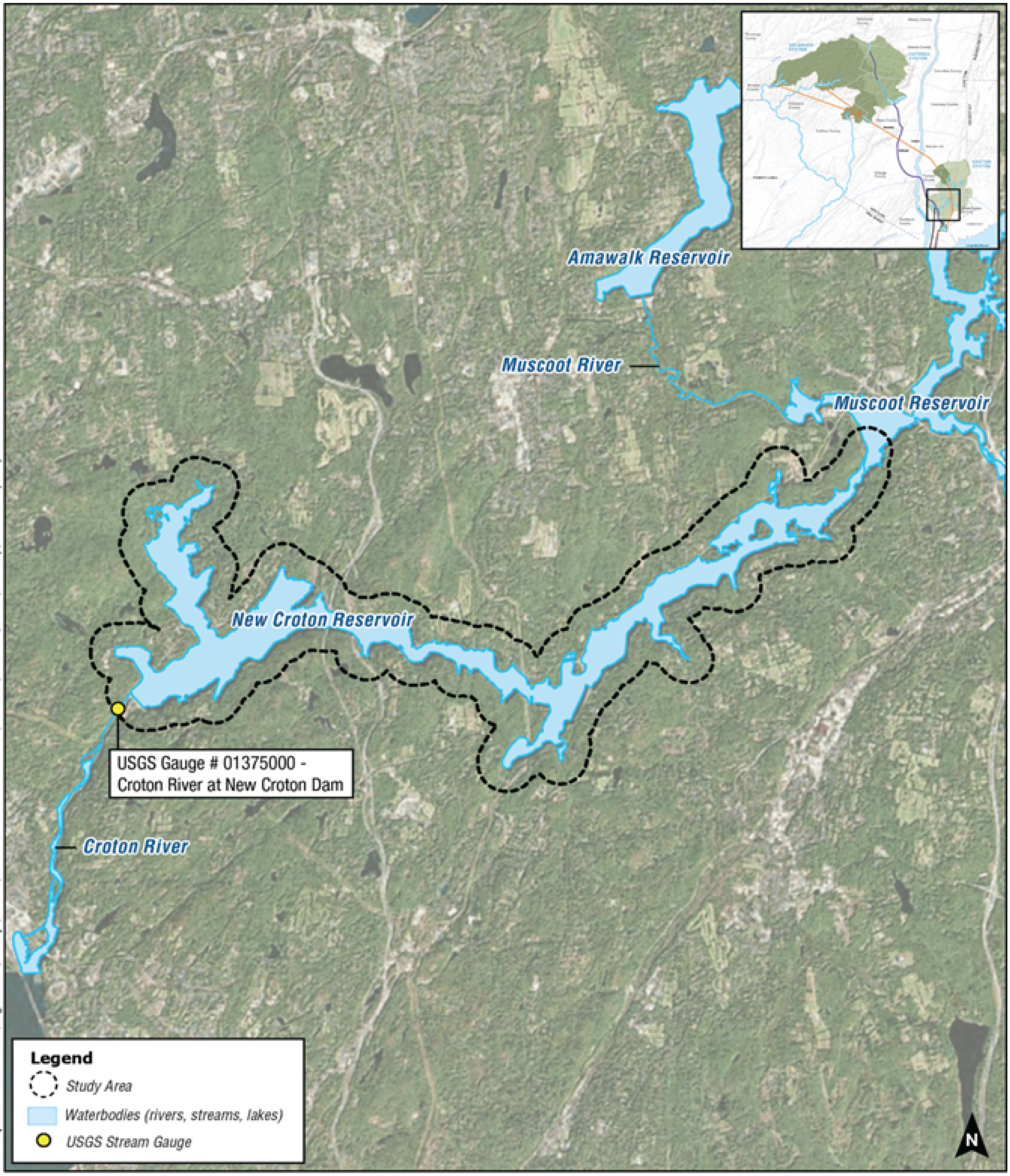
New Croton Reservoir is a high quality waterbody that supports diverse, healthy flora and fauna. The reservoir supports numerous fish species and is popular for recreational fishing, but it is not stocked. Boating for the purposes of fishing is allowed by DEP at the reservoir, and a DEP permit is required to access the reservoir. Ice fishing is prohibited at New Croton Reservoir. The water quality classification for New Croton Reservoir is Class AA throughout its entire length.

10.5.21.2 Study Area Evaluation

Under typical conditions, DEP operates New Croton Reservoir to balance inflows from the upstream Croton System reservoirs, meet minimum releases to the Croton River (see **Table 10.5-8**), and make diversions to the Croton Water Filtration Plant. During wet hydrologic conditions, DEP diverts the minimum flow of 50 mgd to the Croton Water Filtration Plant and allows the reservoir to spill as necessary. The reservoir is generally kept near full, but is drawn down during dry hydrologic conditions. DEP increases diversions to the Croton Water Filtration Plant and, depending on inflows from upstream reservoirs, the water surface elevation at New Croton could drop by up to approximately 30 feet (see **Figure 10.5-65**).

Table 10.5-8: New Croton Reservoir Regulated Releases

	Stream Flow Above Normal		Stream Flow Condition Normal		Stream Flow Below Normal	
Reservoir Storage Condition	**April 1 to June 30**	**July 1 to March 31**	**April 1 to June 30**	**July 1 to March 31**	**April 1 to June 30**	**July 1 to March 31**
Above Normal	75 mgd (116 cfs)	5.5 mgd (8.5 cfs)	75 mgd (116 cfs)	5.5 mgd (8.5 cfs)	16.5 mgd (25.5 cfs)	5.5 mgd (8.5 cfs)
Normal	75 mgd (116 cfs)	5.5 mgd (8.5 cfs)	75 mgd (116 cfs)	5.5 mgd (8.5 cfs)	11.0 mgd (17.0 cfs)	5.5 mgd (8.5 cfs)
Below Normal	16.5 mgd (25.5 cfs)	5.5 mgd (8.5 cfs)	11.0 mgd (17.0 cfs)	5.5 mgd (8.5 cfs)	11.0 mgd (17.0 cfs)	5.5 mgd (8.5 cfs)

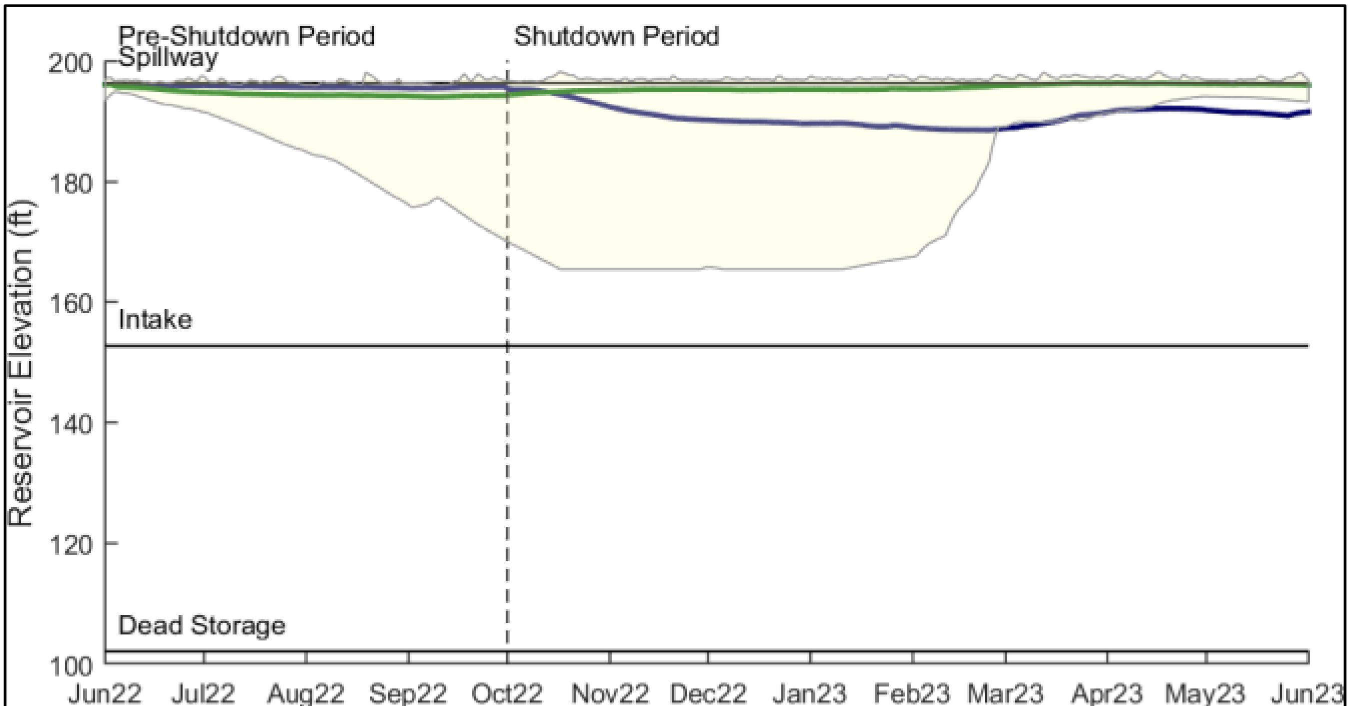


Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Note: USGS = United States Geological Survey

0 7,700
Feet

Figure 10.5-64: New Croton Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (feet)
		Dataset Mean (feet)	Dataset Minimum (feet)	Dataset Maximum (feet)	Dataset Mean (feet)	
Pre-Shutdown Period	June	195	194	197	196	1
	July	195	188	196	196	1
	August	194	181	196	196	2
	September	194	175	196	196	2
Shutdown Period	October	195	167	197	194	-1
	November	195	166	197	191	-4
	December	195	166	197	190	-5
	January	195	166	197	189	-6
	February	196	176	197	189	-7
	March	196	190	197	190	-6
	April	196	193	197	192	-4
	May	196	194	197	191	-5

Note: New Croton Reservoir has multiple direct water utility connections at New Croton Reservoir below approximately elevation 154 feet.

Legend
WSSO dataset mean — Typical dataset mean — Typical range

Figure 10.5-65: Elevation Dataset Mean and Range for Typical Operations and WSSO – New Croton Reservoir Study Area

During the pre-shutdown period, water surface elevations in New Croton Reservoir would be marginally higher than typical conditions by up to 2 feet (see **Figure 10.5-65**). During the temporary shutdown of the RWBT, water surface elevations in New Croton Reservoir would be lower than typical conditions by up to approximately 7 feet (see **Figure 10.5-65**). The dataset mean for water surface elevations during WSSO would remain within the typical range for the duration of the project, except for a minor deviation of 1 to 3 feet below the typical range for April and May of the RWBT temporary shutdown. The dataset mean of water surface elevations returns to the typical range beginning in June following the end of the RWBT temporary shutdown. This deviation is largely due to the Croton System being generally drawn down at the end of the shutdown, whereas under typical operations the Croton System would be refilling in advance of the summer season. Based on these modeling results, additional analysis of the potential for impacts is warranted for New Croton Reservoir.

10.5.21.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Variations in water surface elevations would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning within the surrounding area. For these reasons, and because variations would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the New Croton Reservoir Study Area and no further analysis is warranted.

The consistency of variations in water surface elevations during temporary operations with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in reservoir water surface elevations. Therefore, WSSO would not result in significant adverse impacts to public policy within the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.4 Socioeconomic Conditions

Potentially changes in water surface elevations for New Croton Reservoir during the temporary shutdown would not cause indirect or direct effects to factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Further, reduced water surface elevations would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.6 Open Space and Recreation

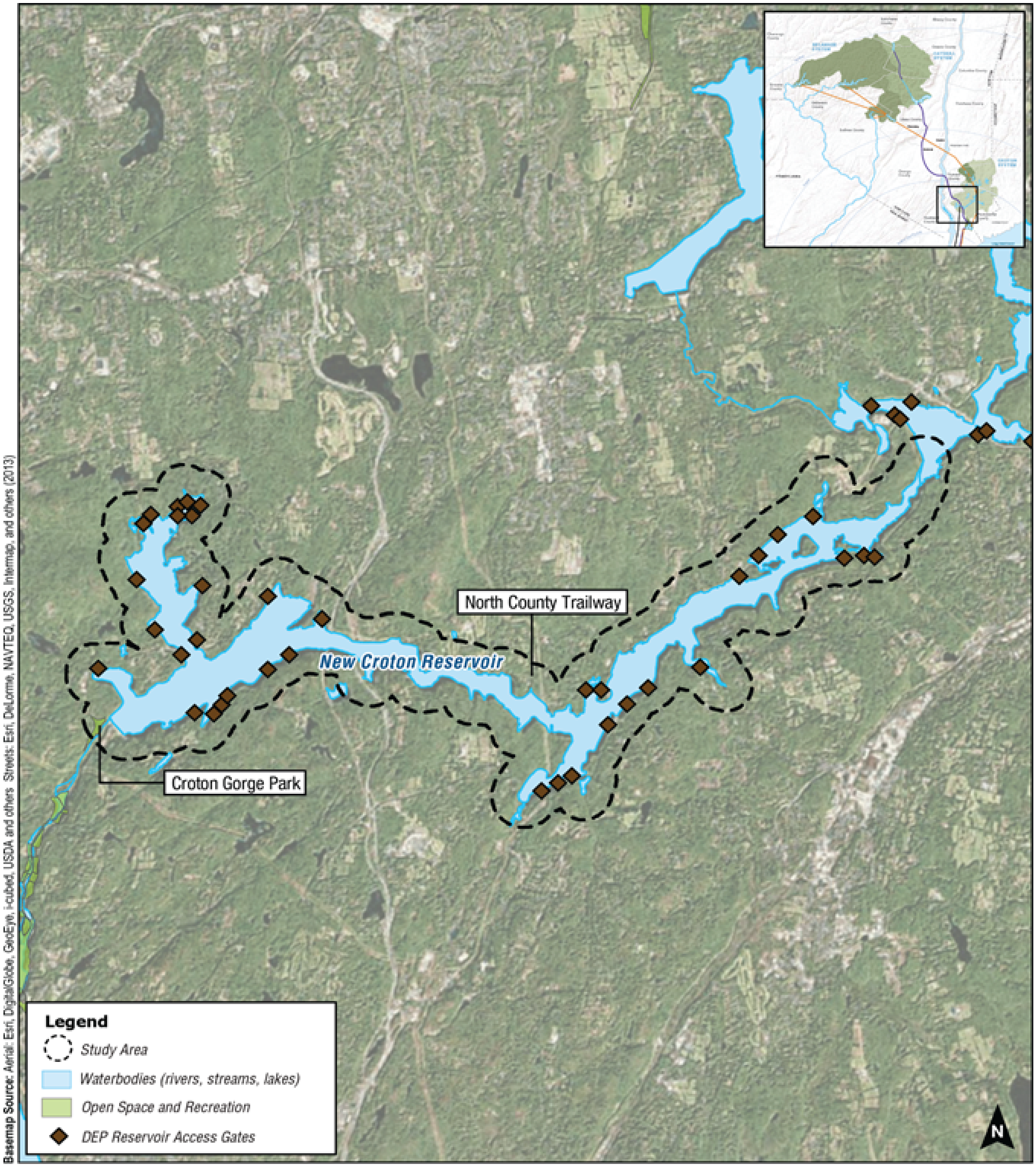
Open space and recreation resources include the New Croton Reservoir and two open spaces located in proximity to the reservoir. Open space and recreation resources are shown in **Table 10.5-9** and locations are shown on **Figure 10.5-66**.

Table 10.5-9: New Croton Reservoir Open Space and Recreation Resources

Map Key	Name	Address	Resource Opportunities	Area/Watercourse Area or Length (if Applicable)
CRO-7	New Croton Reservoir	Towns of Cortlandt, Yorktown, Somers, Bedford and New Castle	Fishing, Non-motorized boating, boat storage	2,182 acres
CRO-9	North County Trailway	Yorktown, New York	Hiking, Biking, Running and passive recreational activities	22.1 miles
CRO-11	Croton Gorge Park	Croton-On-Hudson, New York 10520	Baseball fields, cross country skiing, hiking, fishing, picnicking, playground	97 acres

The New Croton Reservoir provides recreational opportunities in the form of fishing and boating for the purpose of fishing. The reservoir is not stocked, but NYSDEC fishing regulations allow fishing for trout in the New Croton Reservoir year round. However, ice fishing is not permitted. Other sport fishing species are present in the reservoir (see Aquatic and Benthic Resources in Section 10.5.21.10, “Natural Resources,” for aquatic species’ presence and abundance). Access to the New Croton Reservoir is provided via 37 access gates at the New Croton Reservoir. Fishing at New Croton Reservoir is available from the shoreline or while in non-motorized boats with a DEP permit. Boat storage for use in the reservoir is provided by DEP at designated locations along the shoreline. There are approximately 1,649 boats stored at the New Croton Reservoir. Boats are launched from the shoreline or at designated boat launches.

Two open spaces are located within the New Croton Reservoir Study Area abutting the reservoir: the North County Trailway and Croton Gorge Park. The North County Trailway is a paved, multi-use path that spans north through Westchester County for 22.1 miles to the Putnam County border. The Kitchawan to Baldwin Place section of the North County Trailway runs north to south over the New Croton Reservoir by way of the Croton Turnpike. Croton Gorge Park is a 97-acre property at the base of the Croton Dam at the tailwaters of the dam. The Park provides views of the dam and spillway, as well as opportunities to fish, picnic, hike, and access the New York State Old Croton Aqueduct State Historic Park. The New York State Old Croton Aqueduct State Historic Park is discussed in Section 10.5.22.6, “Open Space and Recreation,” under the Croton River Downstream of New Croton Reservoir Study Area.



Notes: *Only Open spaces that immediately abut waterbodies were analyzed.*
DEP has designated a narrow band of property along certain sections of the reservoir for fishing by permit, accessible only through designated access gates. Due to the map scale this open space is not shown.

