Cumulative impacts are two or more individual effects on the environment that, when taken together, are significant or that compound or increase other environmental effects. Cumulative impacts can result from a single action or multiple actions, including individually minor but collectively significant actions that take place over time. They may include indirect or secondary impacts, long-term impacts, and synergistic effects.

In addition to potential cumulative impacts from the implementation of Upstate Water Supply Resiliency, the individual components of Upstate Water Supply Resiliency that overlap in specific municipalities were considered. While each of the proposed activities would be temporary, they were evaluated herein to identify those that would occur simultaneously to determine if the combined effects would increase their level of significance or change the potential for impacts within a municipality.

12.1 CUMULATIVE IMPACTS

An analysis of potential cumulative impacts of Water for the Future (WFF) from shaft and tunnel construction (referred to as RWBT Bypass), and a preliminary review of the potential for impacts associated with four water supply augmentation were previously evaluated in a Final Environmental Impact Statement issued on May 18, 2012 (previous EIS). RWBT Bypass work has commenced.

At the time of the previous EIS publication, these augmentation projects were planned to ensure a continued supply of water to DEP's customers during the 15-month Rondout-West Branch Tunnel (RWBT) temporary shutdown anticipated at the time of publication. These projects included the New Jersey and Nassau County Interconnections, the Catskill Aqueduct Repair and Rehabilitation, and the Queens Groundwater Rehabilitation. Since publication of the previous EIS, it has been determined through ongoing planning and assessment that the amount of time required for the RWBT temporary shutdown could be reduced to a period of up to 8 months. Because of the shorter temporary shutdown period, only one augmentation project, the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation), is now required to support it. The previous EIS assumed that the locations and/or timing of impacts for shaft and bypass tunnel construction would not coincide with what is now referred to as Upstate Water Supply Resiliency. As a result, it was reasonably anticipated that any impacts resulting from Upstate Water Supply Resiliency would not exacerbate any of the impacts associated with shaft and bypass tunnel construction. This assumption remains valid based on the final locations and timing of the proposed activities associated with implementation of Upstate Water Supply Resiliency.

Compared to the description in the previous EIS, Upstate Water Supply Resiliency includes fewer augmentation components (one versus four), has a more limited geographic extent (now limited to upstate New York components), includes fewer required construction activities (predominately to support the Catskill Aqueduct Repair and Rehabilitation), and has a reduced operational duration (to support an 8-month versus a 15-month temporary shutdown).

This section provides the methodology and cumulative impact analyses for those analysis categories associated with the individual components of Upstate Water Supply Resiliency that, when combined with other project components, could potentially have more significant or far-reaching effects on the area covered or served by WFF. The categories include energy, greenhouse gas (GHG) emissions and climate change, and public health. The cumulative socioeconomic conditions analysis is focused on WFF as a whole, because it accounts for the costs associated with Upstate Water Supply Resiliency along with updated costs of shaft and bypass tunnel construction (as compared to costs presented in the previous EIS). While a cumulative water supply infrastructure analysis was identified in the Final Scope of Work, DEP has now determined that this analysis is not required because the effects on water supply infrastructure from each project component would not occur at the same time and would take place at discrete locations.

The proposed individual components of Upstate Water Supply Resiliency include the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation), WFF Shutdown System Operations (WSSO), and the RWBT Inspection and Repair (inspection and repair) including decommissioning, as detailed in Chapter 9, "Proposed Catskill Aqueduct Repair and Rehabilitation," through Chapter 11, "Proposed Rondout-West Branch Tunnel Inspection and Repair." In addition to the cumulative assessments identified above, DEP also considered the potential for overlapping effects within municipalities across impact categories associated with each component of Upstate Water Supply Resiliency. While some towns contain multiple study areas, activities in the study areas associated with each component would largely occur at different times. Most temporary impacts associated with the Catskill Aqueduct Repair and Rehabilitation and RWBT Inspection and Repair at the shaft sites would occur prior to the RWBT temporary shutdown. Impacts associated with leak repair near Wawarsing and WSSO would occur concurrently during the RWBT temporary shutdown, and impacts in Roseton would mostly occur following connection of the RWBT to the bypass (see **Figure 12.1-1**).

Where a municipality contains multiple WSSO study areas, temporary changes to reservoir elevations or flows would largely occur within the typical operating ranges or historical variations of each waterbody. For municipalities that include multiple Catskill Aqueduct Repair and Rehabilitation or RWBT Inspection and Repair study areas, significant adverse impacts would not occur due to the presence of other trees, species, or habitats surrounding the study areas, the use of Best Management Practices during construction, and the short-term nature of the work. Finally, project-wide effects from the Catskill Aqueduct Repair and Rehabilitation would not result in significant adverse impacts as discussed in Section 9.19, "Project-wide Impact Analysis." Therefore, while several activities may occur in a municipality as a result of Upstate Water Supply Resiliency, they would not result in additive or cumulative impacts, and no further analysis of overlapping effects within the various project municipalities is warranted.

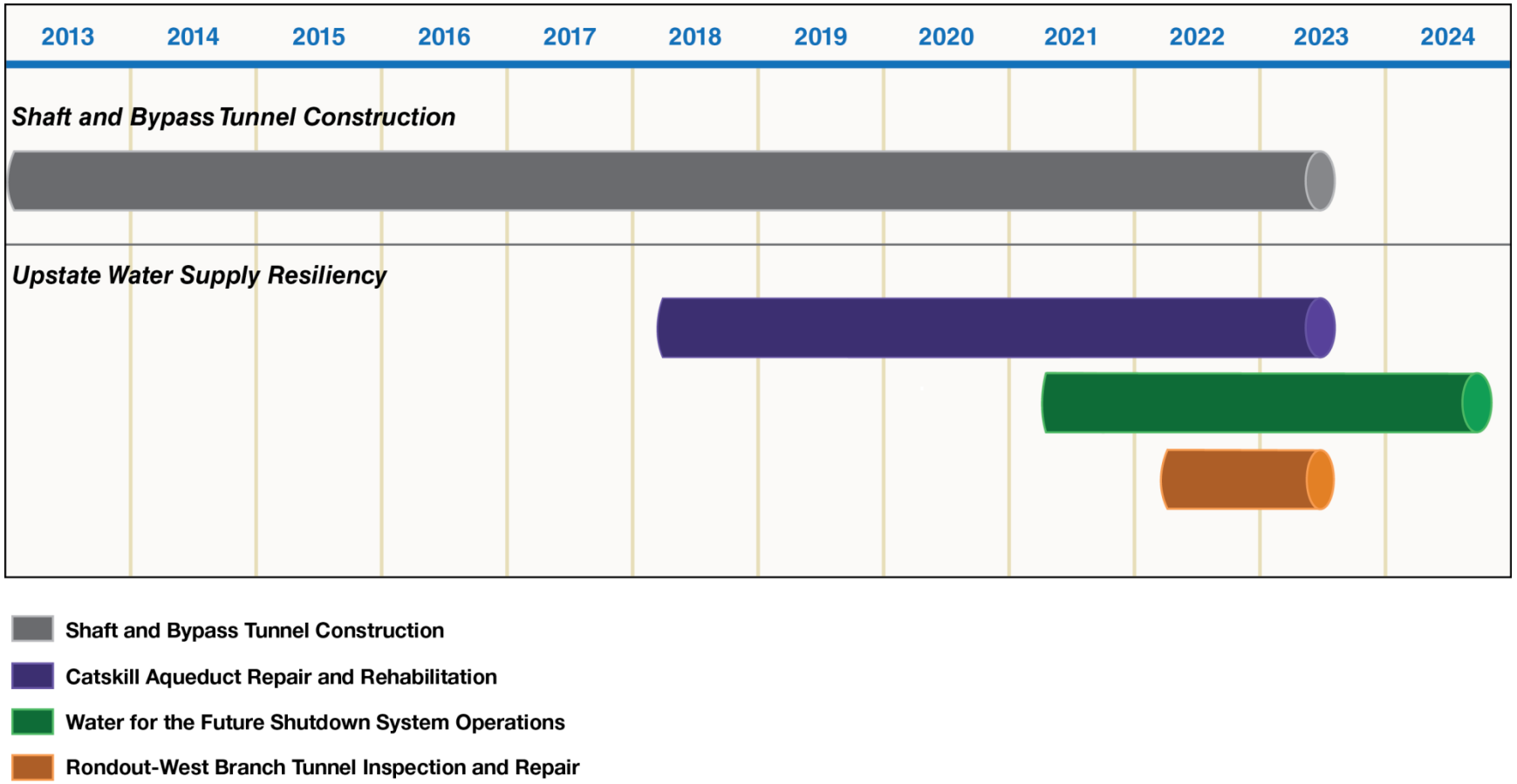


Figure 12.1-1: Water for the Future Timeline

Together, the previous EIS and this FDEIS consider the full range of environmental impacts associated with WFF, including short-term and long-term impacts.

12.1.1 ENERGY

According to the *City Environmental Quality Review (CEQR) Technical Manual*, a detailed analysis of energy impacts is typically required for projects that may significantly affect the transmission or generation of energy. Most actions resulting in new construction would not create significant adverse impacts to energy, and would not require a detailed energy analysis. However, a proposed action's operational energy consumption is typically estimated as part of a CEQR analysis. This cumulative energy analysis evaluates whether Upstate Water Supply Resiliency would cause significant adverse impacts to energy.

12.1.1.1 Assessment

As described in this FDEIS, there would be no long-term construction or operational activities associated with the components of Upstate Water Supply Resiliency. Energy use associated with construction activities, and construction and operation of the leak treatment systems, the chlorination facility at the Ashokan Screen Chamber, and the dechlorination facility at the Pleasantville Alum Plant as part of repair and rehabilitation would be limited. Construction and operation of the leak treatment systems would require little temporary power. Construction and operation of the chlorination facility at the Ashokan Screen Chamber and the dechlorination facility at the Pleasantville Alum Plant would rely on connections to existing power sources at these facilities, and only for a temporary period. Construction of the siphons at Merriman Dam would require little temporary power and their operation would require no power once they are primed. All power requirements associated with the inspection and repair at the shaft sites would be provided via temporary and portable on-site generators. As described in this FDEIS, due to the limited scale and duration of construction activities associated with these components and the minimal energy use associated with their operation, an energy impact analysis is not warranted for Upstate Water Supply Resiliency as it relates to energy consumption or transmission. Any required power would be supplied from existing available sources. Furthermore, temporary loss of electricity generation for the East, West, and Neversink tunnels of the Delaware System, and the Ashokan Reservoir headworks of the Catskill System (each of which has hydroelectric turbines that generate electricity when these system components are in operation) during the RWBT temporary shutdown would not affect the regional availability of electricity. Therefore, Upstate Water Supply Resiliency would not result in significant adverse impacts to energy.