0 7,000 Feet

Figure 10.5-66: Open Space and Recreation Resources – New Croton Reservoir Study Area

DEP has consulted with the Towns of Cortlandt, Yorktown, Somers, Bedford, New Town, New Castle and Katonah, the Village of Croton-On-Hudson, and Westchester County, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the New Croton Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Use of the identified open space is anticipated to continue. Therefore, in the future without WSSO, it is assumed that open space and recreation within the New Croton Reservoir would be the same as baseline conditions.

During WSSO, the New Croton Reservoir water surface elevations would be lower than typical in April and May of the RWBT temporary shutdown. This drop in water surface elevation would be slightly lower than typical, and would persist through the shutdown and into the summer following the end of the shutdown. While reservoir drawdown below typical levels could create difficulties for launching and retrieving recreational boats, the lower water surface elevations in the reservoir would not have a significant adverse impact to open space and recreational uses of the reservoir. Further, there would be no effects on fisheries resources during the temporary shutdown (see Aquatic and Benthic Resources in Section 10.5.21.10, "Natural Resources"). DEP outreach efforts would serve to notify recreational users of potential changes to reservoir access in advance of the RWBT temporary shutdown, as is standard for planned changes at DEP reservoirs. Notifications would disclose any special regulations required during shutdown operations. Use of the North County Trailway and Croton Gorge Park do not depend on the New Croton Reservoir water surface elevations. Therefore, WSSO would not result in significant adverse impacts to open space and recreation resources in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.7 Critical Environmental Areas

Several CEAs were identified in the New Croton Reservoir Study Area. The "County and State Park Lands" CEA is designated by Westchester County and includes all County and State parks. The parks contained in this CEA that overlap with the study area consist of the Kitchawan Research Station County Park, the Muscoot Farm County Park, Croton Gorge County Park, the Old Croton Aqueduct State Historic Park, and the Briarcliff-Peekskill Trailway County Park (see **Figure 10.5-67**). The "Geographic Area Overlaying the Aquifer Within Town" CEA (Bedford Aquifer CEA), designated by the Town of Bedford, was also identified as occurring in the study area.

Kitchawan Research Station was a research facility for the Bronx Botanical Gardens and is now an approximately 208-acre preserve with trails that run through open fields and woodlands. The preserve is located adjacent to the southern shore of New Croton Reservoir near State Route 134. The Muscoot Farm is an approximately 777-acre park with trails, historic farm buildings, and a museum. Muscoot farm is located on the northern shoreline of New Croton Reservoir where the Muscoot Dam separates Muscoot Reservoir from New Croton Reservoir. Croton Gorge County Park is an approximately 97-acre property at the base of the Croton Dam that is popular for fishing, picnicking, and hiking. The Old Croton Aqueduct State Historic Park is a designated National Historic Landmark. This trail runs approximately 26.2 miles from Van Cortlandt Park in the Bronx to New Croton Dam. The Briarcliff-Peekskill Trailway is a linear park and runs approximately 12 miles from Ossining to Peekskill. The trailway runs through the study area and

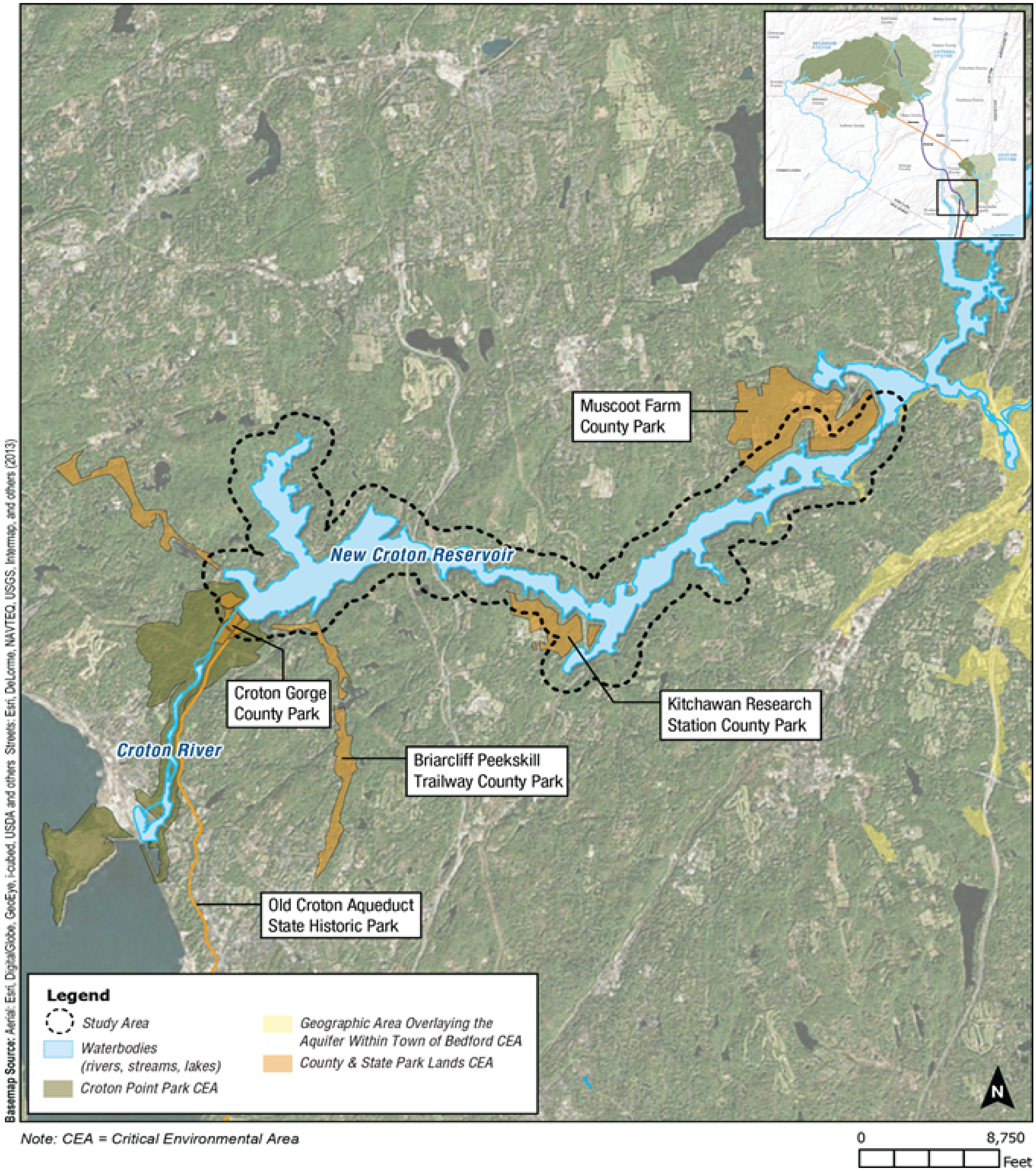


Figure 10.5-67: Critical Environmental Areas – New Croton Reservoir Study Area

crosses the study area at New Croton Dam. The Bedford Aquifer CEA includes all geographic areas within the Town of Bedford that overlap with the delineated boundaries of the aquifers that supply the town with drinking water (see **Figure 10.5-67**).

In the future without WSSO, it is assumed that all of the parks and the Bedford Aquifer CEA would continue to exist in their current capacity. The parks would continue to serve recreational purposes and development in or adjacent to them would be limited. The areas that overlap with the Town of Bedford Aquifer CEA would continue to be subject to local laws that restrict certain development practices within the aquifer areas and the Bedford Aquifers would continue to supply water to the township and its residents.

In the future with WSSO, it is assumed that all of the parks and the Bedford Aquifer CEA would continue to exist in their current capacity. While water surface elevations for the reservoir would be lower than typical, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.5.21.10, "Natural Resources'). Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the New Croton Reservoir Study Area. The potential mechanism for historic or cultural resources impacts from WSSO would be through erosion. While water surface elevations at New Croton Reservoir would be lower during the RWBT temporary shutdown than typical operations, erosion is not likely (see Geology and Soils in Section 10.5.21.10, "Natural Resources").

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no effect on cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.9 Visual Resources

The boundaries of the New Croton Reservoir Study Area is a 0.25-mile buffer beyond the reservoir itself and also includes view corridors that extend further based on the locations that are publicly accessible. Visual resources, consisting of: four sites/structures listed on the National and/or State Register of Historic Places; four sites/structures eligible for listing on the N/SR of Historic Places; one State Scenic Byway; and eight local resources, as shown on **Figure 10.5-68**.

The four properties listed under the N/SR of Historic Places include the New Croton Dam, the Taconic State Parkway (also a State Scenic Byway), the Old Croton Aqueduct, and the Old Croton Aqueduct State Historic Park. The four eligible properties include: two bridges; the New Croton Dam Spillway Bridge and New York City & Northern Railroad Bridge; one dam, the New Croton Aqueduct Muscoot Reservoir Dam; and the former residence of the police 6th precinct.

The one scenic byway is the Taconic State Parkway. The eight local resources include John E. Hand Memorial Park, the Croton Gorge County Park, Kitchawan Preserve, Muscoot Farm, the Teatown-Kitchawan Trail, North County Trailway, and the Muscoot and New Croton reservoirs with surrounding watershed lands.

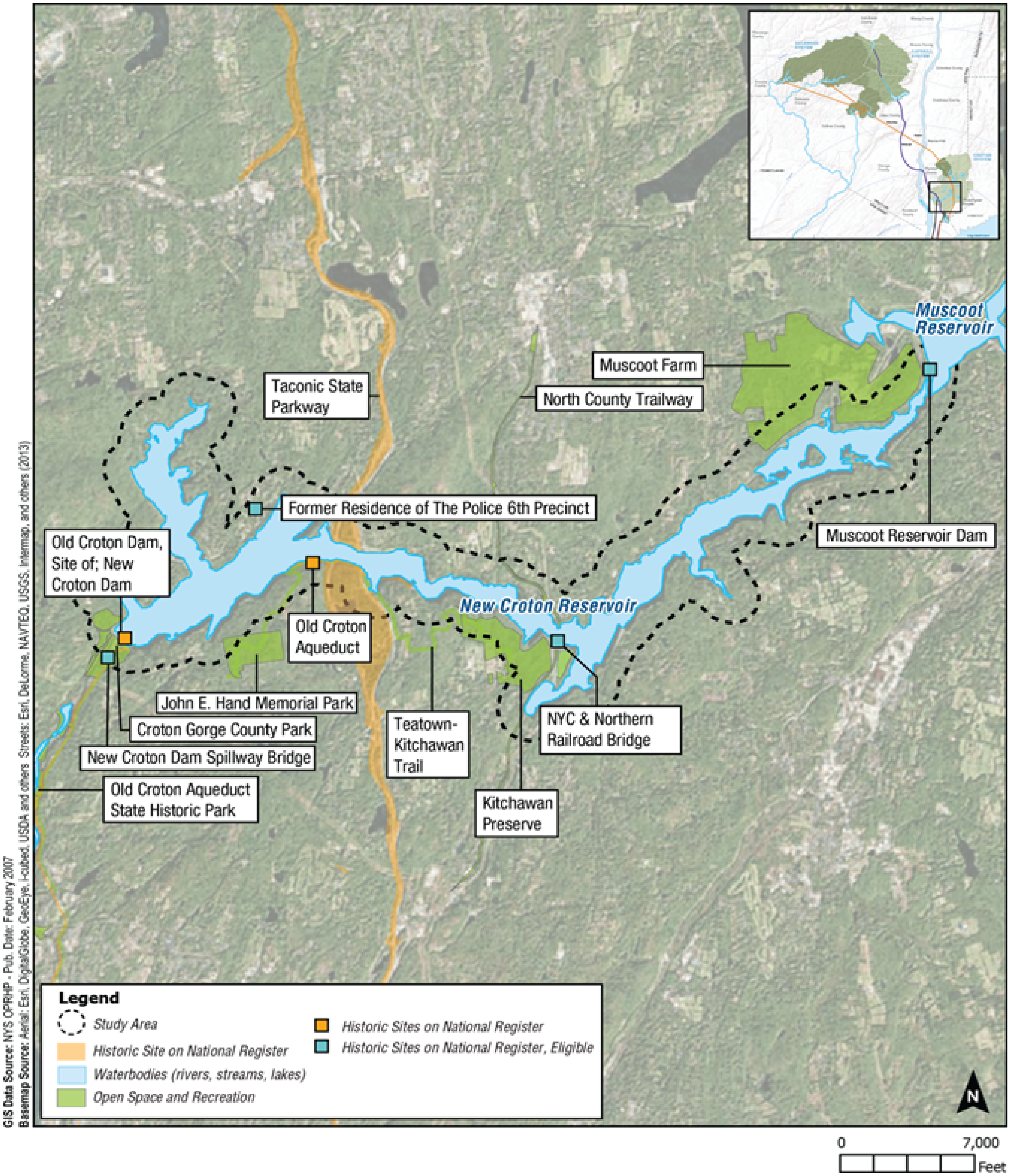


Figure 10.5-68: Visual Resources – New Croton Reservoir Study Area

As described above, changes could occur to the water surface elevations in the New Croton Reservoir as a result of the temporary shutdown and drawdown of the New Croton Reservoir.

New Croton Dam, also known as the Cornell Dam, was completed in 1906 and controls the releases of water from the east portion of the New Croton Reservoir to the Croton River. The reservoir is viewable from the New Croton Dam, which is accessible to the public. The Taconic State Parkway, a 104-mile parkway connecting Kensico Dam Plaza in Westchester County to Chatham in Columbia County, is a winding, hilly route that offers scenic vistas of the Hudson Highlands, Catskill, and Taconic regions of the State. There are many areas of dense vegetation along either side of the parkway. The New Croton Reservoir is visible from the bridges of Taconic State Parkway, as it passes over the reservoir, offering travelers a quick glance of the reservoir below. Views of the reservoir leading up to and from the bridges are limited due to rock outcrops and vegetation.

Built in 1890, the 41-mile route of the Old Croton Aqueduct winds from the Croton Aqueduct Gate House on the south side of the New Croton Reservoir to the City. Beginning at the New Croton Dam, a 26.2-mile length of the Old Croton Aqueduct is also a State Historic Park, National Historic Landmark and trail. Approximately 4.2 miles of Old Croton Aqueduct State Historic Park is located within the New Croton Reservoir Study Area. The park and trail, located at the base of the dam, have no views of the reservoir itself, due to the height of the New Croton Dam.

The New Croton Dam Spillway Bridge crosses in front of the New Croton Dam at the height of the reservoir, providing views of the dam and the reservoir. The bridge, originally constructed in 1905, has been replaced in 1975 and 2005. Traffic has been closed to the public along the bridge since 2011. The New York City & Northern Railroad Bridge crosses New Croton Reservoir, east of the Taconic State Parkway. The bridge is currently used as part of the North Country Trailway rail trail, with views of the reservoir as it crosses. The New Croton Aqueduct Muscoot Reservoir Dam is not located near public roads and is not typically visible to the public. The former residence of the police 6th precinct is a structure built in the 1860s, and is located on the north side of roadway to the north of the reservoir.

The eight locally significant visual resources within the study area are open to the public for recreational purposes. John E. Hand Memorial Park is a 112-acre park consisting of native woodlands that offers hiking opportunities and views of the New Croton Reservoir from the top. Croton Gorge Park is a 97-acre park at the base of the New Croton Dam, with views of the dam and spillway and access to the trails of Old Croton Aqueduct State Historic Park. The New Croton Reservoir is not visible from Croton Gorge Park.

Kitchawan Preserve is a 208-acre natural preserve bordered by the New York City reservoir property and the North County Trailway along the east portion of the New Croton Reservoir. Muscoot Farm is a 777-acre farm that offers year-round programs, hiking, woodlands, wetlands, and an interpretive farm. There are no views of the reservoir from the farm due to the amount of dense vegetation surrounding the reservoir adjacent to the farm. The Teatown-Kitchawan Trail is a 6.5-mile hiking trail that links several parks and trails: North County Trailway, Kitchawan Preserve, John E. Hand Park, and Croton Gorge. North County Trailway is a rail trail spanning 22.1 miles in Westchester County.

As noted above, the trail crosses the New Croton Reservoir over an old railroad bridge, offering views of the reservoir. The bridge crosses the reservoir at one of the narrowest points of the reservoir, limiting views to a majority of the reservoir. The Muscoot Reservoir is adjacent to the New Croton Reservoir, directly upstream. Views of the New Croton Reservoir from the Muscoot Reservoir are limited as the Wood Bridge Road Bridge obstructs the view. The New Croton Reservoir is a local resource with views of the reservoir from various area roadways and bridges. Some views of the reservoir from area roadways are unobstructed, while some are obstructed by topography, structures, and dense vegetation.

DEP has consulted with the Towns of Cortlandt, Yorktown, Somers, Bedford and New Castle, and Westchester County, and it is DEP's understanding that no new developments or structures that would alter views from visual or aesthetic resources are anticipated within the New Croton Reservoir Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Therefore, in the future without WSSO, it is assumed that visual resources within the New Croton Reservoir Study Area would be the same as baseline conditions.

During WSSO, the New Croton Reservoir water surface elevations would be lower than typical in April and May of the RWBT temporary shutdown. The shutdown would be temporary in nature. As noted above, the views from many of the resources are limited due to the vegetation surrounding the reservoir. Limited, obstructed views could occur through the vegetation during the temporary shutdown operations, although are not anticipated to impact the use or enjoyment of the visual resources. Views from the Taconic State Parkway and North Country Trailway would reveal an unobstructed view of the reservoir with potential water levels lower than the typical. Therefore, the temporary shutdown would not result in significant adverse impacts to visual resources within the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.10 Natural Resources

The potential for impacts to natural resources from WSSO within the New Croton Reservoir Study Area is discussed below.

Geology and Soils

While the reservoir has the potential to be drawn down more than typical, the reservoir is drawn down on a regular basis under typical operations. Because of regular drawdown, deposited sediment is regularly transported to deeper sections of the reservoir during refill. No changes to geology or soils at New Croton Reservoir are anticipated from reservoir drawdown. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the New Croton Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. During the period of reservoir drawdown, it is possible that the fringe areas around the reservoir would experience a lower water table than under typical operating conditions. During this period, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor, but would not be significantly affected by the drawdown. Temporary drawdown of the reservoir more than typical or for a longer duration would not result in changes to ecological communities in the vicinity of the New Croton Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the New Croton Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary drawdown of the New Croton Reservoir would not result in significant changes within the study area to critical wildlife habitat, wildlife movement or its ability to forage or breed. As discussed, the reservoir would be drawn down below typical conditions which would result in a temporarily altered shoreline. These temporary changes would not prevent terrestrial wildlife from using the reservoir for behaviors such as foraging or breeding. The drawdown is not anticipated to result in effects on the fish community (see Aquatic and Benthic Resources in Section 10.5.21.10, “Natural Resources”). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the reservoir would still have a source of prey in the reservoir. Any changes experienced by wildlife as a result of WSSO would be temporary and minor. Therefore, WSSO would not result in significant adverse impacts to wildlife in the New Croton Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the New Croton Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the New Croton Reservoir Study Area include the following: Blocks 6057B, 6057C, 6057D, 6056A, 6056B, 6056C, 5956A, 5956B, 5956C, and 5956D. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the New Croton Reservoir Study Area include the Ossining, Mohegan Lake, Mount Kisco, and Croton Falls Quadrangles. In total, these sources identified species with the potential to occur in the New Croton Reservoir Study Area. ArcGIS data was used to assess the potential habitat for these species. Baseline ecological information and assessments for the study area for these species are shown in **Table 10.5-10**. Following the initial analysis, one species was identified as having the potential to be affected by changes in reservoir water surface elevations at New Croton Reservoir that would occur as a result of WSSO. Therefore, an impact analyses for this species is below.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Reptiles and Amphibians				
Blue-spotted salamander (*Ambystoma laterale*)	None	Special Concern	Blue-spotted salamanders inhabit damp deciduous and deciduous/coniferous forests containing temporary ponds at a variety of elevations (Gibbs et al. 2007). They are often found where soils have high sand or loam content and in certain instances can tolerate disturbance in suburban areas. The blue-spotted salamander breeds in March and April and spends most of its lifecycle underground. Blue-spotted salamanders do not require large open water environments for any part of their natural history.	The forested habitat upland of New Croton Reservoir that blue-spotted salamanders could inhabit would not be affected as a result of the drawdown. Therefore, no effects to blue-spotted salamanders are anticipated and no further analysis for blue-spotted salamanders is warranted for this study area.
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	*Threatened*	Endangered	Bog turtles prefer fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and mucky. Vegetation commonly includes calciphile species. Vegetation is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of core bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require large open water environments for any part of their natural history.	Desktop assessments of wetlands occurring in the study area were conducted. Wetlands in the study area with a water table connected to the reservoir may experience minor temporary effects to wetland vegetation resulting from reservoir drawdown. Any wetlands that share a water table with the reservoir would have historically experienced fluctuating conditions. Fluctuating water tables are not typical of suitable bog turtle habitat (Feaga et al. 2012). Drawdown of the reservoir would not influence other wetlands in the study area that are not hydrologically connected to the reservoir and that potentially contain suitable bog turtle habitat. Therefore, no effects to bog turtles are anticipated and no further analysis for bog turtles is warranted for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats from forests with sandy, well-drained soils, dry open uplands such as meadows, pastures, open fields, and utility right-of-ways, to moist lowlands and wetlands. They are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtles do not require large open water environments for any part of their natural history.	Potential upland eastern box turtle habitat adjacent to the reservoir would not be affected by the drawdown in New Croton Reservoir during WSSO. Therefore, no effects to eastern box turtles are anticipated and no further analysis for eastern box turtles is warranted for this study area.
Eastern Hognose Snake (*Heterodon platyrhinos*)	None	Special Concern	Eastern hognose snake prefers open canopy woodlands, brushy fields, and high floodplains of large streams containing sandy substrates. Species also utilizes sand plains, pine plantations, and pin-oak forests (Gibbs et al. 2007; Hudsonia 2008). Eastern hognose snake does not require large open water environments for any part of their natural history.	Potential upland eastern hognose snake habitat adjacent to the reservoir would not be affected by the drawdown in New Croton Reservoir during WSSO. Therefore, no effects to eastern hognose snakes are anticipated and no further analysis for eastern hognose snakes is warranted for this study area.
Jefferson Salamander (*Ambystoma jeffersonianum*)	None	Special Concern	Jefferson salamanders inhabit large tracts of upland deciduous and mixed deciduous/coniferous forest with abundant stumps and logs, but also occur in bottomland forests that border agricultural or otherwise disturbed areas. The Jefferson salamander spends the majority of its lifecycle underground and relies on the tunnels created by burrowing small mammals. Jefferson salamanders breed early in the year in March and April. They are broadly distributed in south-central New York. Jefferson salamander does not require large open water environments for any part of their natural history.	The upland forested habitat Jefferson salamander could inhabit would not be affected as a result of the drawdown. Therefore, no effects to Jefferson salamanders are anticipated and no further analysis for Jefferson salamanders is warranted for this study area.
Marbled Salamander (*Ambystoma opacum*)	None	Special Concern	Marbled salamanders are found in a variety of wooded habitats and are tolerant of upland conditions, often found in dry forests with well-drained, friable soils. Marbled salamanders breed in the fall, which is unique to State salamanders, and breeding takes place in vernal pool basins or at the edges of ponds and wetlands (Gibbs et al. 2007).Marbled salamander does not require large open water environments for any part of their natural history.	The upland and wooded habitats marbled salamander could inhabit would not be affected as a result of the drawdown. Ephemeral pools used for breeding by this species would not be hydrologically connected to New Croton Reservoir. Therefore, no effects to marbled salamanders are anticipated and no further analysis for marbled salamanders is warranted for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Spotted turtle (*Clemmys guttata*)	None	Special Concern	Spotted turtle habitat consists of vernal pools in the spring, upland forest for part of summer after pools dry out, and wet meadows, forested swamps, or sphagnum bogs for overwintering. They are strongly associated with pools that are shallow, have clear water, and have a muddy or mucky substrate. In winter, spotted turtles could inhabit abandoned mammal lodges or burrows or under the roots of flooded shrubs and trees, and could congregate with bog turtles or snapping turtles during this time (Gibbs et al. 2007). Spotted turtle does not require large open water environments for any part of their natural history.	Emergent wetland habitats could occur on the fringe of New Croton Reservoir. These wetlands could experience minor alteration if the water table is connected to the reservoir. A lowered water table could result in stressed herbaceous vegetation. These drawdown conditions are not unprecedented at New Croton Reservoir and any spotted turtles that could occur in wetlands on the fringe of New Croton Reservoir would have adapted to these conditions in the past. These effects would be temporary, and, upon refilling of the reservoir after typical operations resume, the wetlands would return to baseline conditions. Therefore, no effects to spotted turtles are anticipated and no further analysis for spotted turtles is warranted for this study area.
Wood turtle (*Glyptemys insculpta*)	None	Special Concern	Wood turtles have large home ranges and typically inhabit riverside or streamside environments bordered by woodlands or meadows and utilize open sites with low canopy cover. Individuals bask along stream banks and hibernate in creeks (Gibbs et al. 2007). Wood turtle does not require large open water environments for any part of their natural history.	The drawdown would not affect the flow of any streams that are tributaries to East Branch Reservoir which could be potential suitable wood turtle habitat. Therefore, no effects to wood turtles are anticipated and no further analysis for wood turtles is warranted for this study area.
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments for their natural history.	NYNHP identified breeding Bald Eagles that occur on the shoreline of New Croton Reservoir. The temporary New Croton Reservoir drawdown would have temporary effects on the reservoir's fishery and Bald Eagle foraging habitat. Therefore, potential impacts to Bald Eagles were assessed for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Cooper's Hawk (*Accipiter cooperii*)	Protected - MBTA	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests. They are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. Cooper's Hawks forage primarily on other birds. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require open water environments for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Drawdown to New Croton Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.
Yellow-breasted Chat (*Icteria virens*)	Protected - MBTA	Special Concern	Yellow-breasted Chat breed in dense second growth, thickets and brush, including shrubby habitat along streams and ponds, forest edges, regenerating burned-over and logged forest, fencerows, and recently abandoned farmland (McGowan 2008a). Yellow-breasted Chat do not require open water environments for any part of their natural history.	Yellow-breasted Chat habitat would not be affected by the drawdown of New Croton Reservoir. Drawdown could result in minor and temporary effects to fringe herbaceous vegetation but would not have significant adverse effects to the successional and open habitats used by Yellow-breasted Chat. Therefore, no effects to Yellow-breasted Chats are anticipated and no further analysis for Yellow-breasted Chats is warranted for this study area.
Grasshopper Sparrow (*Ammodramus savannarum*)	Protected - MBTA	Special Concern	Grasshopper Sparrow uses open grasslands with patches of bare ground and usually avoids areas with extensive shrub cover. In New York, the species is also known for breeding in forested areas (Smith 2008). Grasshopper Sparrows do not require open water environments for any part of their natural history.	Grasshopper Sparrows have the potential to occur in the forested and open areas upland of New Croton Reservoir. Drawdown of New Croton Reservoir would not affect the ability of Grasshopper Sparrow to utilize these habitats for breeding or foraging. Therefore, no effects to Grasshopper Sparrows are anticipated and no further analysis for Grasshopper Sparrows is warranted for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Red-shouldered Hawk (*Buteo lineatus*)	Protected - MBTA	Special Concern	In New York, Red-shouldered Hawks favor large tracts of mature deciduous and mixed forest in riparian areas or flooded swamps/wetlands. Breeding Bird Atlas data show a steady increase in Red-shouldered Hawk populations, particularly in the Hudson River, as farmland reverts back to forest, resulting in increased habitat. Red-shouldered Hawks occasionally nest in suburban areas where forest cover is less contiguous. Migration and wintering habitats are similar to breeding habitat, although non-breeding birds occur more frequently in fragmented landscapes and open areas than when nesting (Crocoll 2008). Red-shouldered Hawks do not require open water environments for any part of their natural history.	Drawdown in New Croton Reservoir would not affect Red-shouldered Hawk habitat adjacent to the reservoir or affect any breeding or foraging behaviors. Therefore, no effects to Red-shouldered Hawks are anticipated and no further analysis for Red-shouldered Hawks is warranted for this study area.
Osprey (*Pandion haliaetus*)	Protected - MBTA	Special Concern	Osprey habitat is found along coastal and inland waterways that contain abundant fish populations. Osprey forage on fish primarily in shallow waters. Osprey is an adaptable breeder, usually nesting in trees and dead snags, but also uses a variety of man-made structures for nesting and will nest on the ground (Nye 2008a). Osprey require water, which can include large open water environments, for some stage in their natural history.	The temporary New Croton Reservoir drawdown would have minor temporary effects on the reservoir's fishery (see Aquatic Resources). Osprey that could forage at the reservoir would be required to fly further towards the shallow areas of the reservoir to attain prey due to the drawdown. Perching habitat would also be further from the shallow areas of the reservoir due to the drawdown. However, these temporary effects would not prevent Osprey from foraging at New Croton Reservoir during the temporary shutdown. Furthermore, the drawdown would not affect Osprey nesting habitat or behavior. Therefore, WSSO may affect, but is not likely to adversely affect, Ospreys and no further analysis for Ospreys is warranted for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Sharp-shinned Hawk (*Accipiter striatus*)	Protected - MBTA	Special Concern	Sharp-shinned Hawks nest in mixed, coniferous, and deciduous forests, but nest sites are most frequently in wooded areas with a dense canopy cover, small-diameter trees, and high tree density (Hames and Lowe 2008). Sharp-shinned Hawks do not require open water environments for any part of their natural history.	Sharp-shinned Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Temporary drawdown of New Croton Reservoir would not affect Sharp-shinned Hawk habitat, breeding, or foraging. Therefore, no effects to Sharp-shinned Hawks are anticipated and no further analysis for Sharp-shinned Hawks is warranted for this study area.
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize open water environments for foraging and migrating when they are available.	Indiana bats have the potential to utilize New Croton Reservoir for migration and foraging purposes. Drawdown of New Croton Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.
New England Cottontail (*Sylvilagus transitionalis*)	None	Special Concern	New England cottontail is known only to occur east of the Hudson River. This species prefers early successional habitat with dense vegetation generally associated with abandoned agricultural fields, wetlands, clear cuts of woodlands, utility right-of-ways, and other disturbed areas with shrubs and early successional vegetation (Arbuthnot 2008). New England cottontail do not require open water environments for any part of their natural history.	The drawdown would not be anticipated to affect dense woody vegetation typical of New England cottontail habitat that occurs in areas adjacent to the reservoir. Woody vegetation could experience reduced vigor due to a lowered water table but would not lose its ability to provide cover and food for New England cottontail. Therefore, no effects to New England cottontails are anticipated and no further analysis for New England cottontails is warranted for this study area.

Table 10.5-10: Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees that are 3 inches or more in diameter. These bats are opportunistic and will also roost in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize open water environments for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize New Croton Reservoir for migration and foraging purposes. Drawdown of New Croton Reservoir would not affect these behaviors. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act
MBTA: Migratory Bird Treaty Act

Bald Eagle (Haliaeetus leucocephalus)

Breeding Bald Eagles (*Haliaeetus leucocephalus*) were identified by NYNHP as occurring on the shores of New Croton Reservoir. New Croton Reservoir represents high quality habitat for Bald Eagles. It provides ample foraging opportunities on the fisheries within the reservoir and ample nesting, perching, and roosting habitat in the trees along the reservoir shoreline. In the future without WSSO, Bald Eagles, if present, would continue to utilize the reservoir and its surrounding area for foraging, mating and nesting, roosting, and perching.

In the future with WSSO, New Croton Reservoir would be drawn down beginning in the late fall when mating behaviors begin and would continue through the winter and following summer when Bald Eagles would be rearing eaglets. Bald Eagles most commonly forage in the shallows of open water environments such as New Croton Reservoir. However, in the winter they are known to forage more commonly over deeper open water. The drawdown would result in an altered shoreline, changing how the fish use the shallow areas of the reservoir. This drawdown would not significantly affect the fishery (see Aquatic and Benthic Resources in Section 10.5.21.10, “Natural Resources”). Both the shallows and open water areas of the reservoir would continue to be habitat for Bald Eagle prey species. Therefore, drawdown as a result of WSSO at New Croton Reservoir may affect, but is not anticipated to adversely affect breeding, overwintering, or foraging Bald Eagles.

Based on the assessment results, there would be no significant adverse impacts to these species from changes in reservoir water surface elevations at New Croton Reservoir. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the New Croton Reservoir Study Area.

Aquatic and Benthic Resources

New Croton Reservoir is a long, narrow waterbody with a surface area of approximately 2,182 acres and a maximum depth of approximately 120 feet. The headwater of New Croton backs up against Muscoot Dam, which acts as a weir across the waterbody. The reservoir is deep enough to provide cool water to support trout populations year round.

Studies of the plankton communities in New Croton Reservoir were conducted from 1984 to 1988, and the benthic community was studied during late spring and summer in 1994. Throughout most of the year, high flows through the reservoir inhibit the development of substantial algal biomass despite high nutrient loading due to light limitation and sedimentation influenced algal biomass in the photic zone.

The fish community in New Croton Reservoir is a mix of warmwater, coolwater, and coldwater species that utilize the diverse habitats in the reservoir to find suitable areas for growth and reproduction. Among the warmwater species, largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), white perch (*Morone americana*), and black crappie (*Pomoxis nigromaculatus*) are abundant and sought after by anglers. Among coolwater species, yellow perch (*Perca flavescens*) and chain pickerel (*Esox niger*) are abundant. Brown trout

(*Salmo trutta*) is the only coldwater species that utilizes the deep water of the reservoirs. Alewife (*Alosa pseudoharengus*) are abundant and provide forage for most of the predator fish in the reservoir, depending on the seasonal distribution of both predators and alewife in the waterbody. Many other minnows, shiners, and juvenile stages of many species provide forage. Green sunfish (*Lepomis cyanellus*) were introduced into New Croton Reservoir and do not occur in other DEP reservoirs. Striped bass (*Morone saxatilis*) occur in the reservoir as a result of introduction, but they do not spawn in the reservoir.

This diverse assemblage of fishes reflects the long-term typical operation of the reservoir and represents the baseline conditions for this impact analysis. In the future without WSSO, typical reservoir operations would continue and it is assumed that aquatic resources would remain as described above.

During WSSO, the New Croton Reservoir water surface elevations would be lower than typical in April and May of the RWBT temporary shutdown. This drawdown would result in minor temporary effects to shoreline habitat. There would be a loss of benthic invertebrate production in the exposed substrate and a reduction in food resources for fishes. Spawning of early spring shoreline spawners, such as yellow perch and chain pickerel, could be disrupted. However, these species have maintained themselves in many reservoirs that experience annual drawdowns. Any effects to these species would be temporary. Nest spawning species, such as largemouth bass and other sunfishes would be expected to reproduce successfully because water levels would be rising during their late spring-early summer spawning periods. Open water species, such as brown trout and alewife would have sufficient habitat available throughout the shutdown. Therefore, WSSO would not result in significant adverse impacts to aquatic and benthic resources in the New Croton Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.5.21.2, “Study Area Evaluation”), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the New Croton Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the New Croton Reservoir Study Area and no further analysis is warranted.

Floodplains

There would be no construction associated with WSSO in the New Croton Reservoir Study Area. Lower than typical water surface elevations that would occur in the New Croton Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the New Croton Reservoir Study Area and no further analysis is warranted.