12.1.2 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE

Greenhouse gas (GHG) emissions are gases in the atmosphere that can absorb and then emit thermal infrared radiation. In doing so, they change the balance of heat in the atmosphere. As discussed in the *CEQR Technical Manual*, increased concentrations of GHGs in the atmosphere are changing the global climate, resulting in wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is on a global scale, the environmental effects of climate change are also likely to be experienced at the regional and local levels. The City has established initiatives and goals for both greatly

reducing GHG emissions and adapting to climate change locally. Executive Order 109 of 2007 mandated the formulation of a comprehensive plan to reduce GHG emissions from City buildings and operations by 30 percent below 2006 levels by 2017. In addition, the goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 was codified by Local Law 22 of 2008, also known as the New York City Climate Protection Act. GHG emissions goals were amended by Local Law 66 of 2014 in relation to reducing citywide GHG emissions to 80 percent below 2005 levels by 2050. The assessment presented below evaluates Upstate Water Supply Resiliency with the above goals, following procedures presented in the *CEQR Technical Manual*.

12.1.2.1 Assessment

The *CEQR Technical Manual* lists six GHGs that could be evaluated in an EIS: carbon dioxide (CO_2), nitrous oxide (N_2O), methane, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). There would be no significant direct or indirect sources of HFCs, PFCs, or SF_6 associated with Upstate Water Supply Resiliency, since these pollutants are emitted primarily from non-combustion sources, such as refrigeration and industrial sources.

Upstate Water Supply Resiliency activities with the potential to produce GHGs include: (1) repair and rehabilitation, including construction and operation of the chlorination facility at the Ashokan Screen Chamber and dechlorination facility at the Pleasantville Alum Plant; (2) construction and operation of the siphons at Merriman Dam as part of WSSO; and (3) activities associated with inspection and repair at the shaft sites. Typically, projects with larger-scale activities include a GHG analysis focused mainly on CO_2, N_2O, and methane, pollutants associated with fossil fuel combustion. However, since no major stationary fossil fuel combustion sources are proposed for use as part of Upstate Water Supply Resiliency, there would be no significant direct or indirect sources of these compounds. Furthermore, upstream emissions related to the production of construction materials would be negligible and electricity use would also be temporary and minimal, and would not require any additional power supply from the local grid. Moreover, the proposed water supply augmentation largely relies on existing infrastructure; the water supply is conveyed by gravity and thereby does not rely on energy sources. Therefore, there would be no significant direct or indirect sources of CO_2, N_2O, and methane associated with Upstate Water Supply Resiliency.

Upstate Water Supply Resiliency was also evaluated for consistency with the GHG reduction goal, as defined in the *CEQR Technical Manual*, which requires examination of the way in which a project would reduce its carbon intensity. Under such an analysis, a proposed project is weighed against the considerations listed for the following five goals: building efficient buildings, using clean power, creating transit-oriented development and sustainable transportation, reducing construction activity emissions, and using building materials with low carbon intensity.

As described, there would be negligible construction and operational GHG emissions associated with Upstate Water Supply Resiliency. Therefore, Upstate Water Supply Resiliency would not result in significant adverse impacts to GHGs or climate change.

12.1.3 SOCIOECONOMIC CONDITIONS

The socioeconomic character of an area includes its population, housing, and economic activity. As discussed in Section 8.2.2, "Socioeconomic Conditions," a socioeconomic analysis should be conducted if a project is reasonably expected to generate substantial socioeconomic changes that would not occur without the proposed project. While socioeconomic effects were not the primary consideration in selecting the various components of WFF, the most cost-effective solution for addressing the leaking section of the RWBT was the construction of the bypass tunnel and two associated shafts to permanently circumvent the leaking section at the Roseton crossing, coupled with the selected components of Upstate Water Supply Resiliency. WFF would be limited to a defined geographical extent and duration, and would not affect existing or proposed development, or other buildings or structures. Therefore, WFF would not displace existing residents or businesses, or result in any new development in the surrounding area that could lead to higher property values or rents, nor would it generate a significant increase in employment during construction or operation.

This section analyzes the potential cumulative socioeconomic impacts of the future cost increases that would occur as a result of the incremental increase in water costs associated with WFF, including Upstate Water Supply Resiliency. The changes to water and sewer costs to pay for the capital and operating costs of WFF, including Upstate Water Supply Resiliency, would be minor. The previous EIS provided an estimate of the water rate increases that would occur as a result of shaft and bypass tunnel construction based on capital cost estimates available at the time of publication (2012). Since that time, construction cost information for shaft and bypass tunnel construction has been updated and refined, and, therefore, is captured in the following analysis. In addition, capital costs that would be associated with implementation of Upstate Water Supply Resiliency are available and are included in this analysis. The methodology and cumulative analysis of socioeconomic conditions associated with Upstate Water Supply Resiliency are presented in the following sections.

The City's water supply and wastewater (sewer) systems are supported by water and sewer charges. These operating expenses and debt service (further described below) on new and existing capital improvements are estimated by DEP annually for the entire system. Water capital improvements include those programs and activities associated with water treatment, transmission, distribution, and maintenance of the water supply system in a state of good repair. Wastewater and sewer service capital improvements include those programs and activities associated with wastewater and stormwater service, including conveyance and treatment, and maintenance of sewer and stormwater systems in a state of good repair.

To finance these water and wastewater capital programs, the City's Municipal Water Finance Authority issues revenue bonds to finance the City's water and wastewater capital programs. The costs associated with DEP's debt service to the City's Municipal Water Finance Authority consume a significant portion of its revenues. The City's Water Board is responsible for determining the rates, charges, and fees of water and wastewater for users sufficient to cover the costs of operating these systems. Each year, water and sewer rates are adjusted to ensure that

annual operating revenues equal the costs based on projected demand.[1] In accordance with this practice, the Water Board would adjust water rates to pay for the capital and operating costs of WFF, including Upstate Water Supply Resiliency.

To assess the projected increases in costs to both City and upstate wholesale customers as a result of WFF, the incremental increase in costs in the Future Without WFF was first calculated through 2023 when WFF would be complete. To determine this increase, the baseline costs in 2016 were compared to projected cost increases in the Future Without WFF. The average water and sewer usage per household was conservatively assumed to remain the same as baseline conditions. Next, the projected rate increase was applied to the average water and sewer usage per household to determine the projected average annual water and sewer charge per household in the Future Without WFF. The incremental average annual cost of water to residential households in upstate wholesale customer areas was calculated based on: the estimated increases through 2023 of wholesale rates that the City charges to municipalities outside of the City of New York, and average usage per household. Rates for upstate wholesale customers account for the cost of water only (no wastewater) and do not include costs associated with service within the City. The projected incremental cost increases in the Future Without WFF were then compared to the projected incremental increases in water costs associated with WFF.

The projected increases associated with WFF include the costs associated with the amortization of revenue bonds over 30 years. In addition, because the majority of City and upstate wholesale customers are residential, and because WFF would not displace businesses or industries, the socioeconomic analysis presented below was conducted for residential customers only.

12.1.3.1 Assessment

For 2016, the baseline year for this analysis, most City customers are charged a uniform water rate of $0.51 per 100 gallons of water. Wastewater charges are levied at 159 percent of water charges (i.e., $0.81 per 100 gallons). **Table 12.1-1** presents 2016 residential costs and average monthly and annual water and wastewater bills for City residential users by household type.

Table 12.1-1: Estimated Baseline Household Water and Sewer Costs for City Residential Customers

Household Type	Average Annual Bill	Average Monthly Bill
City Single-family Dwelling	$1,058	$88.17
City Multi-family Dwelling	$688	$57.33

In addition to in-City customers, DEP provides water on a wholesale basis to some municipalities outside of the City of New York (Outside Community Connections or upstate wholesale customers), accounting for approximately 10 percent of DEP's total water consumption. These upstate wholesale customers are charged wholesale prices for water use up to their entitled amount (based on per capita use). The upstate wholesale customers receive water at the upstate rate for consumption below their entitlement amount, which is set at the equivalent of City per capita consumption multiplied by each upstate wholesale customer's population.

[1] Demand equates to the amount of water sold and is also used to estimate sewer service charges.

Water usage in excess of this entitled amount is charged at a rate equivalent to the City water rate. **Table 12.1-2** presents 2016 costs and average monthly and annual bills for upstate wholesale customers and applies only to water.

Table 12.1-2: Estimated Baseline Water Costs for Upstate Communities Based on Wholesale Water Rates for Municipalities Outside of the City of New York

Household Type	Estimate of Average Annual Bill Based on Wholesale Water Rate	Estimate of Average Monthly Bill Based on Whole Water Rate
Upstate Single-family Dwelling	$138	$11.50

DEP has a robust capital improvement plan to pursue State- and federally mandated projects and to fund critical state of good repair and other projects to maintain the City's water and wastewater infrastructure. Accordingly, future water and wastewater rates are forecasted in line with the anticipated costs of these projects and other required investments. As shown in **Table 12.1-3**, based on preliminary capital forecasting estimates, household bills for City residents are expected to increase by approximately 3 percent to an average annual of $1,301 by the year 2023 for single-family residences, while multi-family residences are anticipated to increase by approximately 3 percent to an annual average of $845. Note that the average annual usage (in gallons) is assumed to remain the same as in 2016.

Table 12.1-3: Estimated Future Without WFF Household Water and Sewer Costs for City Residential Users

Household Type	Projected Average Annual Bill	Projected Average Monthly Bill
City Single-family Dwelling	$1,301	$108.40
City Multi-family Dwelling	$845	$70.41

As shown in **Table 12.1-4**, based on preliminary capital forecasting estimates, household bills for upstate communities are estimated to increase to an average annual of $175 by the year 2023 based on wholesale water rates for municipalities outside of the City of New York. Water rates for upstate service to communities account for the cost of water only and do not include sewer service.