Groundwater

Reservoir drawdown by up to 3 feet more than typical is a minor change for a reservoir that has a maximum depth of approximately 120 feet. The reservoir would continue to have a large volume of water to provide recharge to local groundwater aquifers. Therefore, aside from minor changes to the surficial aquifer immediately adjacent to the reservoir, there would not be any widespread changes to groundwater from WSSO in the New Croton Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to groundwater in the New Croton Reservoir Study Area and no further analysis is warranted.

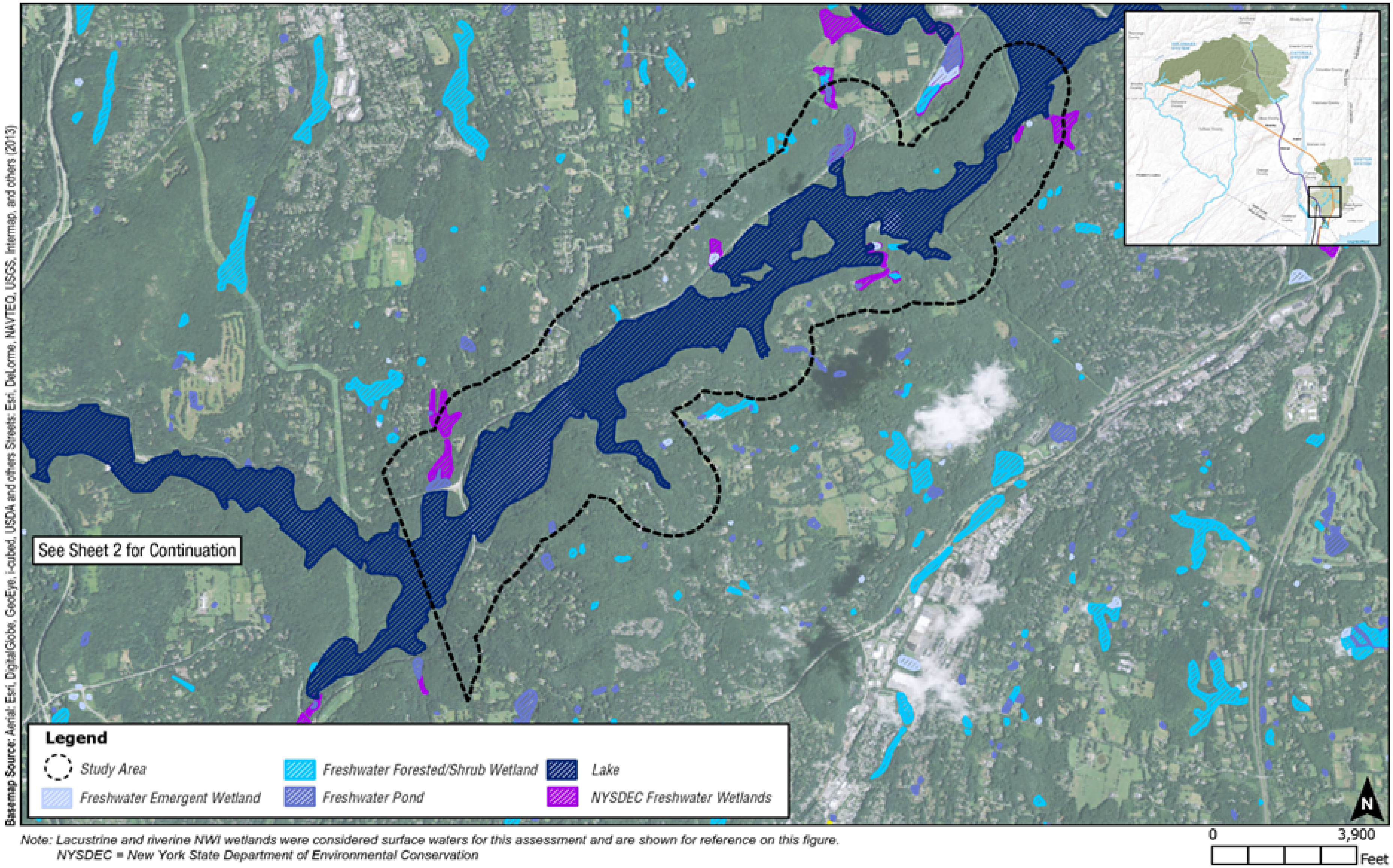
Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the New Croton Reservoir Study Area (see **Figure 10.5-69**). The study area extends 0.25 mile around the reservoir and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on New Croton Reservoir. There are 31 NYSDEC wetlands mapped within or intersecting the study area. The 31 NYSDEC wetlands cover approximately 187 acres and are all Class I wetlands. There are 84 USFWS NWI-mapped wetlands within or intersecting the study area. The 84 USFWS NWI wetlands cover approximately 87 acres and consist of 8 emergent wetlands, 35 scrub/shrub or forested wetlands, and 41 ponds. Of the 187 acres of NYSDEC and 87 acres of NWI-mapped wetlands, approximately 20 acres overlap and contain both NYSDEC and NWI-mapped wetlands.

In the future without WSSO, it is assumed that wetland resources in New Croton Reservoir would generally remain the same as baseline conditions, and there would be no change from typical operations of the reservoir.

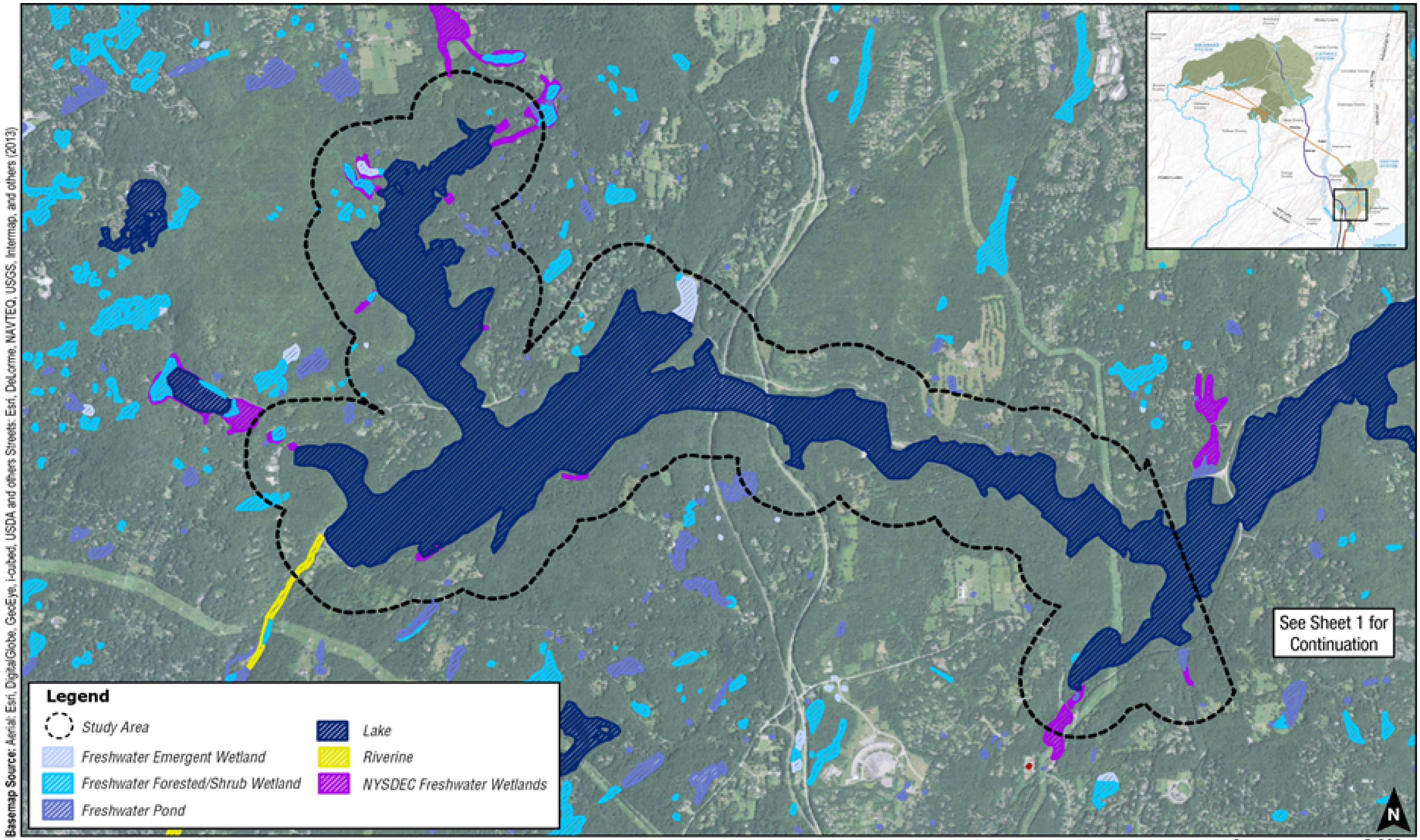
Wetlands along the tributary streams or located inland at higher elevations would be unaffected by reservoir drawdown during the shutdown because they are above the full pool elevation and are not influenced by reservoir water. Lowered reservoir elevations are not anticipated to impact groundwater that may source some of these wetlands. Most of the mapped wetlands in the New Croton Reservoir Study Area occur in landscape positions (i.e., separated from the reservoir by elevation or landform) that would not be influenced by the proposed drawdown of New Croton Reservoir. Some of the mapped wetlands are located in shallow areas along the reservoir edge, also referred to as fringe wetlands.

Drawdown at New Croton Reservoir is anticipated to begin in October of the shutdown, and extend through the following summer, before starting to refill in the spring following the shutdown (see **Figure 10.5-65**). Drawdown of New Croton Reservoir is part of the normal operation of the water supply system. Additionally, the level of drawdown anticipated for the temporary shutdown of the RWBT has been experienced during past operation of the reservoir (prior to the Croton Water Treatment Plant construction), including the summers of 1991, 1993, 1995, 1999, and 2002. The level of drawdown is anticipated under future typical operation of the Croton System with the Croton Water Filtration Plant online.



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

Figure 10.5-69: Wetlands Resources – New Croton Reservoir Study Area (Sheet 1)



Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

0 3,900 Feet

Environmental Protection

Figure 10.5-69: Wetlands Resources – New Croton Reservoir Study Area (Sheet 2)

Drawdowns that occur at different times of year can affect fringe wetland vegetation differently. Drawdowns in the middle of the growing season in summer would affect fringe wetland vegetation differently than reservoir drawdown in the spring when the growing season is beginning. During winter through spring drawdowns, under typical climactic conditions, early spring vegetation such as spring ephemerals may not emerge or would be stressed due to the different hydrologic conditions. Emergence of other vegetation may similarly be affected. During summer drawdowns, under typical climactic conditions, vegetation that has emerged may experience effects to vegetation growth, flowering, or fruit production. Regardless of season, stress to fringe wetland vegetation can be triggered by even small drawdowns of a foot or less depending on rooting depth and other characteristics of individual plants. Surface water fluctuations of this magnitude are typical for water supply reservoirs and are part of the typical hydrologic conditions for wetlands occurring on the fringes of water supply reservoirs. Furthermore, the seed bank and root stock of the fringe wetlands are typically robust and would not be anticipated to be permanently impacted by up to one growing season of lowered reservoir elevations.

Additionally, because the temporary shutdown of the RWBT would only commence in non-drought conditions, it is anticipated that the New Croton Reservoir and its watershed and the fringe wetlands of New Croton Reservoir would still receive rainfall and runoff in amounts consistent with typical (i.e., non-drought) conditions. Upon refilling of New Croton Reservoir, the fringe wetlands would be anticipated to return to their typical condition. Therefore, WSSO would not result in significant adverse impacts to wetlands in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. The potential mechanism for disturbing potentially existing hazardous materials within the New Croton Reservoir Study Area would be through excessive erosion. While water surface elevations would be lower than typical, there is low potential for erosion (see Geology and Soils in Section 10.5.21.10, “Natural Resources”).

Based on the low potential for erosion at New Croton Reservoir, WSSO would not result in significant adverse impacts to hazardous materials in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.12 Water and Sewer Infrastructure

There are no municipal sewer outfalls at the study area. There are multiple municipal drinking water intakes at New Croton Reservoir. However, water surface elevations would remain above the intakes during WSSO. Further, while water surface elevations would be lower than typical, regional groundwater elevations would be unaffected by the temporary drawdown (see Groundwater in Section 10.5.21.10, “Natural Resources”). WSSO would not include any construction that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.13 Energy

Changes to water surface elevations in the New Croton Reservoir Study Area during the temporary shutdown would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.14 Transportation

Water surface elevations in the New Croton Reservoir Study Area would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.15 Air Quality

While the reservoir could be drawn down more than typical, the reservoir is drawn down regularly under typical operations. Regular drawdown limits the growth of macrophytes and aquatic vegetation, which would typically inhabit the reservoir shallows to about the top 10 feet of depth. Deeper areas are limited by low light conditions. Drawdown of the reservoir during temporary operations would not result in objectionable odors or other air quality affects from decaying vegetation. Therefore, WSSO would not result in significant adverse impacts to air quality in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.16 Noise

Water surface elevations at the New Croton Reservoir Study Area would have no effect on noise levels in the vicinity of the waterbody. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.17 Neighborhood Character

The character of the New Croton Reservoir Study Area is largely defined by public service/utility, residential, commercial, transportation corridors, and vacant land uses, as well as its physical setting within a suburban area (see **Figure 10.5-64**). New Croton Reservoir is the terminal reservoir of the Croton System and receives water from all other Croton System reservoirs.

DEP has consulted with the Towns of Cortlandt, Yorktown, Somers, Bedford and New Castle, and Westchester County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the New Croton Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the study area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the New Croton Reservoir Study Area was not warranted. As described in Section 10.5.21.3, "Land Use, Zoning, and Public Policy," Section 10.5.21.4, "Socioeconomic Conditions," Section 10.5.21.8, "Historic and

Cultural Resources," Section 10.5.21.14, "Transportation," and Section 10.5.21.16, "Noise," an impact analysis for the New Croton Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; transportation; or noise.

As described in Section 10.5.21.6, "Open Space and Recreation," WSSO activities would be short-term and would result in a temporary change in open space and recreation during the RWBT temporary shutdown and during WSSO operations. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the East Branch Reservoir Study Area and no further analysis is warranted. As described in Section 10.5.21.9, "Visual Resources," WSSO activities effects to visual resources would be temporary and minor.

Water surface elevations at the New Croton Reservoir Study Area during the temporary shutdown would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.21.18 Public Health

While the reservoir would be drawn down lower than typical, the reservoir would not be stagnant. Flow would continue through the reservoir from inflows into the reservoir and releases downstream to meet minimum releases, as well as diversions to supply drinking water for the City. There would be no increase in potential for mosquito breeding at the reservoir. While an increase in turbidity associated with the drawdown is not anticipated water would be treated at the Croton Water Filtration Plant. In addition, large portions of inflow to New Croton Reservoir come from Muscoot Reservoir where turbidity present in the water would have an opportunity to settle prior to entering New Croton Reservoir. Additionally, there would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from water surface elevations at the New Croton Reservoir Study Area. Therefore, WSSO would not result in significant adverse impacts to public health in the New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22 CROTON RIVER DOWNSTREAM OF NEW CROTON RESERVOIR STUDY AREA IMPACT ANALYSIS

10.5.22.1 Study Area Location and Description

Croton River downstream of New Croton Reservoir flows approximately 3 miles through the Town of Cortlandt, Croton on Hudson, Town of New Castle, Town of Ossining and Village of Ossining in Westchester County, New York (see **Figure 10.5-70**). It is a high quality stream that supports diverse, healthy flora and fauna. The river sustains numerous fish species, and is stocked with trout annually by NYSDEC, making it popular for recreational fishing. Other forms of aquatic recreation, such as boating and swimming, also occur along the river, but to a more limited extent. The water quality classification for approximately 1 mile downstream of Cornell Dam is Class A(T). The Water quality classification then transitions to Class B, SB, and SC as it flows downstream and joins with the Hudson River.

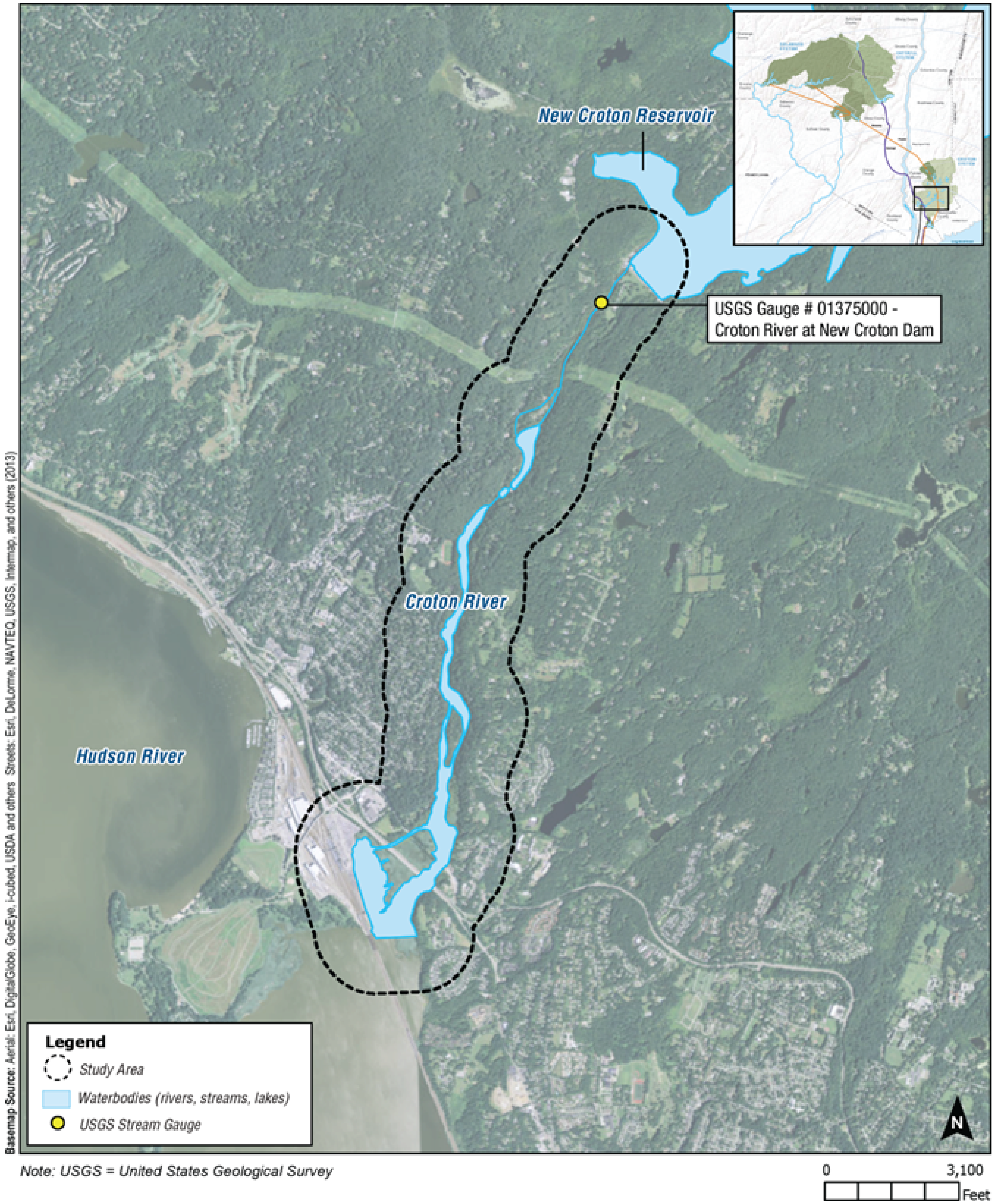


Figure 10.5-70: Croton River Downstream of New Croton Reservoir Study Area

10.5.22.2 Study Area Evaluation

Under typical operations, the minimum regulated flow is released (see **Table 10.5-8**) and the reservoir spills as necessary based on inflows and diversions to the Croton Water Filtration Plant. During WSSO, the operation of New Croton Reservoir would remain the same as during typical operations, with one exception. During the temporary shutdown, DEP would request a variance from NYSDEC to limit minimum releases to the drought levels that are normally prescribed for April 1 through May 31. Required releases from July to March are set to 5.5 mgd, and there is no need for a variance. Required releases in April, May, and June are 75 mgd during normal conditions. A variance from 75 mgd to the 11 mgd drought level would help reduce losses from the system during April and May of the temporary shutdown. The variance would result in releases being lower during April and May of the temporary shutdown. Further, DEP would increase diversions to the Croton Water Filtration Plant from October through May of the shutdown, which would result in reduced spills to the Croton River.

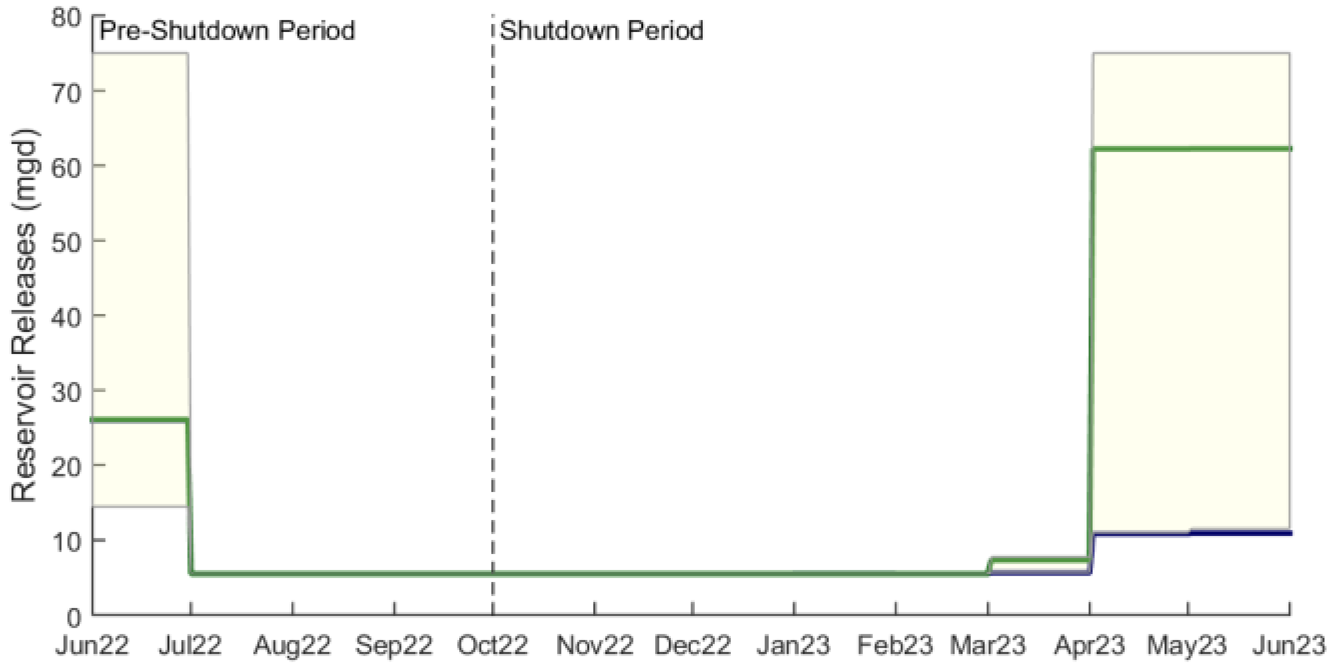
Based on modeling analyses, under typical operations, monthly average daily releases can range from approximately 6 mgd up to approximately 75 mgd (see **Figure 10.5-71**). The monthly average daily spills can reach approximately 2,000 mgd (see **Figure 10.5-72**). Spills can occur during any month, but are more frequent and of larger magnitude in the spring.

During the pre-shutdown period, releases into the Croton River downstream of New Croton Reservoir would be unchanged from typical conditions (see **Figure 10.5-71**). During this period, spills into the Croton River would be higher than typical by up to approximately 127 mgd (see **Figure 10.5-72**). During the temporary shutdown of the RWBT, releases into the Croton River downstream of New Croton Reservoir would be unchanged from October through March and lower than typical conditions by approximately 51 mgd in April and May due to the variance from regulated releases (see **Figure 10.5-71**). Spills occurring during the same period would be lower than typical conditions by up to approximately 409 mgd (see **Figure 10.5-72**). Except for the regulated release variance during April and May of the RWBT temporary shutdown, the dataset mean for both spills and releases during WSSO would remain within the typical range for the duration of the project. While the variance would result in drought-level releases in April and May of the temporary shutdown, spills would still be possible, such that the dataset mean of combined spills and releases would remain higher than minimum required releases without the variance (see **Figure 10.5-73**). In addition, the probability of high flows would be lower than typical (see **Figure 10.5-74**).

Because DEP is planning to request a variance to set releases at the lowest conservation release rate during the temporary shutdown, an analysis of impacts that could result from WSSO was warranted for Croton River downstream of the New Croton Reservoir.

10.5.22.3 Land Use, Zoning, and Public Policy

There would be no construction activities from WSSO in this study area. Variations in flows would be temporary in nature, and would not appreciably affect the surrounding study area land uses. All land uses would remain consistent with existing public service/utility land use. Furthermore, WSSO activities would not require a change in or alteration of existing zoning

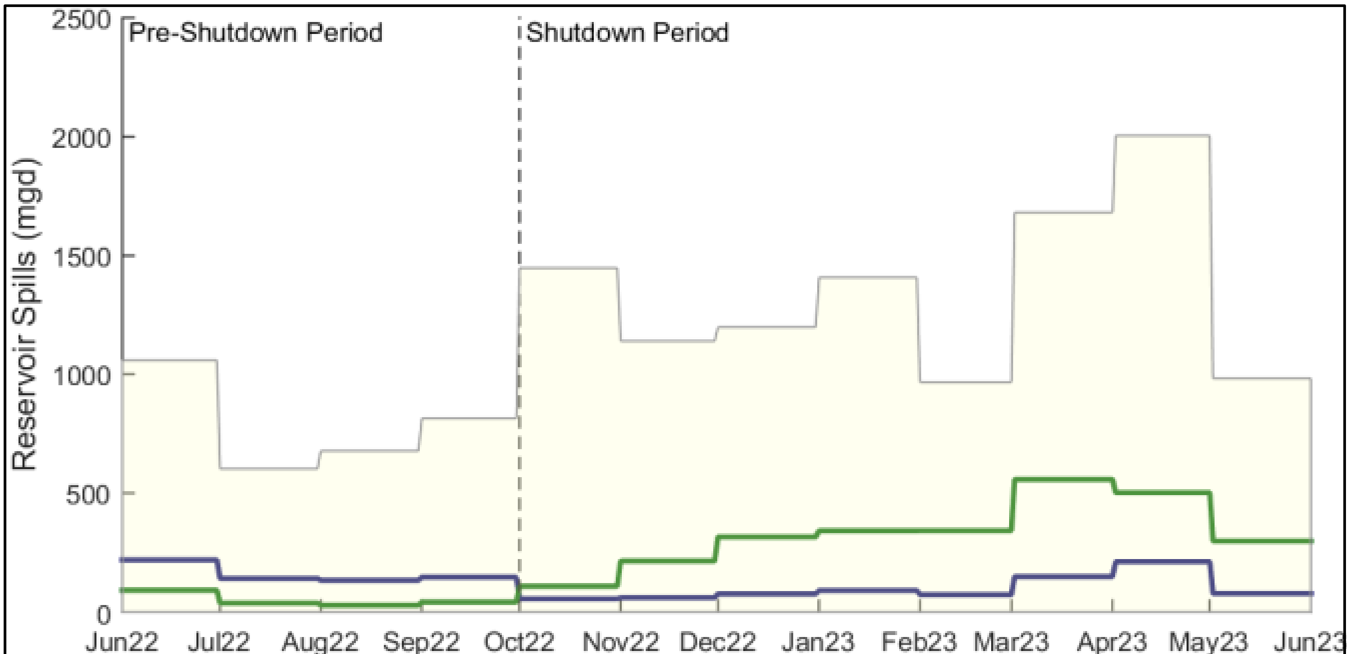


		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	26	14	75	26	0
	July	6	6	6	6	0
	August	6	6	6	6	0
	September	6	6	6	6	0
Shutdown Period	October	6	6	6	6	0
	November	6	6	6	6	0
	December	6	6	6	6	0
	January	6	6	6	6	0
	February	6	6	6	6	0
	March	6	6	6	5	-1
	April	62	11	75	11	-51
	May	62	11	75	11	-51

Note: Releases for normal reservoir storage and steamflow conditions shown. Because DEP would use forecasts to avoid commencing with the WSSO during a drought, it assumed the highest regulated releases would be required without the variance during the WSSO.

Legend
WSSO dataset mean
Typical dataset mean
Typical range

Figure 10.5-71: Release Dataset Mean and Range of Releases Predicted under Typical Operations and WSSO – Croton River Downstream of New Croton Reservoir Study Area



		Typical Operations			WSSO	Difference between Typical and WSSO Dataset Means (mgd)
		Dataset Mean (mgd)	Dataset Minimum (mgd)	Dataset Maximum (mgd)	Dataset Mean (mgd)	
Pre-Shutdown Period	June	92	0	1059	219	127
	July	38	0	603	142	104
	August	29	0	678	134	105
	September	42	0	815	147	105
Shutdown Period	October	109	0	1448	56	-53
	November	215	0	1140	61	-154
	December	316	0	1200	77	-239
	January	342	0	1409	91	-251
	February	339	0	989	73	-266
	March	553	0	1674	144	-409
	April	510	0	2002	215	-295
	May	303	0	971	77	-226

Figure 10.5-72: Spill Dataset Mean and Range of Spills Predicted under Typical Operations and WSSO – Croton River Downstream of New Croton Reservoir Study Area

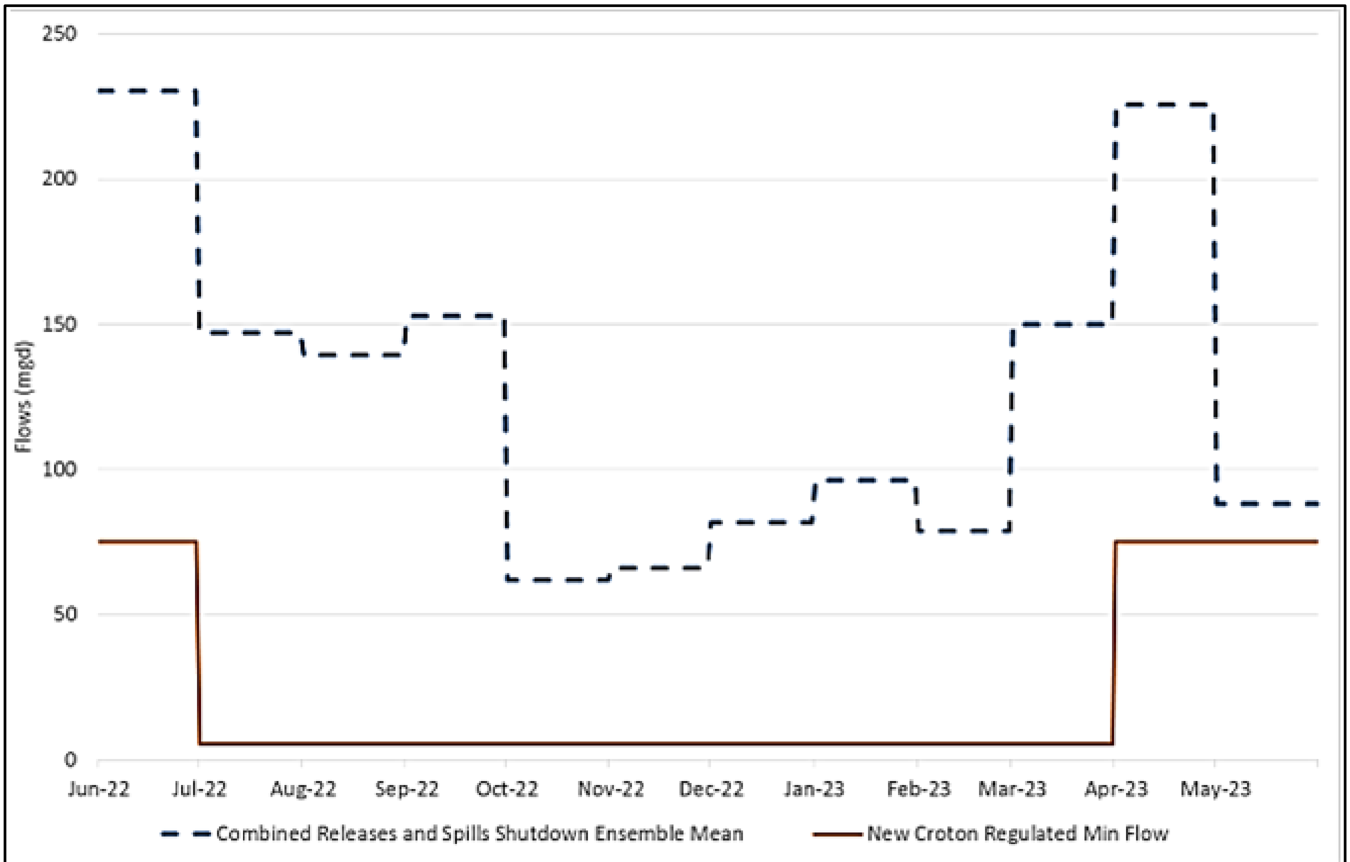
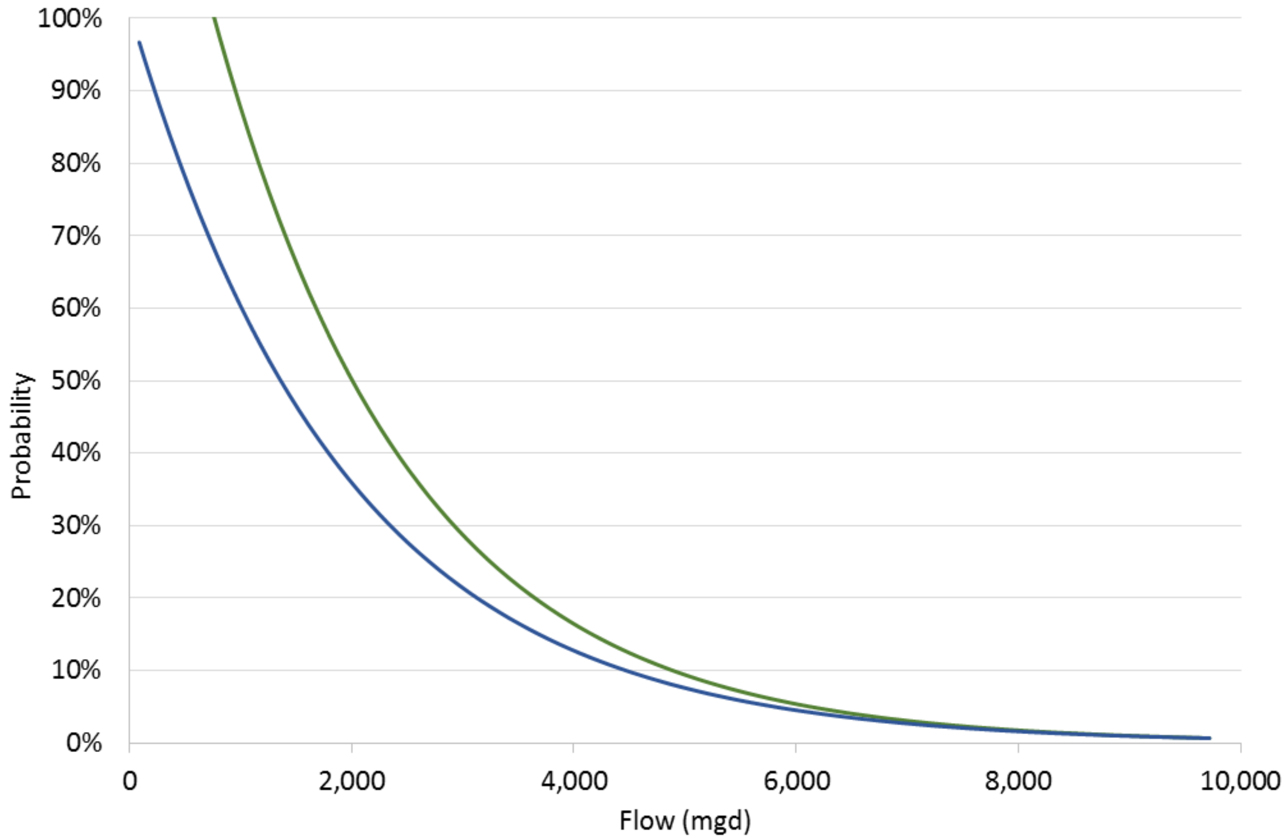


Figure 10.5-73: Combined Release and Spill Dataset Mean Predicted under the Temporary Shutdown – Croton River Downstream of New Croton Reservoir Compared to Regulated Minimum Releases without the Variance



Note: There are no USGS gauges with National Weather Service flood stage delineations along the Croton River.