Table 12.1-4: Estimated Future Without WFF Water Costs for Upstate Communities Based on Wholesale Water Rates for Municipalities Outside of the City of New York

Household Type	Estimate of Projected Average Annual Bill Based on Wholesale Water Rates	Estimate of Projected Average Monthly Bill Based on Wholesale Water Rates
Upstate Single-family Dwelling	$175	$14.58

Costs presented in this section reflect the revised cost estimate for shaft and bypass tunnel construction in addition to new or refined estimates for expenditures associated with construction and additional debt service for Upstate Water Supply Resiliency. Refined estimates for Upstate Water Supply Resiliency activities include the repair and rehabilitation (including construction and operating costs associated with addition of a chlorination facility at the Ashokan Screen

Chamber and a dechlorination facility at the Pleasantville Alum Plant) and siphon construction at Merriman Dam as part of WSSO. Including these costs, the total capital cost of WFF is estimated to be $1.16 billion. Based on this information, **Table 12.1-5** presents the estimated total average annual residential bill for City residential users and the incremental cost increase attributable to WFF. Similar to the Future Without WFF, it is assumed that the average annual usage would remain the same as in 2016. As shown in **Table 12.1-5**, the projected costs for City single- and multi-family units reflect an annual increase of approximately $40 and $26, respectively, or a percent difference of approximately 3 percent, compared to the Future Without WFF.

Table 12.1-5: Estimated Household Water and Sewer Costs for City Residential Users in the Future With WFF Compared to the Future Without WFF

Household Type	Average Annual Bill With WFF	Increase of Average Annual Bill With WFF over Future Without WFF	Percent Increase of Average Annual Bill With WFF over Future Without WFF
City Single-family Dwelling	$1,341	$40	3.1%
City Multi-family Dwelling	$871	$26	3.1%

As shown in **Table 12.1-6**, for upstate wholesale customers, increases in water bills relative to costs in the Future Without WFF are estimated to be approximately $23 higher on an annual basis, equating to a 13 percent change compared to the Future Without WFF based on wholesale water rates for municipalities outside of the City of New York. It is important to note that the upstate wholesale bill values are substantially lower than City residential users, resulting in a higher percentage increase.

Table 12.1-6: Estimated Water Costs for Upstate Communities in the Future With WFF Compared to the Future Without WFF Based on Wholesale Water Rates for Municipalities Outside of the City of New York

Household Type	Estimate of Average Annual Bill With WFF Based on Wholesale Water Rate	Increase of Estimated Average Annual Bill With WFF over Future Without WFF	Percentage Increase of Estimated Average Annual Bill With WFF over Future Without WFF
Upstate Single-family Dwelling	$197.80	$22.80	13%

12.1.3.2 Conclusion

In conclusion, the cumulative impact of WFF on future water and sewer costs would be minor. The increases in water costs associated with WFF, including Upstate Water Supply Resiliency, would contribute only a small percentage to the total projected average annual bill increase. The projected increases attributed to WFF would be too small to adversely affect the socioeconomic and financial well-being of the City residential users and upstate wholesale customers that rely on the City's water supply system. Additionally, the estimated increases in costs would occur

gradually over the duration of the analysis period. The nominal increases in costs that would be attributed to WFF would not cause displacement of residents or businesses, nor would they affect the continued viability of businesses.

As described throughout this F~~D~~EIS, WFF (including Upstate Water Supply Resiliency) is necessary to ensure the continued reliability of the City's water supply system for years to come. As determined through DEP's iterative planning process involving complex modeling and considerations for both repair time and cost, the selected alternative for addressing the leaking section of the RWBT, coupled with the selected components of Upstate Water Supply Resiliency, represents the optimal approach for meeting this goal. While socioeconomic effects were not the primary consideration in selecting the various components of WFF, the overall approach is the most cost-effective solution, especially as opposed to the reactive approach of initiating repairs or upgrades should an emergency event affect the City's ability to supply water reliably. Furthermore, WFF (in particular, the repair and rehabilitation) presents a more cost-effective solution than the Interconnections to Water Supplies in New Jersey Alternative, because this alternative would entail construction of entirely new infrastructure, whereas the repair and rehabilitation is an upgrade of existing infrastructure. The City's ability to implement WFF is partly a result of the citywide Demand Management Plan, which was selected for both its relatively low cost and its ability to account for, manage, and protect the City's water resources during WFF and on a long-term basis. In this way, construction and operation of the RWBT Bypass, as well as the ability to rely entirely on DEP water supply during the RWBT temporary shutdown, minimizes the potential impact to City residential users and upstate wholesale customers.

Therefore, Upstate Water Supply Resiliency would not result in significant adverse impacts to socioeconomic conditions.

12.1.4 PUBLIC HEALTH

The City of New York has a fundamental obligation to provide a reliable potable water supply that meets all public health and regulatory requirements, and is mandated under the federal Safe Drinking Water Act and New York Sanitary Code, as well as its obligations under the FAD. On behalf of the City, DEP is responsible for ensuring the safe and reliable transmission of drinking water from the watershed to consumers in sufficient quantity to meet all present and future water demands. As previously discussed, Upstate Water Supply Resiliency would help ensure that this goal and obligation are met.

Public Health is defined by the *CEQR Technical Manual* as "the activities that society undertakes to create and maintain conditions in which people can be healthy." As discussed in Section 8.2.19, "Public Health," a public health analysis is warranted if a proposed project would result in a significant unmitigated adverse impact to air quality, water supply (quantity or quality), hazardous materials, or noise. The public health analysis consists of identifying the potential for Upstate Water Supply Resiliency to result in changes to the quality or quantity of water available from the City's water supply system. No significant unmitigable changes to air quality, water supply (quantity or quality), hazardous materials, or noise are anticipated. An assessment of the potential for Upstate Water Supply Resiliency to result in significant adverse impacts to the overall public health conditions is presented below.

12.1.4.1 Assessment

The RWBT segment of the Delaware Aqueduct is leaking up to 35 mgd, primarily in the area known as the Roseton crossing under the Town of Newburgh, Orange County, New York. A second leaking section is located near the Town of Wawarsing, Ulster County, New York. To address these leaks, an iterative planning process involving complex modeling and considerations for water supply availability and potential environmental impacts was undertaken to determine the optimal method of repair. As a result of this planning process, DEP elected to construct a bypass tunnel and two associated shafts to permanently circumvent the leaking section at the Roseton crossing, and to conduct internal repairs to the section near Wawarsing (this project was evaluated in the previous EIS).

As described in Chapter 2, "Purpose and Need for the Proposed Water Supply Resiliency," WFF was developed to respond to the need to repair and improve resiliency in the RWBT, a vital piece of the City's overall water supply system. WFF would ensure continued water supply service for current and future generations of DEP customers. The repair and rehabilitation and WSSO would allow DEP to continue to meet water demand during the approximately 8-month RWBT temporary shutdown, and would support inspection and repair. Each of these components was carefully selected to optimize existing City water resources and to enhance key infrastructure while managing the cost of WFF. Chapter 4, "Water for the Future Background and Planning," explains how these components were selected.

Since releasing the previous EIS, DEP has optimized the scope and schedule associated with implementing WFF by refining the design of the bypass tunnel connection construction, thereby reducing the temporary shutdown period from the original estimate of up to 15 months disclosed in the previous EIS to 8 months. To ensure the continued supply of clean drinking water during the RWBT temporary shutdown, DEP is proposing Upstate Water Supply Resiliency as part of WFF. Prior to, during, and just following the RWBT temporary shutdown, DEP would implement WSSO, a specific and substantially different operating protocol that is designed to maintain reliability of the water supply system during an extended shutdown of the RWBT. In addition, WSSO includes a provision to ensure that favorable hydrologic conditions are present prior to commencing the RWBT temporary shutdown based on hydrologic forecasts at certain reservoirs.

Throughout the RWBT temporary shutdown, DEP would rely entirely on the Catskill and Croton systems while continuously monitoring and evaluating water supply and demand. As described in Section 9.2, "Project Description," if, at any given time, system demand exceeds predicted available supply, demobilization from the RWBT bypass tunnel connection would be initiated, the RWBT would be brought back into service, and the water supply systems would be allowed return to baseline conditions. The repair would be continued in a subsequent year, when the hydrologic condition of the water supply system allows.

Once inspections of and repairs to the RWBT are complete and the bypass tunnel is connected to the existing RWBT, the bypass tunnel would become a permanent component of the RWBT. At that time, the bypassed segment would be permanently decommissioned. When the connection and repairs are complete, water flow would be restored to the Delaware Aqueduct. DEP would

temporarily rely more heavily on the Delaware System to allow the water supply system to return to the baseline conditions that existed prior to the RWBT temporary shutdown.

As described above, WFF is inherently designed to be protective of public health. Implementation of WFF would allow the City to continue to meet and respond to variable water supply and demand conditions, even after WFF is complete and essential City infrastructure has been repaired. Cessation of leaks along the RWBT would reduce water losses in the Delaware water supply system, thus contributing to its long-term sustainability. In addition, through implementation of the above measures, DEP would ensure that no unmitigable impacts to public health would occur as a result of WFF.

Therefore, Upstate Water Supply Resiliency would not result in significant adverse impacts to public health.

As part of the proposed project, DEP has incorporated commitments and protective measures into the project components that would avoid or minimize the potential for significant adverse impacts. Through implementation of these commitments and/or protective measures, no significant adverse impacts would result from the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation) and Water for the Future Shutdown System Operations (WSSO). Therefore, mitigation is not required for these components.

In addition, commitments and protective measures are incorporated into the Rondout-West Branch Tunnel Inspection and Repair (inspection and repair) that would also avoid or minimize the potential for significant adverse impacts. Significant adverse impacts associated with the inspection and repair that could not be avoided or minimized through incorporation of commitments and protective measures would be mitigated as described in Chapter 14: , "Mitigation."

Upstate Water Supply Resiliency commitments are described below and in greater detail within this F~~D~~EIS.

13.1 CATSKILL REPAIR AND REHABILITATION

As part of the proposed project, DEP identified and incorporated specific commitments within the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation) component of Upstate Water Supply Resiliency to avoid and/or minimize the potential for significant adverse impacts to the maximum extent practicable. The commitments and protective measures associated with the repair and rehabilitation are summarized below and discussed in further detail within Chapter 9, "Proposed Catskill Aqueduct Repair and Rehabilitation."