Legend
WSSO
Typical

Figure 10.5-74: Annual Probability of High Flows from Spills and Releases – Croton River Downstream of New Croton Reservoir Study Area

within the surrounding area. For these reasons, and because variations in flows would be temporary, WSSO activities would not physically displace existing land uses, or alter existing land uses or zoning within the study area. Therefore, WSSO would not result in significant adverse impacts to land use and zoning within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

The consistency of variations in flows as a result of WSSO with State, county, and local policies was evaluated. The review did not identify plans or policies that are applicable to changes in receiving waterbody flows. Therefore, WSSO would not result in significant adverse impacts to public policy within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.4 Socioeconomic Conditions

Potential changes in releases from New Croton Reservoir during the temporary shutdown would not cause indirect or direct effects to factors that influence the socioeconomic character of the surrounding areas, including land use, population, housing, and economic activity. Therefore, WSSO would not result in significant adverse impacts to socioeconomic conditions within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.5 Community Facilities and Services

There would be no development or other construction associated with WSSO within this study area. Further, decreased flows would not physically impact or otherwise impair the use of existing community facilities and services including public schools, libraries, child care centers, health care facilities, and police and fire protection services. Therefore, WSSO would not result in significant adverse impacts to community facilities and services within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.6 Open Space and Recreation

Open space and recreation resources include the Croton River and six parcels located along the Croton River. Open space and recreation resources are shown in **Table 10.5-11,** and locations are shown on **Figure 10.5-75**.

Six designated open spaces are located within the Croton River Study Area abutting the river. Open spaces along the Croton River include the Croton Gorge Park, Old Croton Aqueduct State Historic Park, Black Rock Park, Silver Lake Park, Mayo's Landing, and Van Cortlandt Manor. In addition to these designated open spaces, much of the land along the Croton River is identified on assessor maps as open space owned by Westchester County, Croton-on-Hudson (north of Croton River), or the Town of Cortlandt (south of Croton River). However, due to the non-formalized and unprogrammed use of this land, it is highlighted on **Figure 10.5-75**, but not discussed in detail.

Table 10.5-11: New Croton Reservoir Open Space and Recreation Resources

Map Key	Name	Address	Resource Opportunities	Area/Watercourse Area or Length (if Applicable)
CRO-10	Croton River	Cortlandt, Croton-on-Hudson, New York	Fishing	3.5 miles
CRO-11	Croton Gorge Park	Croton-On-Hudson, New York 10520	Baseball fields, cross country skiing, hiking, fishing, picnicking, playground,	97 acres
CRO-12	Old Croton Aqueduct State Historic Park	Croton-On-Hudson, New York 10520	Hiking, biking, running and passive recreational activities	26.2 miles
CRO-13	Black Rock Park	Croton-On-Hudson, New York 10520	Picnicking, fishing	1 acre
CRO-14	Silver Lake Park	Croton-On-Hudson, New York 10520	Swimming, beach, picnicking	4 acres
CRO-15	Mayo's Landing	Croton-On-Hudson, New York 10520	Picnicking, fishing	0.15 acre
CRO-16	Van Cortlandt Manor	Croton-On-Hudson, New York 10520	Education, historic facility	8 acres

Croton Gorge Park is an approximately 97-acre property at the base of the Croton Dam, which is the tailwater of the Croton River. The park provides views of the dam and spillway, as well as opportunities to fish, picnic, hike, and access the New York State Old Croton Aqueduct State Historic Park. The Old Croton Aqueduct State Historic Park was created in 1968 and encompasses the northernmost 26.2 miles of the original aqueduct and its right-of-way, from Croton Gorge Park to the Yonkers-New York City line. The Park provides opportunities for passive recreation such as biking and jogging.

Downstream of the Croton Dam, Black Rock Park provides a local park along the Croton River. The park is managed by Croton-on-Hudson and provides approximately 1 acre for residents to fish and picnic. There are 2,000 feet of Black Rock Park located along the Croton River.

Silver Lake Park, located alongside the Croton River at the end of Truesdale Drive, is open to Croton-on-Hudson residents as a beach for swimming during the summer season. Silver Lake is approximately 4 acres and is located along 2,000 feet of the Croton River. Mayo's Landing is an undeveloped parcel of land owned by Croton-on-Hudson that is used for public access to the Croton River.

Van Cortlandt Manor is a property located by the confluence of the Croton and Hudson Rivers located in the Village of Croton-on-Hudson in Westchester County, New York. The Van Cortlandt Manor is managed by the Historic Hudson Valley and provides educational resources for visitors to experience life during the 1700s. Located on premise, the stone and brick manor house is a National Historic Landmark.

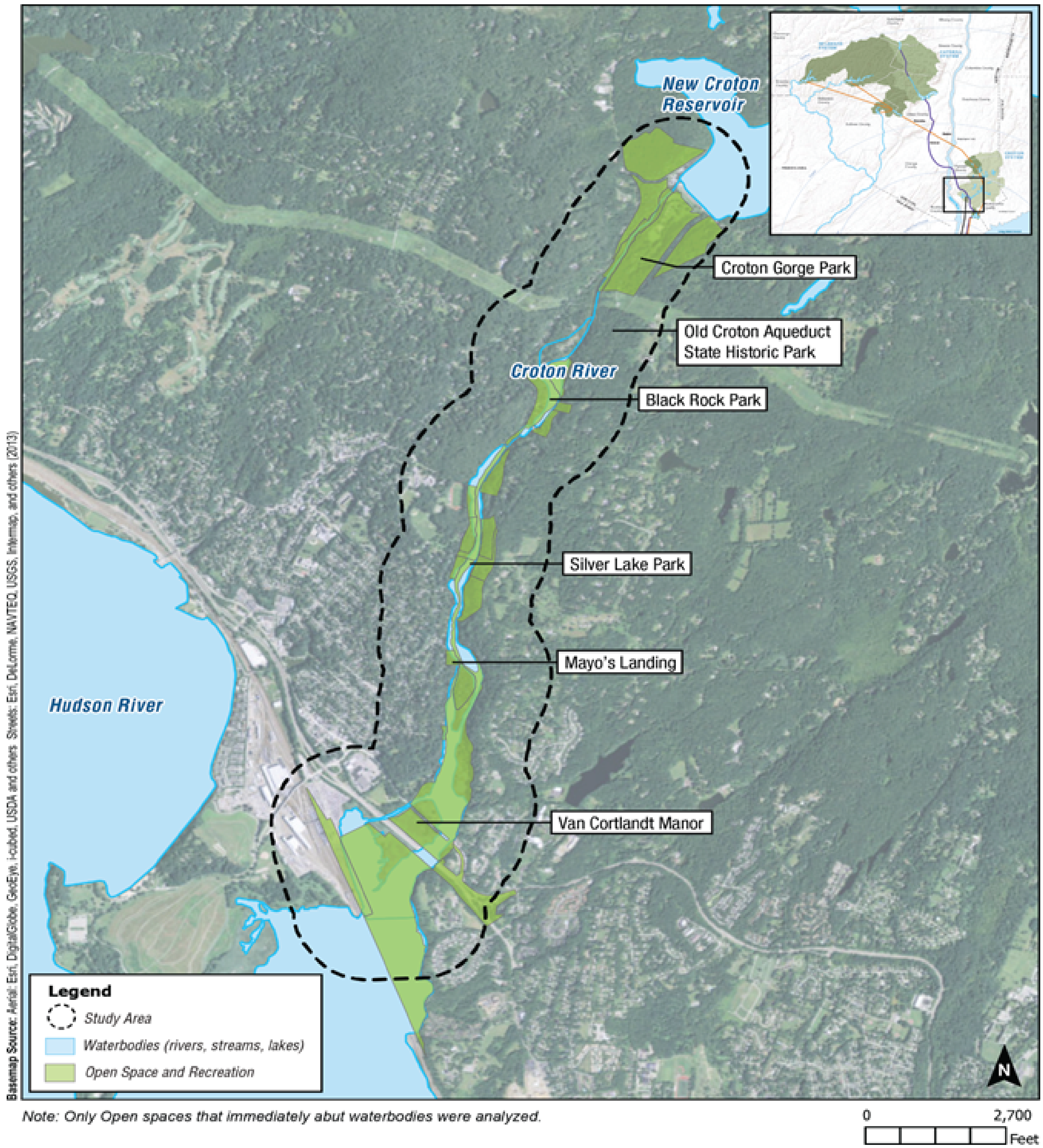


Figure 10.5-75: Open Space and Recreation Resources – Croton River Downstream of New Croton Reservoir Study Area

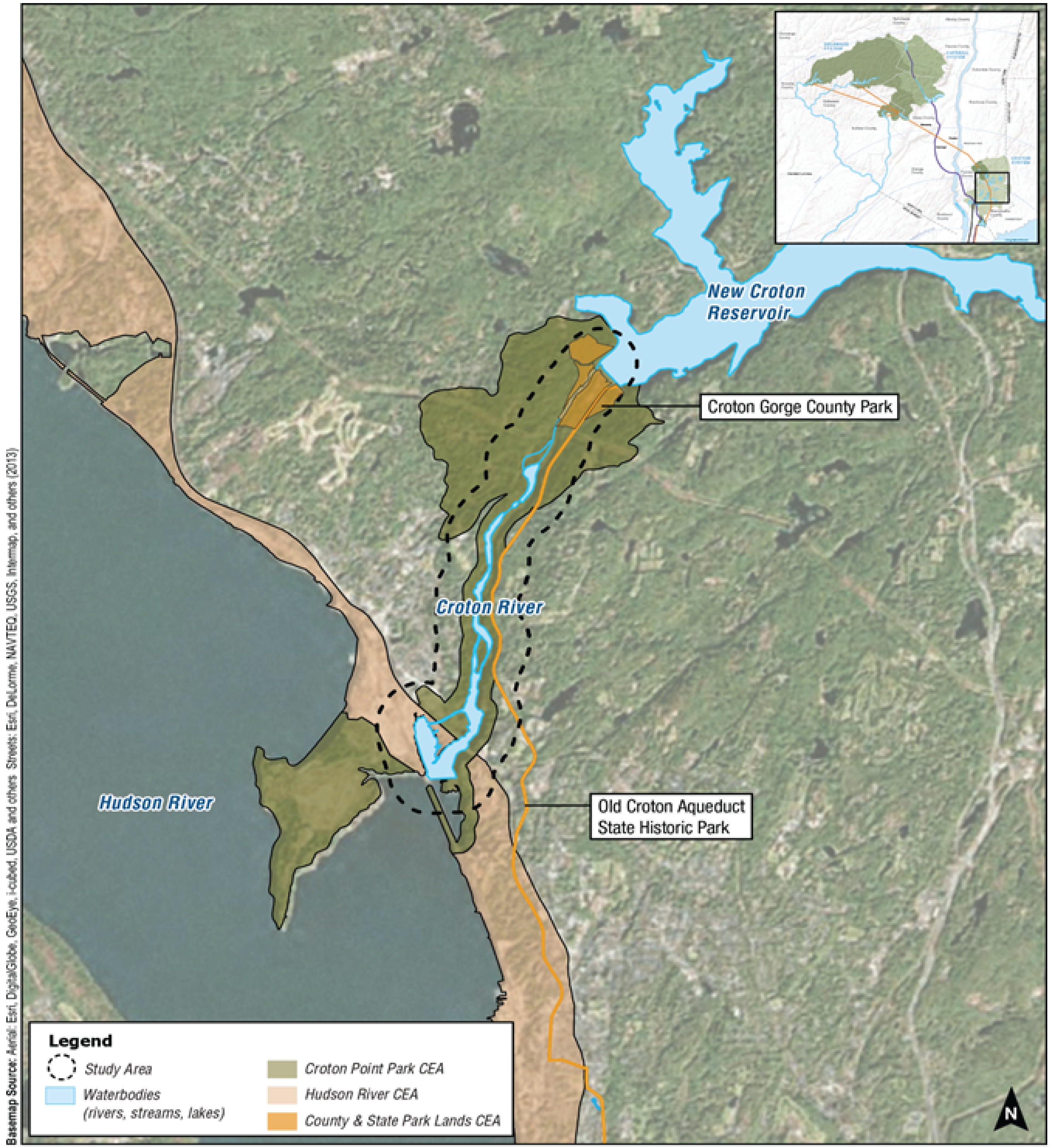
DEP has consulted with the Town of Cortlandt, Croton on Hudson, Town of New Castle, Town of Ossining and Village of Ossining, and Westchester County, and it is DEP's understanding that no plans to expand or create new open space or recreational resources are anticipated within the Croton River Study Area within the timeframe of the impact analysis. Natural processes, such as changes in habitat due to natural vegetative succession, are anticipated to continue. Use of the identified open spaces is anticipated to continue. Therefore, in the future without the temporary shutdown, it is assumed that open space and recreation within the Croton River would be the same as baseline conditions. Similarly, it is assumed that the use of the Croton River, and the six open space and recreational resources identified in the Croton River Study Area would be the same as baseline conditions.

DEP is planning to request a variance from NYSDEC to reduce the spring releases from New Croton Reservoir to the minimum drought release rate of 11 mgd, which would be effective between April 1 and May 31. Minimum releases between July 1 and March 31 are set at 5.5 mgd and would remain unchanged. The dataset mean of combined releases and spills from the reservoir would remain above the typical required release rate during the temporary shutdown. Flows would, therefore, remain within the range experienced by the river under typical operations. The release modifications would not result in adverse impacts on open space and recreational resources downstream of the Reservoir. Release modifications would not limit waterfront access, or impact recreational use of North County Trailway, Croton Gorge Park, Old Croton Aqueduct State Historic Park, Black Rock Park, Silver Lake Park, Mayo's Landing, and Van Cortlandt Manor. Further release modifications are not anticipated to impact aquatic resources in the Croton River. Because NYSDEC trout stocking of Croton River, which typically occurs in March and April, would overlap with the reduced reservoir releases in April and May during the temporary shutdown, NYSDEC would monitor habitat and could curtail stocking for the season if unfavorable habitat conditions are present in the river. As a result, temporary effects to open space and recreation could occur in the form of reduced fishing opportunities for one season. However, no significant adverse impacts to fishing opportunities would be expected. Accessibility of the river, and angler safety in-water and on the banks of the Croton River would not be impacted. Therefore, WSSO would not result in significant adverse impacts to open space and recreation.

10.5.22.7 Critical Environmental Areas

The area consists of the Croton River downstream of New Croton Reservoir and a 0.25-mile buffer area. Several CEAs were identified in the study area. The "County and State Park Lands" CEA is designated by Westchester County and includes all State and county parks. The parks contained in this CEA that overlap with the study area consist of Croton Point Park, the Old Croton Aqueduct State Historic Park, and the Briarcliff-Peekskill Trailway County Park (see **Figure 10.5-76**). The Hudson River and Croton Point Park CEAs are also located in this study area.

The Hudson River is the defining drainage feature for the region and Westchester County's western boundary. This CEA was designated to protect the Hudson River and its immediate shoreline and the natural resources found within these areas. Croton Point Park is a 508-acre park located on a peninsula adjacent to the confluence of the Croton River and the Hudson River. This



Note: CEA = Critical Environmental Area

0 5,000 Feet

Figure 10.5-76: Critical Environmental Areas – Croton River Downstream of New Croton Reservoir Study Area

park contains an array of natural resources such as marshes and meadows with passive and active recreational opportunities such as hiking, swimming, and fishing. This CEA also encompasses the entirety of the Croton River and some surrounding areas up to and including the New Croton Dam. Within the County and State Park Lands CEA is the Old Croton Aqueduct State Historic Park, which is a designated National Historic Landmark. This trail runs 26.2 miles from Van Cortlandt Park in the Bronx to New Croton Dam. The Briarcliff-Peekskill Trailway is a linear park and runs approximately 12 miles from Ossining to Peekskill. The trailway runs through the study area and crosses the study area at New Croton Dam.

In the future without WSSO, it is assumed that all of the parks and the Hudson River CEA would continue to exist in their current capacity. The parks would continue to serve recreational purposes and development in or adjacent to them would be limited. The Hudson River would continue to provide innumerable benefits to the economy and recreation of Westchester County.

While stream flows would be lower than typical in April and May of the RWBT temporary shutdown, flows would remain within the minimum that can be experienced by the river. The river would continue to be accessible for recreation, and the river would continue to be a source of freshwater into the Hudson River. Lower than typical flows in the Croton River would be temporary, and would not affect the long-term character or uniqueness of the CEAs designated in the study area. Therefore, WSSO would not result in significant adverse impacts to Critical Environmental Areas in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.8 Historic and Cultural Resources

There would be no construction associated with WSSO in the Croton River Downstream of New Croton Reservoir Study Area. The potential mechanism for historic or cultural resources impacts from WSSO would be through erosion. While flows to the Croton River would be lower during the RWBT temporary shutdown than typical operations, erosion is not likely (see Geology and Soils in Section 10.5.22.10, "Natural Resources").

The State Historic Preservation Office was consulted, and their review dated September 15, 2015, indicated WSSO would have no effect on cultural resources in or eligible for inclusion in the National Register of Historic Places. Therefore, WSSO would not result in significant adverse impacts to historic and cultural resources in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.9 Visual Resources

While stream flows would be lower than typical, flows would remain within the minimum that can be experienced by the stream, and would not result in a substantial visual change to the waterbody. There would not be any visual contrast in the stream due to turbidity during WSSO, nor are decreased flows anticipated to result in vegetation mortality or erosion to the streambed (see Geology and Soils in Section 10.5.22.10, "Natural Resources"). Therefore, WSSO would not result in significant adverse impacts to visual resources within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.10 Natural Resources

The potential for impacts to natural resources from WSSO within the Croton River Downstream of New Croton Reservoir Study Area is discussed below.

Geology and Soils

While stream flows would be lower than typical, flows would remain within the minimum that can be experienced by the stream under typical conditions. Further, reduced stream flow would result in slower stream velocities, reducing the possibility of erosion. No changes to geology or soils at Croton River downstream of New Croton Reservoir are anticipated from reduced stream flows. Therefore, WSSO would not result in significant adverse impacts to geology and soils in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Terrestrial Resources

Ecological Communities

Desktop assessments of baseline ecological communities were conducted at the study area. In the future without WSSO, it is assumed that ecological communities within the study area would largely be the same as baseline conditions with the exception of possible changes in habitat due to natural vegetative succession. During the period of lower flows, April and May of the temporary shutdown, it is possible that the fringe riparian areas around Croton River would experience a lower surface water elevation than under typical operating conditions. During this period, herbaceous vegetation could experience stresses such as reduced vigor, failure to produce fruit or flowers, temporary dieback, or mortality of weakened plant individuals. Woody vegetation could also experience slightly reduced vigor but would not be anticipated to be significantly affected by the temporary reduction in flows. NYNHP identified one significant natural community, a tidal river, as occurring within the study area. This significant natural community is the Hudson River and the lower tidal portion of the Croton River, and is designated as such due to its significant ecological character and the fact that it is considered the longest tidal river in the world. The Hudson River supports two species of federally endangered sturgeon as well as a range of habitats that support a variety of life stages for numerous other fish species. Temporary reduction of flows to Croton River would not result in changes to ecological communities in the vicinity of the Croton River Downstream of New Croton Reservoir Study Area, including the tidal river significant natural community. The reduction in flows would not significantly affect the salinity, flow, or water quality of the Hudson River, and therefore, the tidal river community would remain unchanged. Therefore, WSSO would not result in significant adverse impacts to ecological communities in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Wildlife

In the future without WSSO, it is assumed that wildlife within the study area would largely be the same as baseline conditions. The temporary reduction of flows to Croton River would not result in significant changes within the study area to critical wildlife habitat, wildlife movement or its ability to forage or breed. As discussed, the flows to the river would be reduced below typical conditions which would result in a temporarily altered shoreline and riparian area. These temporary changes would not prevent terrestrial wildlife from using the river for behaviors such as foraging or breeding. The drawdown is not anticipated to result in effects on the fish community (see Aquatic and Benthic Resources in Section 10.5.22.10, “Natural Resources”). Any piscivorous (fish feeding) wildlife such as birds of prey or American mink (*Neovison vison*) that typically use the river would still have a source of prey in the river. Any changes experienced by wildlife as a result of WSSO would be temporary and minor. Therefore, WSSO would not result in significant adverse impacts to wildlife in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species

Federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species with the potential to occur in the Croton River Downstream of New Croton Reservoir Study Area were identified using consultations with USFWS and NYNHP and from data in the NYSDEC 2000-2005 Breeding Bird Atlas and the NYSDEC Herp Atlas. The Breeding Bird Atlas blocks that are contained in the Croton River Downstream of New Croton Reservoir Study Area include the following: Blocks 5856D, 5956C, and 5855B. The USGS Quadrangles used for the NYSDEC Herp Atlas that overlap with the Croton River Downstream of New Croton Reservoir Study Area include the Ossining and Haverstraw Quadrangles. In total, these sources identified species with the potential to occur in the Croton River Downstream of New Croton Reservoir Study Area (see **Table 10.5-12**). ArcGIS data was used to assess the potential habitat for these species. Based on the assessment results, there would be no significant adverse impacts to these species as a result of changes in flows to Croton River. Therefore, WSSO would not result in significant adverse impacts to federal/State Threatened, Endangered, and Candidate Species, State Species of Special Concern, and unlisted rare or vulnerable species in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Reptiles and Amphibians				
Bog Turtle (*Clemmys [=Glyptemys] muhlenbergii*)	Threatened	Endangered	Suitable bog turtle habitat includes fen or wet meadow habitats with cool, predominantly groundwater fed, shallow and slow moving water. Soils in bog turtle habitat are typically calcareous, deep, organic, and "mucky." Vegetation commonly includes calciphile species. Suitable bog turtle habitat is usually dominated by sedges, sphagnum moss, and other hydrophytes. Tussock forming species are common. Scrub-shrub vegetation can be a component of bog turtle habitat and is important for bog turtle hibernation. Hibernacula often occur adjacent to spring or seep heads in and amongst woody vegetation root structures (USFWS 2001; Gibbs et al. 2007). Bog turtle do not require river environments for any part of their natural history.	Desktop assessments of wetlands occurring in the study area were conducted. Wetlands in the study area with a water table connected to the river may experience minor temporary effects to wetland vegetation resulting from reduced flows. Any wetlands that share a water table with the river would have historically experienced fluctuating conditions. Fluctuating water tables are not typical of suitable bog turtle habitat (Feaga et al. 2012). Reduced flows would not influence other wetlands in the study area that are not hydrologically connected to the river and that potentially contain suitable bog turtle habitat. Therefore, no effects to bog turtles are anticipated and no further analysis for bog turtles is warranted for this study area.
Eastern box turtle (*Terrapene carolina*)	None	Special Concern	Eastern box turtles are a terrestrial species that use a variety of habitats including forests with sandy, well-drained soils; dry open uplands such as meadows, pastures, open fields, and utility right-of-ways; and, moist lowlands and wetlands. Eastern box turtles are poor swimmers and generally avoid streams and open waters (Gibbs et al. 2007). Eastern box turtle does not require rivers for any part of their natural history.	Eastern box turtle could potentially utilize the forested areas upland of Croton River. However, eastern box turtles only rarely inhabit streams. Reduction in flows to Croton River would not prevent eastern box turtles from utilizing the riverine habitat and would not affect their nesting, foraging, or hibernating outside of the river. Therefore, no effects to eastern box turtles are anticipated and no further analysis for eastern box turtles is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Eastern Hognose Snake (*Heterodon platyrhinos*)	None	Special Concern	Eastern hognose snake prefers open canopy woodlands, brushy fields, and high floodplains of large streams containing sandy substrates. Species also utilizes sand plains, pine plantations, and pin-oak forests (Gibbs et al. 2007; Hudsonia 2008). Eastern hognose snake does not require rivers for any part of their natural history.	Eastern hognose snake could potentially utilize upland forested areas adjacent to Croton River. Eastern hognose snake would not inhabit the riverine habitat of the Croton River. Reduction in flows to Croton River would not affect the natural history of eastern hognose snakes upland of the river; eastern hognose snake would be able to continue foraging, basking, hibernating, and reproducing independent of the reduction of flows to Croton River downstream of Croton River. Therefore, no effects to eastern hognose snakes are anticipated and no further analysis for eastern hognose snakes is warranted for this study area.
Spotted turtle (*Clemmys guttata*)	None	Special Concern	Spotted turtle habitat consists of vernal pools in the spring, upland forest for part of summer after pools dry out, and wet meadows, forested swamps, or sphagnum bogs for overwintering. They are strongly associated with pools that are shallow, have clear water, and have a muddy or mucky substrate. In winter, spotted turtles could inhabit abandoned mammal lodges or burrows or under the roots of flooded shrubs and trees, and could congregate with bog turtles or snapping turtles during this time (Gibbs et al. 2007). Spotted turtle could be found in small slow flowing streams but would not use moderate to large rivers such as Croton River.	During field investigations, the only wetlands that were found in areas that would be affected by WSSO were shallow emergent marshes on the stream edge. These wetlands did not have the shallow pools or muddy/mucky substrate preferred by spotted turtle. Therefore, no effects to spotted turtles are anticipated and no further analysis for spotted turtles is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Birds				
Bald Eagle (*Haliaeetus leucocephalus*)	Protected – BGPA, MBTA	Threatened	Bald Eagles typically build nests that are several feet wide and located in tall, live trees near water. The Hudson Valley population of Bald Eagles forages primarily in areas of shallow water, such as bays, intertidal marshes, and mudflats, along shorelines, and over open water. Open water foraging is more prevalent in winter (Thompson and McGarigal 2002; Nye 2008). Bald Eagles require large open water environments, which can include rivers for their natural history.	NYNHP has identified Bald Eagles as occurring at Croton River downstream of New Croton Reservoir. Flows would be reduced to flows experienced during drought conditions. Reduced flows in Croton River would not affect breeding Bald Eagles nesting behaviors, foraging ability, or nesting habitat. Reduced flows are not anticipated to have negative effects on the fishery present in Croton River (see Aquatic Resources). Reduced flows could temporarily alter the location of the shallow water habitat in the river; however, foraging habitat would still be available. Therefore, no effects to Bald Eagles are anticipated and no further analysis for Bald Eagles is warranted for this study area.
Cooper's Hawk (*Accipiter cooperii*)	Protected - MBTA	Special Concern	Cooper's Hawks generally nest in deciduous and mixed forests. They are considered relatively tolerant of human disturbance and fragmentation, and are occasionally found nesting in small woodlots and urban parks. Cooper's Hawks forage primarily on other birds. During migration and winter, Cooper's Hawks utilize a variety of forested and open habitats, ranging from large forests to forest openings and fragmented lands (Hames and Lowe 2008). Cooper's Hawks do not require rivers for any part of their natural history.	Cooper's Hawks forage primarily on other woodland birds and inhabit a variety of forested habitats. Reduced flows in Croton River downstream of New Croton Reservoir would not affect Cooper's Hawk habitat, breeding, or foraging. Therefore, no effects to Cooper's Hawks are anticipated and no further analysis for Cooper's Hawks is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Osprey (*Pandion haliaetus*)	Protected - MBTA	Special Concern	Osprey habitat is found along coastal and inland waterways that contain abundant fish populations. Osprey forage on fish primarily in shallow waters. Osprey is an adaptable breeder, usually nesting in trees and dead snags, but also uses a variety of man-made structures for nesting and will nest on the ground (Nye 2008a). Osprey require water, which can include streams, for some stage in their natural history.	Suitable Osprey habitat occurs in the study area along Croton River. Osprey breeding, nesting behaviors, and nesting habitat are not dependent on stream flow and reduced flows in Croton River would not affect breeding Osprey nesting behaviors or nesting habitat. Reduced flows are not anticipated to have significant adverse effects to the fishery present in Croton River (see Aquatic Resources). Osprey would still be able to forage on fish in Croton River. Reduced flows could temporarily altar the location of the shallow water habitat used for foraging; however, this habitat would still be available in the river. Therefore, no effects to Ospreys are anticipated and no further analysis for Ospreys is warranted for this study area.
Peregrine Falcon (*Falco peregrinus*)	Protected - MBTA	Endangered	Peregrine Falcons traditionally nest on cliff ledges. Peregrine Falcons generally prefer open landscapes, including over open water, particularly for foraging during the nesting and non-nesting periods. However, in the Hudson Valley they also commonly nest on man-made structures such as bridges and buildings, and often use nest boxes provided by NYSDEC that are intended to reduce egg loss and increase nest success (Loucks 2008). Peregrine Falcons do not require rivers for any part of their natural history.	Peregrine Falcons do not rely on rivers for any essential natural history. They could be present at nearby Croton Point, the Hudson River, or foraging near or over Croton River; however, reduction in flows to Croton River would not affect their prey, ability to forage, or ability to nest. Therefore, no effects to Peregrine Falcons are anticipated and no further analysis for Peregrine Falcons is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Mammals				
Indiana Bat (*Myotis sodalis*)	Endangered	Endangered	The Indiana bat forms maternity colonies to bear young in crevices of trees or beneath loose bark. Ideal roost trees are typically mature and dead or dying and hold a landscape position in which there is ample solar exposure. Foraging occurs over open water, along riparian edges or hedgerows, and along watercourses. Indiana bat hibernates in caves and could migrate moderately long distances between its hibernacula and summer habitat (USFWS 2004; USFWS 2007). Indiana bats will utilize rivers for foraging and migrating when they are available.	Indiana bats have the potential to utilize Croton River for migration and foraging purposes. Reduction of flows to Croton River would not affect these behaviors and flow would still remain in the river allowing Indiana bats, if present, to continue using the river. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to Indiana bats are anticipated and no further analysis for Indiana bats is warranted for this study area.
New England Cottontail (*Sylvilagus transitionalis*)	None	Special Concern	New England cottontail is known only to occur east of the Hudson River. This species prefers early successional habitat with dense vegetation generally associated with abandoned agricultural fields, wetlands, clear cuts of woodlands, utility right-of-ways, and other disturbed areas with shrubs and early successional vegetation (Arbuthnot 2008). New England cottontail do not require river environments for any part of their natural history.	The temporary reduction of flows to Croton River downstream of New Croton Reservoir would not be anticipated to affect dense woody vegetation typical of New England cottontail habitat. Woody vegetation at the river fringe could experience reduced vigor due to a lowered water table but would not lose its ability to provide cover and food for New England cottontail, if they occur in the study area. Therefore, no effects to New England cottontails are anticipated and no further analysis for New England cottontails is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Northern Long-eared Bat (*Myotis septentrionalis*)	Threatened	Threatened	The northern long-eared bat habitat requirements are very similar to those of the Indiana bat. The species roosts singly or in colonies in cavities, underneath bark, crevices, or hollows of live or dead trees of varying sizes. These bats are opportunistic, roosting in man-made structures including barns and sheds. Foraging habitat includes upland and lowland woodlots, tree-lined corridors and open water areas (USFWS 2014). Northern long-eared bats will utilize rivers for foraging and migrating when they are available.	Northern long-eared bats have the potential to utilize Croton River for migration and foraging purposes. Reduction of flows to Croton River would not affect these behaviors and flow would still remain in the river allowing northern long-eared bats, if present, to continue using the river. No tree clearing would occur as a result of WSSO in this study area. Some trees at the reservoir fringe could experience reduced vigor, but would not be anticipated to result in tree mortality. These effects to trees would not affect the trees' suitability to support summer roosting. Therefore, no effects to northern long-eared bats are anticipated and no further analysis for northern long-eared bats is warranted for this study area.
Plants				
Eastern Grasswort (*Lilaeopsis chinensis*)	None	Threatened	Eastern grasswort grows on a variety of habitats that are influenced by brackish waters including intertidal mudflats, peaty borders of salt marshes, and rocky shores adjacent to salt marshes. Eastern grasswort is a small perennial herb that reproduces by both seed and vegetative growth. Its growth habit is low to the ground and forms large mats (NYNHP 2013). Eastern grasswort is not known to require rivers for any part of its natural history.	NYNHP identified eastern grasswort as occurring in the study area. Eastern grasswort requires brackish waters and in the study area it is associated with areas adjacent to the Hudson River. Reduced flow in Croton River would not have an effect on the brackish waters or marsh habitat on the Hudson River where this species occurs. All conditions that promote growth of eastern grasswort by the Hudson River would be unchanged as a result of reduced flow in Croton River. Therefore, no effects to eastern grasswort are anticipated and no further analysis for eastern grasswort is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Invertebrates – Damselflies and Dragonflies				
Dusky Dancer (*Argia translata*)	None	None	Dusky dancer is not currently protected but population decline has occurred in New York and the species has the potential to be listed as Threatened if trends continue. Dusky dancer is a poorly studied species. Habitat from known occurrences typically includes streams and rivers with sun exposure and moderate vegetation (Abbott 2015).	NYNHP identified dusky dancer as occurring within the study area. Dusky dancer adults utilize riverine habitat by foraging around the river and laying eggs in the river. Dusky dancer larvae live in rivers and streams until they are mature enough to become adults. Reduced flow in Croton River has the potential to reduce the habitat available to the larval and adult stages of dusky dancers. However, both life stages are mobile and would be anticipated to adapt to the reduced flow conditions: larvae would swim to new shallow areas and adults would forage over the new shallow areas. These conditions are not unprecedented in the operation of Croton River and would mimic flows typical of drought conditions. Upon completion of the temporary shutdown, flows to Croton River would return to typical conditions. Therefore, no effects to dusky dancers are anticipated and no further analysis for dusky dancers is warranted for this study area.