13.1.1 OPERATIONS

- DEP would only commence aqueduct shutdowns under favorable hydrologic conditions and when the water supply system is entering a period of lower demand.

13.1.2 NATURAL RESOURCES

- Tree removal would be conducted from November 1 through March 31 to avoid impacts to Indiana bats (*Myotis sodalis*) and northern long-eared bats (*Myotis septentrionalis*).

- DEP would inspect structures that would be repaired prior to commencement of work to verify whether there are signs of roosting bats.

- For federal/State Threatened, Endangered Species, and Candidate Species, State Species of Special Concern, protective measures include perimeter fencing and other measures ~~species relocation~~ as discussed in detail in Section 9.4, "Town of Olive Impact Analysis," through Section 9.19, "Project-wide Impact Analysis." As an example, should any federal/State Threatened and Endangered Species and State Species of Special Concern, such as timber rattlesnakes (*Crotalus horridus*), be encountered during construction, DEP would enact an encounter plan. Among other elements, the encounter plan would include having a natural resource specialist relocate the species outside of the work area, as appropriate.

- Use of stream diversions for in-water work would be limited to the maximum extent practicable, particularly within those locations where waterbodies are supportive of coldwater fisheries (e.g., trout [T] or trout spawning [TS]). Where temporary diversions are required, DEP would employ partial diversions where feasible that would not restrict more than 40 percent of the stream width in order to maintain stream flow and fish passage throughout the duration of construction. For waterbodies where a full stream diversion may be required, this work would be done outside of any work restrictions associated with coldwater fisheries and would be limited in scope and duration to the maximum extent practicable. Permanent streambank protection measures would be installed along streams in selected areas to prevent erosion and possible scouring within receiving streams.

- Leaks along the aqueduct would be repaired or have local dechlorination systems installed prior to commencing chlorination to prevent chlorinated water from being released into the environment. DEP would conduct a photographic survey of vegetation in proximity to leak flowpaths prior to initiating chlorination and following repair and rehabilitation.

13.1.3 WATER AND SEWER INFRASTRUCTURE

- Discharges associated with unwatering of the Catskill Aqueduct would be controlled through the use of throttle valves and on-site monitoring to avoid a bankfull event in receiving waterbodies. In addition, for receiving streams that could be inundated during an unwatering event, DEP would avoid discharging at these sites within 24 hours of predicted rain events, during these rain events, and for a period of 48 hours after rain events or after which time streamflow returns to normal.

- DEP would coordinate closely with Outside Community Connections to confirm they have adequate water supply independent of the upper Catskill Aqueduct prior to any temporary shutdown of the aqueduct required for the repair and rehabilitation.

- DEP would add sodium hypochlorite or chlorine dioxide as part of the proposed chlorination at doses that would ensure effectiveness of the repair and rehabilitation while maintaining sodium hypochlorite and chlorine dioxide residuals and the associated formation of disinfection by-products (DBPs) below their respective maximum residual

disinfection or maximum contaminant levels for all Outside Community Connections, as applicable.[2]

13.1.4 TRANSPORTATION

- Use of the primary staging areas during the 10-week shutdowns would generate higher vehicle trips than during construction when the aqueduct is in service. During these periods, there would be shuttle trips between the primary staging area and study areas to reduce the volume of construction vehicles on local roads.

- To reduce truck trips during the weekend, biofilm removed from the aqueduct would be stockpiled at the Wallkill Downtake Chamber in the New Paltz-Minnewaska Road Study Area and removed from the site Monday through Friday.

13.1.5 NOISE

- DEP would use generators and fans during construction. Generators would not exceed a maximum noise emission of 75 A-weighted decibels (dBA) equivalent average sound level (Leq) 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 Leq at 50 feet from the fans.[3]

13.1.6 PUBLIC HEALTH

- DEP would not dose chlorine dioxide above 0.8 milligrams per liter (mg/L) or sodium hypochlorite above 1.25 mg/L under the proposed chlorination. This would ensure effectiveness of the repair and rehabilitation while maintaining residuals of these chemicals and the associated formation of disinfection by-products (chlorite, chlorate, trihalomethanes [THM], and haloacetic acids [HAAs]) below their respective New York State Department of Health maximum residual disinfection or maximum contaminant standards, as applicable.

- DEP would work with Outside Community Connections to implement measures aimed at monitoring and minimizing any potential changes to water supply characteristics as a result of temporary chlorination. These measures may include operational changes to reduce water age or oxidant use; monitoring of pH, chlorine dioxide, and DBPs; and addition of a corrosion inhibitor, as applicable.

- DEP is committed to developing and working with owners to implement an Action Plan for potentially affected private drinking water supply wells within the Lucas Turnpike and Mossybrook Road study areas (see **Figure 13.1-1** and **Figure 13.1-2**), if required.

[2] DBPs formed as a result of sodium hypochlorite addition include trihalomethanes (THM) and haloacetic acids (HAAs). For chlorine dioxide, DBPs are chlorite and chlorate. Chloride is also formed.

[3] These reduced noise levels for generators and fans were not used in the impact analyses.

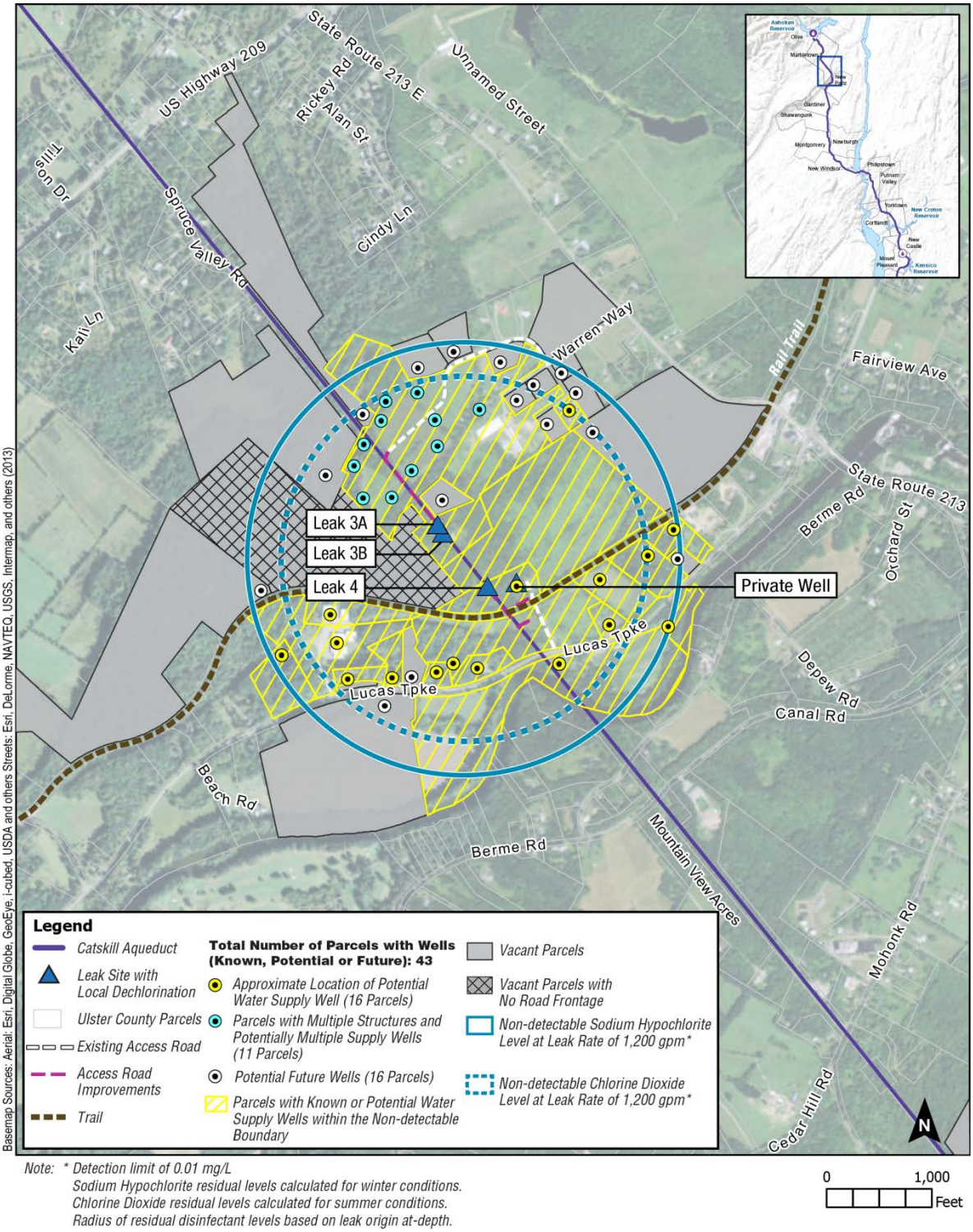


Figure 13.1-1: Well Action Plan – Lucas Turnpike Study Area, Town of Marbletown, Ulster County

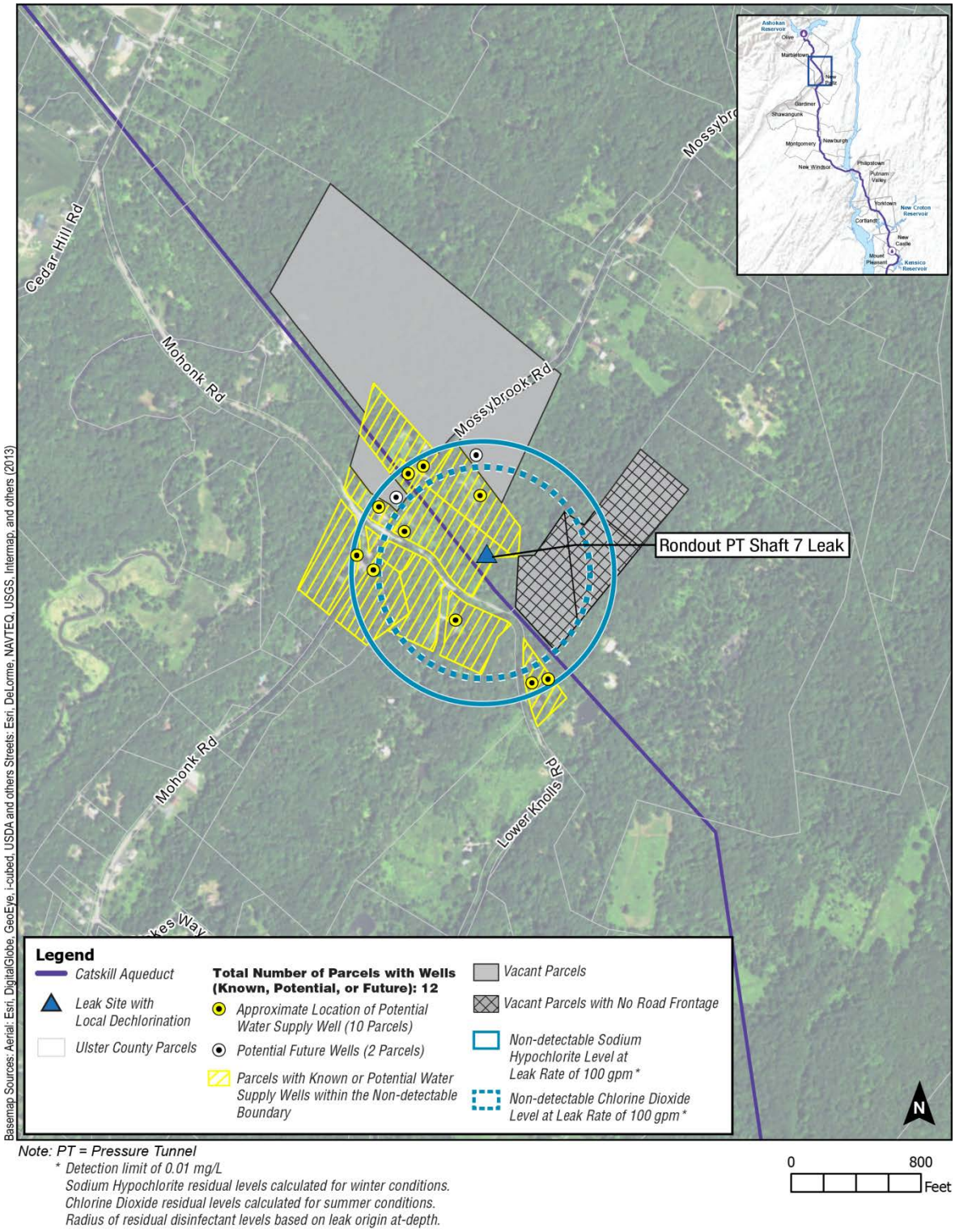


Figure 13.1-2: Well Action Plan – Mossybrook Road Study Area, Town of Marbletown, Ulster County

13.1.6.1 Well Action Plan

For the Lucas Turnpike and Mossybrook Road study areas, DEP would coordinate with landowners of parcels with structures that could contain drinking water supply wells. DEP would also coordinate with current and/or future landowners of vacant parcels that could contain, or be developed to contain, private drinking water supply wells that could be developed before or during the temporary chlorination of the aqueduct. The Action Plan would consist of well monitoring that would occur 12 months before, during, and up to 12 months after the temporary chlorination period. Water levels would be measured and water samples would be collected from each monitored well quarterly, if agreed to by the landowner, to determine the chlorine dioxide, sodium hypochlorite, and/or chlorine residual level in each well. Monitoring results would be compared to the criteria below.

13.1.6.2 Well Action Plan Criteria

- Point-of-use treatment would be provided to any well that has a documented hydraulic connection to the Catskill Aqueduct and has the potential for detectable levels of chlorine dioxide, sodium hypochlorite, and/or chlorine residual within the areas shown on **Figure 13.1-1** and **Figure 13.1-2**.

- Point-of-use treatment would be provided to any well that has a level above the laboratory detection limit for either chlorine dioxide, sodium hypochlorite, and/or chlorine residuals.

13.2 WATER FOR THE FUTURE SHUTDOWN SYSTEM OPERATIONS

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 and discussed in further detail in Chapter 10, "Proposed Water for the Future Shutdown System Operations."

13.2.1 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.[4]

13.2.2 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.

13.2.3 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.[5]

[4] 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)."

[5] These reduced noise levels for generators and fans were not used in the impact analyses.

13.3 RONDOUT-WEST BRANCH TUNNEL INSPECTION AND REPAIR

As part of the proposed project, DEP identified and incorporated specific commitments and protective measures within the Rondout-West Branch Tunnel Inspection and Repair (inspection and repair) component of Upstate Water Supply Resiliency. Commitments and protective measures were incorporated to avoid and/or minimize the potential for significant adverse impacts to the maximum extent practicable. Commitments and protective measures that have been identified are summarized below and discussed in further detail in Chapter 11, "Proposed Rondout-West Branch Tunnel Inspection and Repair."

13.3.1 NATURAL RESOURCES

- For federal/State Threatened, Endangered Species, and Candidate Species, State Species of Special Concern, protective measures include perimeter fencing and species relocation.

13.3.2 NOISE

- Construction associated with the inspection and repair would require operation of fans and generators. 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.

13.3.3 WATER AND SEWER INFRASTRUCTURE

- DEP would implement a Well Action Plan for potentially affected private drinking water supply wells within the applicable study areas, as described further below.

13.3.3.1 Well Action Plan

To commence the Well Action Plan, a survey would be prepared and sent to landowners to obtain information on available well construction details, water use, and occupants, for the following parcels:

- Within the Wawarsing Leak Repair Study Area, there are 145 total parcels with known, potential or future private drinking water supply wells identified in the Estimated Bedrock Aquifer Groundwater Influence Area (see **Figure 13.3-1**). One hundred and two (102) of these parcels currently have structures with potential wells. Forty three (43) of these parcels are vacant parcels that may be developed in the future and could require a private drinking water supply well; and

Within the Roseton Study Area, there are 27 parcels with known, potential or future potential private drinking water supply wells identified in the Estimated Bedrock Aquifer Groundwater Influence Area (see **Figure 13.3-2**). Twenty five (25) of these parcels currently have structures with potential wells (one parcel has both a known supply well and a potential drinking water supply well). Two (2) of these parcels are vacant parcels that may be developed in the future and could require a private drinking water supply well. There are 28 known, potential, or future wells, as one parcel (Cedar Hill Cemetery) has two existing wells.

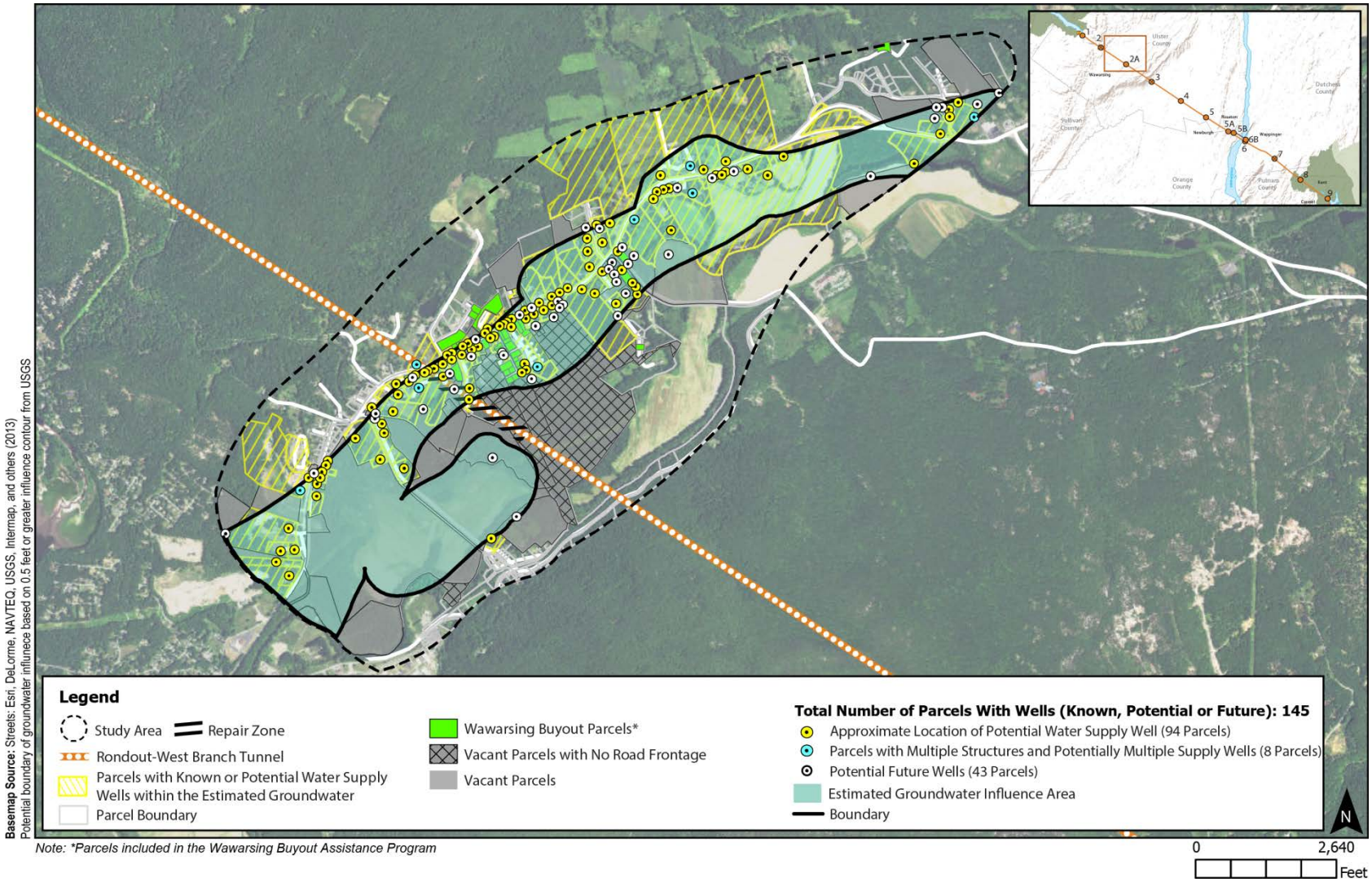
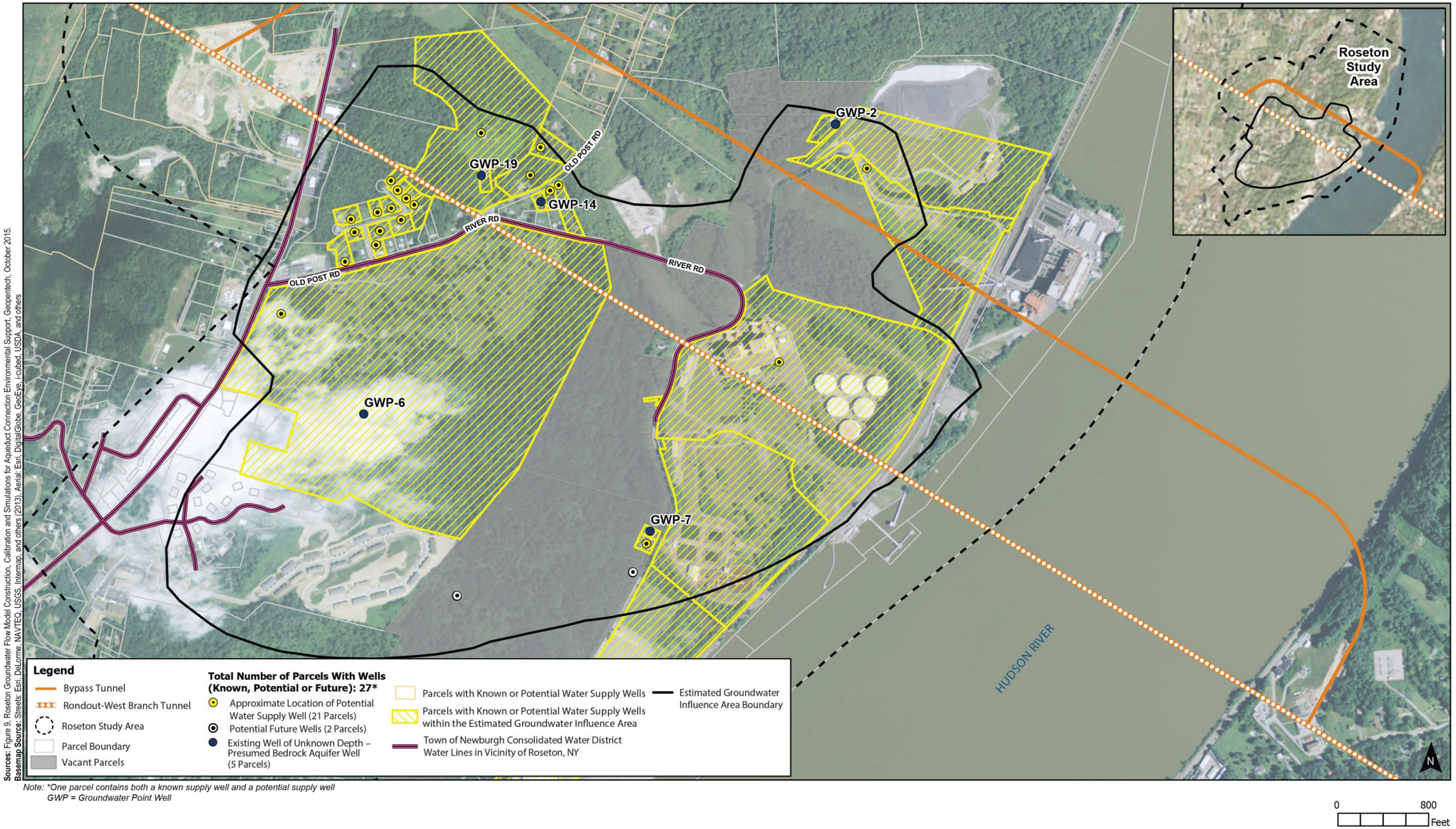