Table 10.5-12: Federal/State Threatened and Threatened, Endangered, and Candidate Species, State Species of Special Concern, and Unlisted Rare or Vulnerable Species with the Potential to Occur within the Croton River Downstream of New Croton Reservoir Study Area

Species (Common/Scientific)	Federal Status	State Status	Habitat Notes	Assessment
Fish				
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)	Endangered	Endangered	Atlantic sturgeon is a long-lived, estuarine dependent, anadromous fish. Anadromous species are species that migrate into freshwater to spawn then return to estuarine or salt water. Spawning adults migrate upriver beginning in April and May in the mid-Atlantic. Spawning occurs in the saline sections of deep rivers with flowing water in May to early July (Smith 1985a). Following spawning, males could remain in the river or lower estuary until the fall; females typically exit the rivers within 4 to 6 weeks. Juveniles move downstream and inhabit brackish waters until October or November (Smith 1985a). This species typically forages on benthic macroinvertebrates such as crustaceans, worms, and mollusks.	Atlantic sturgeons do not typically utilize freshwater rivers such as the Croton River. It is possible that Atlantic sturgeon could utilize the area of tidal influence found at the confluence of the Croton River and the Hudson River. Flow would be reduced in the Croton River; however, flow would be maintained at 11 mgd from New Croton Reservoir and any Atlantic sturgeon that could use the brackish portion of the Croton River at its confluence with the Hudson River would be able to continue to do so throughout WSSO. The reduction in flow would not be anticipated to have effects on the salinity of the Hudson River. Therefore, no effects to Atlantic sturgeon are anticipated and no further analysis of Atlantic sturgeon is warranted for this study area.
Shortnose Sturgeon (*Acipenser brevirostrum*)	Endangered	Endangered	Shortnose sturgeon spend their entire lives in the Hudson River Estuary. Spawning occurs in deeper pools with soft substrates and vegetated bottoms although a variety of spawning habitats have been documented. Larvae typically spend most of their time in the upper Hudson River between Albany and Poughkeepsie. Juveniles spend more time in brackish areas of the Hudson River and adults spend most time in the lower estuary or potentially at sea (NYNHP 2013).	Shortnose sturgeons do not typically utilize freshwater rivers such as the Croton River. It is possible that shortnose sturgeon could utilize the area of tidal influence found at the confluence of the Croton River and the Hudson River. Flow would be reduced in the Croton River; however flow would be maintained at 11 mgd from New Croton Reservoir and any shortnose Sturgeon that could use the brackish portion of the Croton River at its confluence with the Hudson River would be able to continue to do so throughout WSSO. The reduction in flow would not be anticipated to have effects on the salinity of the Hudson River. Therefore, no effects to shortnose sturgeon are anticipated and no further analysis of shortnose sturgeon is warranted for this study area.

Notes:
BGPA: Bald and Golden Eagle Protection Act
MBTA: Migratory Bird Treaty Act

Aquatic and Benthic Resources

The Croton River is an approximately 3.1-mile river from New Croton Reservoir to the Hudson River and contains a variety of habitat types. There are high gradient reaches with swift water, riffles, and pools, small impoundments upstream of small dams, and low gradient riverine habitat as the river transitions into the Hudson River. The lower end of the river is accessible for fish to migrate upstream from the Hudson River on a seasonal basis. The flow is controlled at New Croton Dam, which results in modified flows compared to natural conditions, as well as a reduced sediment load due to deposition in the reservoir and reduced flood flows due to upstream reservoir storage and flow attenuation.

The fish community in the river is a mix of species reflecting the diverse habitats present. Largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), and rock bass (*Ambloplites rupestris*) are abundant and would use mostly the slowing moving areas in this reach. Bluegill (*Lepomis macrochirus*) and pumpkinseed (*Lepomis gibbosus*) would also use the ponded areas of this reach. Brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) are stocked in the upper mile of this reach every spring. Trout are stocked each year in March and April. Alewife (*Alosa pseudoharengus*) are abundant in this reach, which could be a combination of fish passing out of the reservoir and migratory fish from the Hudson River.

In the future without WSSO, typical reservoir operations would continue and it is assumed that aquatic resources would remain as described above.

Flows in the Croton River downstream of New Croton Reservoir are controlled primarily by releases and spills at the dam, and baseflow contributions from groundwater. There are no major tributaries between the dam and the Hudson River that could influence flows in this reach. Flows in the river are typically limited to the regulated minimum flows throughout the year. The highest flows occur as a result of spills, which occur most often in late winter and spring.

The river experiences variations in flow levels throughout most of the year, and spills are anticipated to offset the reduction in releases during the shutdown. Therefore, the reduction in releases during the temporary shutdown would have negligible effects on fish and benthic macroinvertebrates in the river. The reduced flows during typical operations have influenced the long-term habitat availability throughout the river. During drought years the flows in the river have matched the proposed shutdown flows. The small impoundments along the river have served as refuges for fish and benthic macroinvertebrates and would continue in that function during shutdown operations. The small dams which form the impoundments would maintain a constant water level in their pools during shutdown operations. The trout fishery in the river is supported by annual stocking that would sustain the fishery during the shutdown.

The effect of the temporary shutdown on the aquatic resources of the river would be minimal because the temporary shutdown would be a small departure from typical operations. Therefore, WSSO would not result in significant adverse impacts to aquatic and benthic resources in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Water Resources

Surface Water

In addition to hydrologic changes described previously (see Section 10.5.22.2, "Study Area Evaluation"), WSSO would not include any construction in this study area that would increase impervious surfaces. Runoff from the Croton River Downstream of New Croton Reservoir Study Area would not change from typical conditions during WSSO. Therefore, WSSO would not result in significant adverse impacts to surface water resources in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Floodplains

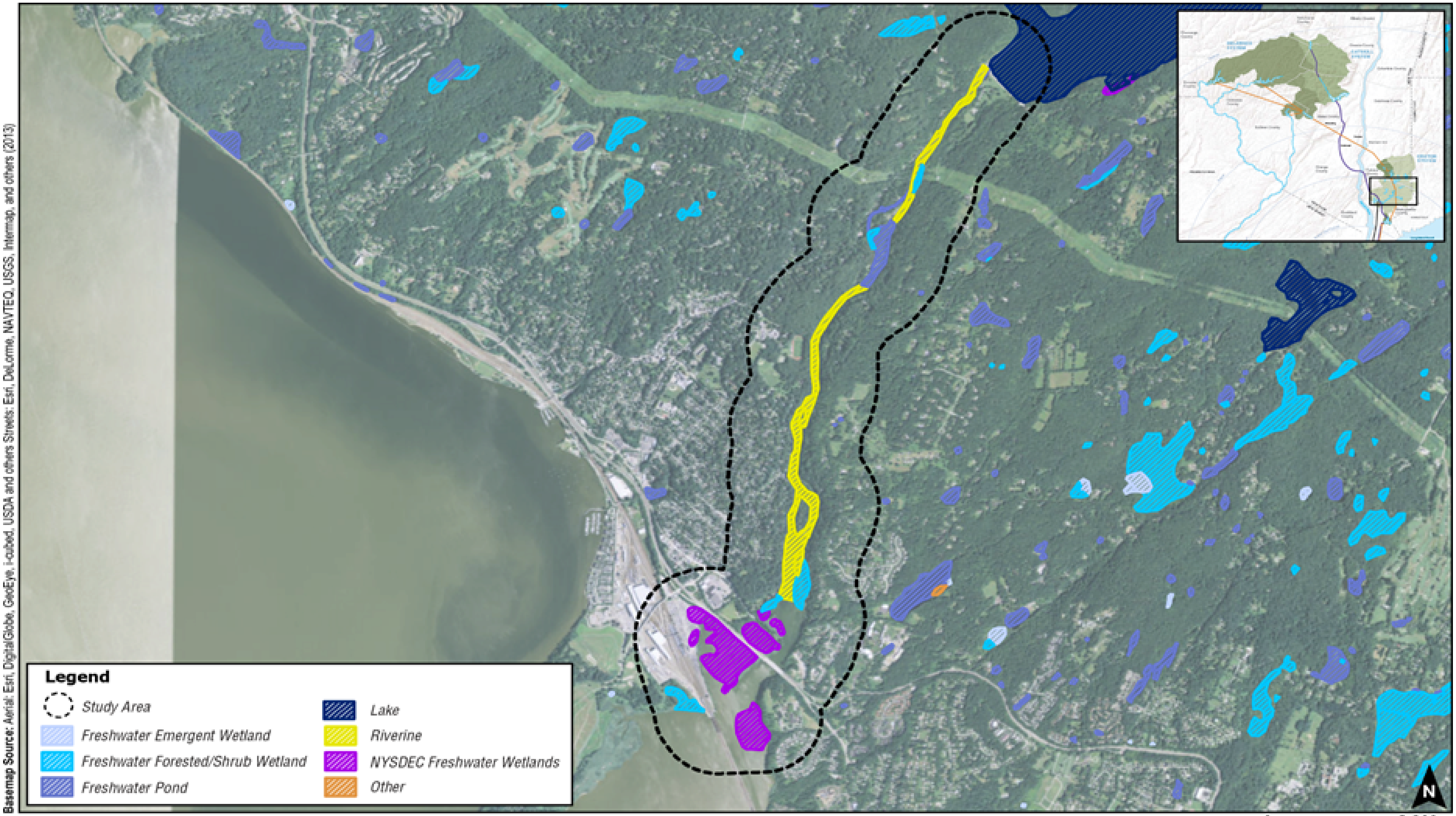
There would be no construction associated with WSSO in the Croton River Downstream of New Croton Reservoir Study Area. Lower than typical stream flows that would occur in the Croton River downstream of New Croton Reservoir would have no effect on floodplains within the study area. Therefore, WSSO would not result in significant adverse impacts to floodplains in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Groundwater

While releases would be lower than typical, flows would remain within the range that can be experienced by the stream under typical conditions. Releases from New Croton Reservoir would be lower than typical at approximately 11 mgd in the months of April and May during the RWBT temporary shutdown. However, releases are typically lower at 5.5 mgd for July through March each year under typical conditions. Further, a USGS review of the regional hydrogeology in the vicinity of the Croton River indicates the primary sources of groundwater recharge are direct precipitation and runoff from adjacent hillsides (Reynolds 1988). Therefore, temporary reductions in releases are not anticipated to change groundwater elevations in the vicinity of the Croton River. Therefore, WSSO would not result in significant adverse impacts to groundwater in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

Wetlands

Wetlands resources mapped by NYSDEC and USFWS NWI have been identified within the Croton River Downstream of New Croton Reservoir Study Area (see **Figure 10.5-77**). The study area extends 0.25 mile around the stream and captures any wetlands that occur at elevations that have the potential to be hydrologically dependent on the Croton River. There are six NYSDEC wetlands mapped within or intersecting the study area. The six NYSDEC wetlands cover approximately 50 acres and five are Class I wetlands and one is a Class II wetland. There are 10 USFWS NWI-mapped wetlands within or intersecting the study area. The 10 USFWS NWI wetlands cover approximately 23 acres and consist of five scrub/shrub or forested wetlands and five ponds. Of the 50 acres of NYSDEC wetlands and 23 acres of NWI-mapped wetlands, approximately 0.2 acre overlap and contain both NYSDEC and NWI-mapped wetlands.



Basemap Source: Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA and others Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013)

Note: Lacustrine and riverine NWI wetlands were considered surface waters for this assessment and are shown for reference on this figure.
NYSDEC = New York State Department of Environmental Conservation

0 3,200 Feet

Figure 10.5-77: Wetlands Resources – Croton River Downstream of New Croton Reservoir Study Area

NYC Environmental Protection

In the future without WSSO, it is assumed that wetland resources in Croton River would generally remain the same as baseline conditions and there would be no change from typical operations of the reservoir.

During the temporary shutdown, releases would be lower than typical at approximately 11 mgd in April and May. However, overall flows would remain within the range that can be experienced by the stream under typical conditions, because spills are anticipated to offset reduced releases during WSSO at the Croton River Downstream of New Croton Reservoir Study Area. Further, releases are typically lower at 5.5 mgd for July through March each year under typical conditions.

Based on the minimal difference in typical hydrology along the Croton River, WSSO would not result in significant adverse impacts to wetlands in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.11 Hazardous Materials

WSSO would not include the use or generation of potentially hazardous substances (i.e., pesticides, chemicals, wastes), nor would it include any construction or other land disturbing activities at this study area. The potential mechanism for disturbing potentially existing hazardous materials within the Croton River Downstream of New Croton Reservoir Study Area would be through excessive erosion. Stream flows would be lower than typical, and the potential for erosion is low (see Geology and Soils in Section 10.5.22.10, "Natural Resources").

Based on the low potential for erosion along the Croton River, WSSO would not result in significant adverse impacts to hazardous materials in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.12 Water and Sewer Infrastructure

There are no municipal drinking water intakes or sewer outfalls along the study area. The Village of Croton-on-Hudson utilizes three drinking water wells that are located along the Croton River downstream of the New Croton Reservoir. The three wells are completed in an unconfined sand and gravel aquifer and obtain water from the aquifer through induced infiltration from the nearby Croton River. While the 11 mgd release would be lower than typical in April and May of the temporary shutdown, releases would be higher than the 5.5 mgd typical for July through March each year, which would not affect the approximately 1 mgd withdrawal by the Village of Croton-on-Hudson. Additionally, WSSO would not include any construction in the Croton River Downstream of New Croton Reservoir Study Area that would increase demands on existing water and sewer infrastructure. Therefore, WSSO would not result in significant adverse impacts to water and sewer infrastructure in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.13 Energy

Changes to flows for the Croton River Downstream of New Croton Reservoir Study Area during the temporary shutdown would have no effect on energy usage or consumption. Therefore, WSSO would not result in significant adverse impacts to energy in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.14 Transportation

Stream flows for the Croton River Downstream of New Croton Reservoir Study Area would have no effect on transportation within the study area. Therefore, WSSO would not result in significant adverse impacts to transportation in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.15 Air Quality

Stream flows for the Croton River Downstream of New Croton Reservoir Study Area would have no effect on air quality within the study area. Therefore, WSSO would not result in significant adverse impacts to air quality in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.16 Noise

Stream flows at the Croton River Downstream of New Croton Reservoir Study Area would have no effect on noise levels in the vicinity of the waterbody. Therefore, WSSO would not result in significant adverse impacts to noise-sensitive receptors in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.17 Neighborhood Character

The character of the Croton River Downstream of New Croton Reservoir Study Area is largely defined by public service/utility, residential, open space, and vacant land uses, as well as its physical setting within a suburban area (see **Figure 10.5-70**). Croton River downstream of New Croton Reservoir flows approximately 3 miles to the southwest from New Croton Reservoir to the Hudson River.

DEP has consulted with the Town of Cortlandt, Croton on Hudson, Town of New Castle, Town of Ossining and Village of Ossining and Westchester County, and it is DEP's understanding that no changes in land use and no new projects or structures are anticipated within the Croton River Downstream of New Croton Reservoir Study Area within the timeframe of the impact analysis. Therefore, in the future without WSSO, it is assumed that neighborhood character within the study area would be the same as baseline conditions.

As described in Section 10.2.3, "Impact Analysis Methodology," based on the screening assessment for shadows and urban design, an impact analysis for the Croton River Downstream of New Croton Reservoir Study Area was not warranted. As described in Section 10.5.22.3, "Land Use, Zoning, and Public Policy," Section 10.5.22.4, "Socioeconomic Conditions," Section 10.5.22.8, "Historic and Cultural Resources," Section 10.5.21.9, "Visual Resources," Section 10.5.22.14, "Transportation," and Section 10.5.22.16, "Noise," an impact analysis for the Croton River Downstream of New Croton Reservoir Study Area was not warranted for land use, zoning, and public policy; socioeconomic conditions; historic and cultural resources; visual resources; transportation; or noise.

As described in Section 10.5.22.6, “Open Space and Recreation,” WSSO activities would be short-term and would result in a temporary change in open space and recreation during the RWBT temporary shutdown and during WSSO operations. Therefore, WSSO would not result in significant adverse impacts to open space and recreation within the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

During WSSO, stream flows at the Croton River Downstream of New Croton Reservoir Study Area would not result in significant adverse impacts to land use, zoning, and public policy, socioeconomic conditions, open space, historic and cultural resources, visual resources, shadows, transportation, or noise. Therefore, WSSO would not result in significant adverse impacts to neighborhood character in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.5.22.18 Public Health

There would be no significant adverse impacts related to air quality, water quality, hazardous materials, or noise from decreased flows to the Croton River Downstream of New Croton Reservoir Study Area during the temporary shutdown. Therefore, WSSO would not result in significant adverse impacts to public health in the Croton River Downstream of New Croton Reservoir Study Area and no further analysis is warranted.

10.6 COMMITMENTS

As part of the proposed project, DEP identified and incorporated specific commitments within the Water for the Future Shutdown System Operations (WSSO) component of Upstate Water Supply Resiliency to avoid and/or minimize the potential for significant adverse impacts to the maximum extent practicable. Commitments and protective measures that have been incorporated into WSSO are summarized below.

10.6.1 OPERATIONS

- DEP would only commence the RWBT temporary shutdown under favorable hydrologic conditions and when the aqueduct system is entering a period of lower demand.

- While DEP would use the existing exception from the Interim Ashokan Release Protocol in accordance with Section 7.c. of the New York State Department of Environmental Conservation (NYSDEC)/DEP Interim Ashokan Release Protocol for the Ashokan Reservoir (September 27, 2013), DEP would continue to maintain community releases from the Ashokan Release Channel.[57]

10.6.2 NATURAL RESOURCES

- Siphons at Rondout Reservoir would be available for the duration of the temporary shutdown. Siphons would operate continuously while the reservoir water surface elevation is above the minimum operating level. However, to not contribute to downstream flooding, DEP would temporarily cease operation of the siphons when flows at the U.S. Geological Survey Rosendale Gauge reach within 1 foot of the flood action stage. Following a temporary curtailment of flows, the siphons would be reactivated and flow control valves would be used to ramp flows back up slowly over a number of days.

10.6.3 NOISE

- DEP would use generators and fans during construction of the siphons at Rondout Reservoir. Generators would not exceed a maximum noise emission of 75 dBA L_{eq} at 50 feet from the generators, and may need to be equipped with protective and sound attenuating enclosures to meet this level. Fans would not exceed a maximum noise emission of 51 dBA L_{eq} at 50 feet from the fans.[58]

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[57] Section 7 c. of the Interim Ashokan Release Protocol for Ashokan Reservoir states “DEC, or DEP with concurrence by DEC, determines that releases must be changed or interrupted as necessary for inspection, maintenance, testing and repairs (including Delaware Aqueduct repairs).”

[58] These reduced noise levels for generators and fans were not used in the impact analyses.