Figure 13.3-1: Well Action Plan – Wawarsing Leak Repair Study Area



Sources: Figure 9, Roseton Groundwater Flow Model Construction, Calibration and Simulations for Aqueduct Connection Environmental Support, Geopentech, October 2015.
Basemap Source: Streets: Esri, DeLorme, NAVTEQ, USGS, Intermap, and others (2013), Aerial: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, and others (2013).

*Note: *One parcel contains both a known supply well and a potential supply well*
GWP = Groundwater Point Well

Figure 13.3-2 : Well Action Plan – Roseton Study Area Estimated Groundwater Influence Areas

If the landowner provides the applicable well characteristics (e.g., depth and yield), they would be compared to the well monitoring criteria described further below. If a landowner does not have or cannot provide sufficient information for comparison to the well monitoring criteria, DEP would, with their approval, determine the water supply well characteristics (e.g., depth and yield) approximately one year before the RWBT temporary shutdown.

13.3.3.2 Well Action Plan Criteria

The criteria below were created to identify wells or parcels with future wells that have the potential for water level changes due to the inspection and repair and decommissioning. They were created based on a combination of well characteristics. These include the type of aquifer, well depth, well yield, water usage rates, well storage, and well pump setting, and whether a lower groundwater level could affect the well's ability to meet the water supply needs of its users.

The criteria are based on NYSDOH Individual Water Well recommendations. A well that yields 5 gpm or more is capable of meeting the peak-day demand and the average day demand for a home. For wells that yield less than 5 gpm, it is necessary to store a sufficient volume of water in the well and in the pressure tank for the home to meet peak demands. The NYSDOH recommends a minimum storage volume that ranges from 100 gallons for a two-bedroom home to 300 gallons for a five-bedroom home based on the yield of the well. To put this into perspective, a standard 6-inch drilled bedrock well contains 1.5 gallons per foot, or 150 gallons for every 100 feet of water in the well. These factors were used to create the well monitoring eligibility criteria as described below.

Before the start of the temporary shutdown, the wells would be evaluated to determine if they meet the criteria below. Each well would be evaluated to determine the well yield (in gallons per minute [gpm] over a 4-hour period), depth to water, depth to pump intake, and depth to bottom of well. These data would be used to evaluate the well performance characteristics of each well and would be compared to the criteria below:

- Wells with yield greater than 5 gpm:
  - NOT MONITORED - would not be monitored.
- Well with yield greater than 3 but less than 5 gpm:
  - NOT MONITORED - would not be monitored if the well stores greater than 300 gallons;
  - MONITORED - would be monitored if the well stores less than 300 gallons;
  - ALTERNATIVE SUPPLY - would be provided an alternative water supply if the well stores less than 100 gallons.
- Well with yield greater than 1 but less than 3 gpm:
  - NOT MONITORED - would not be monitored if the well stores greater than 350 gallons;
  - MONITORED - would be monitored if the well stores less than 350 gallons;

- ALTERNATIVE SUPPLY - would be provided an alternative water supply if the well stores less than 200 gallons.

- Well with yield less than 1 gpm:
  - ALTERNATIVE SUPPLY - would be provided an alternative water supply.

These criteria were established by adding 50 gallons to the NYSDOH storage recommendations (Individual Water Supply Wells – Fact Sheet No. 2) for a five-bedroom home for each well yield range (e.g., 1 to 3 gpm and 3 to 5 gpm). Fifty gallons of storage was added to the NYSDOH recommended water storage to account for the water storage that could be lost (e.g., 25 feet of water in a 6-inch diameter well equates to 37.5 gallons) during the temporary shutdown and over the long term from repair of the leaks.

A well that yields 5 gpm or greater would be excluded from the Action Plan. If a water supply well meets the criteria for monitoring and the landowner allows, DEP would conduct well monitoring for groundwater level and groundwater quality 12 months before, during, and up to 12 months after the temporary shutdown. Monitoring would include installing a water level transducer in each well to measure and record the water level fluctuation in each well. Monitoring would also include collecting water samples quarterly and analyzing the water samples for metals and inorganic parameters.

A well in the monitoring program would receive an alternative supply based on the following criteria:

- If the water level in the monitored well is within 20 feet of the pump intake at its typical lowest operating point.

- If a metal or inorganic water quality parameter result exceeds the NYSDOH Part 5 Standards as confirmed by a second sample collected as soon as practical once sampling results indicate a possible exceedance. In the event the baseline water quality monitoring prior to the temporary shutdown demonstrates an existing water quality exceedance, an increase in the concentration of that parameter would also result in alternative supply (see Section 13.3.4, “Public Health”).

If a water supply well meets the alternative supply criteria, and where the landowner allows, DEP would provide an augmented or alternative water supply. The augmented or alternative supply may include the following options:

- Install an above ground pneumatic storage tank to increase water storage capacity;

- Lower the pump intake in the well to increase water storage capacity in the well;

- Drill the well deeper and lower the pump intake in the well to increase water storage capacity in the well if it is a bedrock well and the well is judged to be suitable to be deepened; or

- Drill a new deeper well and lower the pump intake in the well to increase storage capacity in the well if it is an unconsolidated well.

If the water quality results show that quality exceeds the NYSDOH Part 5 drinking water standards, DEP would provide treatment to treat or remove contaminants to below the NYSDOH Part 5 drinking water standards (see Section 13.3.4, "Public Health").

The Town of Wawarsing has initiated the planning studies for the formation of a municipal water supply district that would provide a public water supply for the local residents. For those properties that connect to the water district, this would result in the abandonment of the existing water supply wells, and the need for a Monitoring Action Plan would no longer be necessary. For any additional parcels that may become connected to either a local or municipal water supply district within the study area, well monitoring would no longer be necessary.

13.3.4 PUBLIC HEALTH

As further described above under Section 13.3.3.2, " Well Action Plan Criteria," if the water quality results from the Well Action Plan show that quality exceeds the NYSDOH Part 5 drinking water standards, DEP would provide either an alternate supply or treatment to treat or remove contaminants to below the NYSDOH Part 5 drinking water standards.

13.3.5 GEOLOGY AND SOILS

Decommissioning would result in a change of ground water levels, which could result in areas that could be subject to settlement within the Roseton Study Area. DEP is developing and working with owners to implement preventative Action Plans for structures within this area, as described further below.

13.3.5.1 Action Plans for Structures

DEP is developing, and working with owners to implement, preventative Action Plans for areas within the area that could be subject to settlement during and after the RWBT temporary shutdown (see shaded parcels in **Figure 13.3-3**). Where structures and infrastructure are located in areas that have the potential to be subject to ground settlement, the specific Action Plans would identify measures that could be implemented prior to, during, and after the temporary shutdown to protect the potentially affected structures or infrastructure based on their type, function, and estimated magnitude of change. These measures could include: additional investigations; development of engineering techniques; and further assessment against structure-specific thresholds to evaluate whether additional engineering techniques are required.

Prior to the temporary shutdown, additional investigations that could be conducted include the following:

- Pre-condition surveys of existing structures and infrastructure within the targeted area of potential settlement to establish structure/infrastructure-specific baseline conditions; and

- Additional structure/infrastructure-specific geotechnical investigations (field explorations and laboratory testing) for specific structure/infrastructure.

Figure 13.3-3: Action Plan Parcels in Roseton

Results from these investigations would be used to assess the estimated values for stress, strain, and distortion the structure or infrastructure could experience as a result of the changing physical condition of the ground as settlement occurs. These estimated values would be compared with structural or empirical criteria to further identify the potential response of the structure or identified infrastructure to the estimated ground settlement.

If results from these additional investigations identify potential settlement that could affect the integrity of a structure or infrastructure, DEP would work with owners to provide protective engineering techniques that would be implemented prior to the temporary shutdown. All of the structures and infrastructure in the Estimated Unconsolidated Aquifer Groundwater Influence Area could be stabilized, if necessary, using readily available engineering techniques. For example, structures or infrastructure that could be subject to differential settlement (e.g., rigid structure subjected to bending or tilting) can be stabilized using grouting techniques such as jet, compaction, or compensation grouting. Additional commonly used engineering techniques for stabilization include providing additional structural supports, providing flexible connections for utilities, and rerouting critical infrastructure.

Some structures or infrastructure could be subject to differential settlement because of differing foundation types used within the same or connected structures (e.g., building founded on piles and soil, or a building founded on piles with utility connections founded on soil). For these, stabilizing techniques that could be applied consist of compaction grouting to prevent ground movements or modification of connections to accommodate potential differential settlement.

Linear structures and infrastructure that could be subject to differential settlement (e.g., railroad tracks, utilities, or pipelines) could be stabilized to stabilize and reinforce the soil.

Prior to the temporary shutdown, a settlement monitoring program would also be developed and implemented during the temporary shutdown as part of the Action Plans. The monitoring program would be specific to the type and function of each potentially impacted structure or infrastructure. It would include monitoring to measure settlement and movements or changes to structures or infrastructure that could be subject to settlement for comparison to estimated changes. The monitoring could include the following measures:

- Surface/subsurface instrumentation such as high-precision settlement survey markers, piezometers, extensometers, and inclinometers; and
- Structural/infrastructure monitoring with instruments such as tiltmeters, crack gauges, and vibration monitors.

In addition to these engineering techniques, the Action Plans could include implementation of similar techniques for specific structures or infrastructure if threshold values of changes associated with estimated settlement or structure/infrastructure distress are exceeded during monitoring (e.g., vibration level, crack size, or new observed distresses). As applicable, the Action Plans would include threshold action values that would be agreed upon with the owners based on the anticipated potential settlement or structure/infrastructure stress levels. For example, for structures or infrastructure that could be subject to differential settlement, compaction grouting or modification of connections would be initiated if the anticipated settlement reaches the agreed-upon threshold action values.

As described in Chapters 9 and 10 respectively, no potential significant adverse impacts are anticipated from the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation) and Water for the Future Shutdown System Operations (WSSO). Therefore, no mitigation is required for those components. There remains the potential for significant adverse impacts to non-regulated (USACE and NYSDEC) wetlands in the Roseton Study Area associated with the inspection and repair. For these potential impacts, mitigation measures would be developed as discussed below.

14.1 RONDOUT-WEST BRANCH TUNNEL INSPECTION AND REPAIR

14.1.1 WETLANDS

A total of approximately 1.2 acres of existing delineated non-regulated wetlands within the Roseton Study Area are estimated to be lost as a result of the cessation of leaks from decommissioning on surface water and shallow groundwater levels that are the source of water to these wetlands, including Wetlands A, B, D, and E (see **Figure 14.1-1**).

DEP commits to developing a wetland monitoring program that would be implemented prior to, during, and after the RWBT temporary shutdown to assess the impacts to Wetlands A, B, C, D, and E, and riparian areas adjacent to Stream Segments 3, 3B, and 4. The monitoring program would consist of continuous hydrologic monitoring for up to 5 years following decommissioning, and biennial vegetation monitoring, wetland delineation, wetland functional assessment, and photographic documentation of fixed monitoring plots during the first, third, and fifth years following decommissioning. The objective of the monitoring program would be to document changes to wetland communities and their size and function, and to compare changes to local reference wetlands to determine if significant adverse impacts have occurred as a result of decommissioning. The monitoring of reference wetlands would allow for comparison to determine if any change at the potentially impacted wetland is a result of decommissioning or other source (e.g., climatological). Should permanent impacts to wetland size and/or function be measured, DEP would perform compensatory mitigation.

Compensatory mitigation for permanent impacts to wetlands would include wetland creation, restoration, and/or enhancement, with a minimum one to one mitigation ratio (i.e., 1 acre of wetland creation, restoration, or enhancement for every acre of wetland permanently lost as a result of the project). Once the compensatory mitigation site is established, DEP would monitor the site for a minimum of 3 years to confirm that the site meets the objective to compensate for the permanent loss of wetlands in the Roseton Study Area.

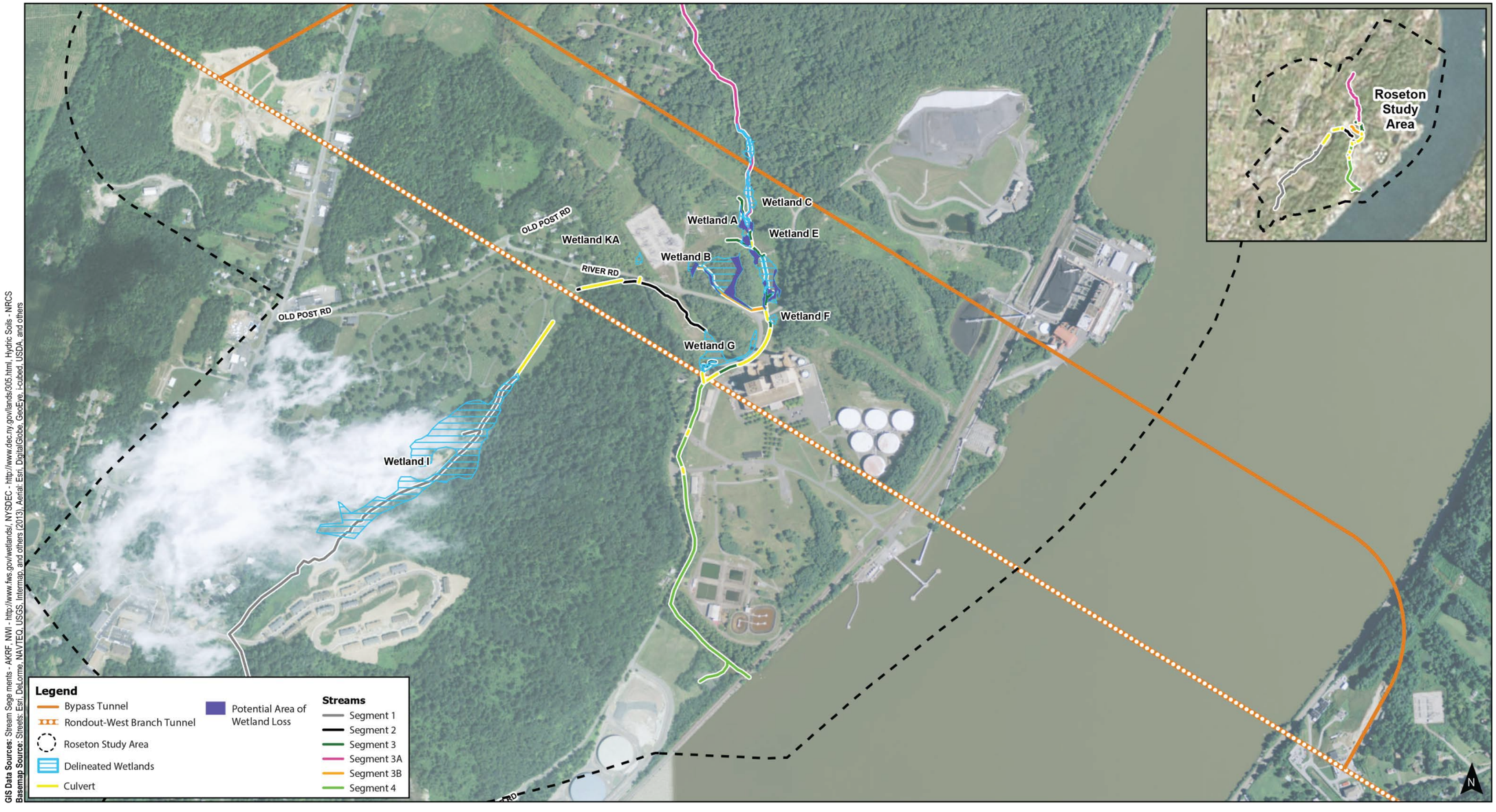


Figure 14.1-1: Estimated Impacts to Non-regulated Wetlands - Roseton Study Area

15.1 INTRODUCTION

State Environmental Quality Review Act (SEQRA) and City Environmental Quality Review (CEQR) require that alternatives to a proposed project or action be identified and evaluated in an EIS, including a No Action Alternative to present environmental conditions that would exist if the proposed project were not implemented. The previous EIS provided a detailed impact analysis of the RWBT shaft and bypass connection, and also included a review of several alternatives to WFF that are not repeated in this F~~D~~EIS (see Section 4.2, "Water Supply Augmentation Planning," for a description of the alternatives selection process). The alternatives analysis for this F~~D~~EIS focused on the potential for impacts associated with three alternatives to Upstate Water Supply Resiliency: the No Action Alternative, Interconnections to Water Supplies in New Jersey, and RWBT Leak Stabilization.

15.2 UPSTATE WATER SUPPLY RESILIENCY ALTERNATIVES ANALYSIS

As described in Chapter 5, "Program Description," Upstate Water Supply Resiliency is necessary to enable DEP to temporarily shut down the RWBT for inspection, for conducting repairs near Wawarsing and bypass tunnel connection. In accordance with SEQRA and CEQR, review of the potential for adverse environmental impacts from implementation of Upstate Water Supply Resiliency has been presented in Chapters 9 through 11 of this F~~D~~EIS. SEQRA also requires that alternatives to a proposed project be identified and evaluated as part of the EIS process. CEQR procedures, established pursuant to SEQRA, therefore also require that an EIS include a discussion of alternatives to a proposed project, and the comparable impacts and effects of such alternatives.

According to CEQR, an EIS must include a description and evaluation of the range of reasonable alternatives that are feasible, including an alternative that presents environmental conditions that would exist if the proposed project was not implemented (the No Action Alternative), and considering the objectives and capabilities of the project sponsor. The alternatives analysis should present reasonable options for reducing or eliminating project impacts or effects, while substantively meeting project goals and objectives, demonstrating a reasonable range of options to the proposed project, and comparing potential impacts or effects with alternative approaches for meeting project objectives. The range of alternatives that should be considered is determined by the nature, goals, and objectives of the specific action and its potential impacts or effects, as disclosed by the technical impact analysis in this F~~D~~EIS. In general, since the alternatives analysis compares each alternative's impacts or effects to those of the proposed project, the level of detail in the analysis depends on the alternative and the project's impacts or effects. When limited impacts of the proposed project are disclosed, a screening or qualitative assessment is appropriate. Where a potential significant adverse impact of the proposed project has been identified or where the alternative may disclose a potential significant adverse impact in an area where the proposed project would have none, it is appropriate to provide additional detail on the potential for impacts of the alternative. To that end, analysis of the No Action Alternative (Alternative 1) and two additional alternatives to Upstate Water Supply Resiliency: Interconnections to Water Supplies in New Jersey (Alternative 2) and Leak Stabilization (Alternative 3) are presented in the following sections.

15.3 ALTERNATIVE 1: NO ACTION ALTERNATIVE

Under the No Action Alternative, Upstate Water Supply Resiliency would not be implemented. Specifically, the Catskill Aqueduct Repair and Rehabilitation (repair and rehabilitation), WFF Shutdown System Operations (WSSO), and the RWBT Inspection and Repair (inspection and repair) would not be undertaken. Therefore, there would be no construction or operational changes related to any of these components during the RWBT temporary shutdown or over the long term, and the RWBT would continue to function as it does currently. The RWBT diverts water from the Delaware System. If the RWBT bypass were not connected, access to the Delaware System would be compromised, the leaks would continue, water would be lost, and there is a potential for the leaks to worsen in the future. Under the No Action Alternative, DEP would continue to plan and undertake discrete projects for emergency repair of the RWBT, should such repairs be necessary. The No Action Alternative would not result in any of the environmental impacts or effects associated with Upstate Water Supply Resiliency and its individual components, specifically the loss of approximately 1.2 acres of non-regulated wetlands in the Roseton Study Area. However, the No Action Alternative would not address RWBT reliability or issues related to the continued leakage from the tunnel, such as a reduction in water available for the City's drinking water system. Therefore, the No Action Alternative would not allow DEP to continue ensuring the safe and reliable transmission of drinking water from the Delaware System to consumers in sufficient quantity to meet all present and future water demands. In addition, if the tunnel is not repaired and the leaks are allowed to continue, there is a potential for a failure of the RWBT, which could cut off the water supply to the City. In this case, water could stop flowing through the RWBT and could still result in effects to water supply wells and wetlands, and changes in stress to soils from lower groundwater levels that could result in areas that could be subject to settlement within the Roseton Study Area.

15.4 ALTERNATIVE 2: INTERCONNECTIONS TO WATER SUPPLIES IN NEW JERSEY

The Interconnections to Water Supplies in New Jersey Alternative would include the development of up to three new water system interconnections between certain New Jersey water suppliers and the City's distribution system in Staten Island, New York. The purpose of this alternative would be to provide alternate or additional sources for augmentation of the City's water supply during the temporary shutdown of the RWBT. Because the amount of water available from New Jersey water supply purveyors is unknown at this time, and may not be sufficient to meet the augmentation needs of the RWBT temporary shutdown, Interconnections to Water Supplies in New Jersey Alternative may not function as a stand-alone alternative. However, should sufficient water supply be available it could be developed as an alternative to the repair and rehabilitation component of Upstate Water Supply Resiliency and is analyzed accordingly. The following sections describe the New Jersey water supplies that could be diverted to the City and details related to the project components necessary to facilitate interconnections between New Jersey and Staten Island that would be advanced under this alternative to support the impact analysis.

15.4.1 NEW JERSEY WATER SUPPLY

New Jersey's water supply is owned or operated by different entities including: the State of New Jersey, municipalities, public commissions, or investor-owned utility companies. In all cases, the systems are subject to rules and regulations enforced by the New Jersey Department of Environmental Protection (NJDEP) and the EPA. The NJDEP enforces the Safe Drinking Water Act regulations and the withdrawal of water from both surface water and groundwater resources. Similar to the City, most of the major regional water systems in northern and central New Jersey use surface water supply to meet the majority of their water system demand. In addition, many of the New Jersey systems are already interconnected or have identified future interconnection points. The potential candidates for interconnection with the City's distribution system in Staten Island include the North Jersey District Water Supply Commission, which draws water from the Passaic Basin, and New Jersey American Water, and the Middlesex Water Company, which both draw water from the Raritan Basin (see **Figure 15.4-1**).

Both the Passaic Basin and Raritan Basin are susceptible to flooding, drought, and pollution from surrounding land use. In addition to the Passaic and Raritan basins providing a key water source for New Jersey, the basins are also home to important wetland ecosystems and provide natural habitat for a large variety of flora and fauna. As a result, the quantity of water that can be diverted from both basins is limited by safe yield requirements, water allocation permits, and in some cases, contracts with member municipalities. Therefore, interconnections with these systems would need to be carefully developed and planned.

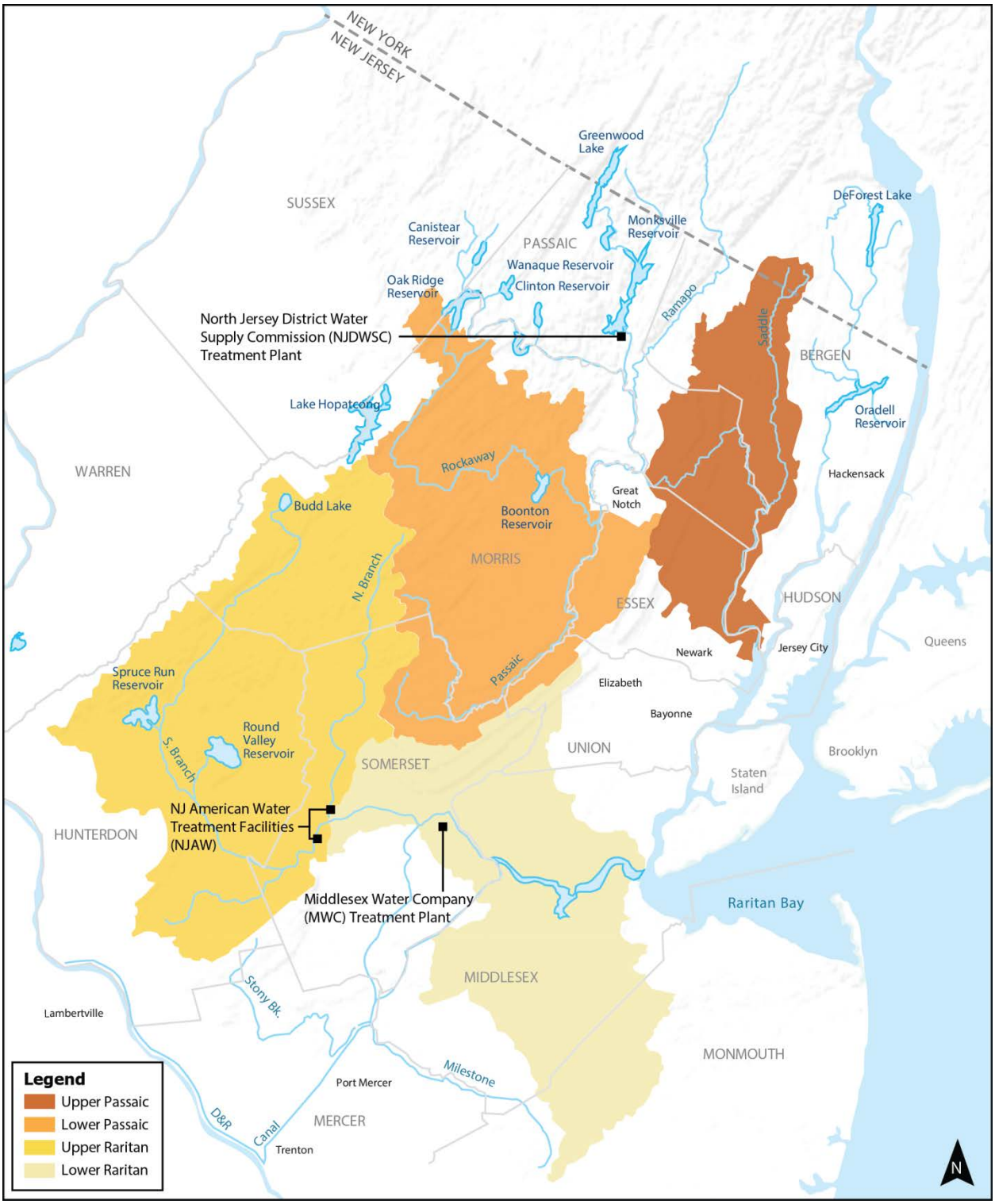


Figure 15.4-1: Potential Candidates for Interconnection with New York City

15.4.1.1 Possible Interconnections

Interconnections to the New Jersey systems would involve transferring water from New Jersey to Staten Island. Staten Island is connected to the City's distribution system via three interconnection points in Brooklyn, New York, with a new interconnection under development to replace two of the three older connections. Because Staten Island is at the far end of the City's distribution system, the chlorine residual here can be low. Chlorine can be boosted locally to provide additional disinfection to control bacteria growth in Staten Island's distribution system and meet regulatory requirements to maintain minimum disinfectant residuals. The chlorine is added to the distribution system at a chlorination facility located on the eastern shore of Staten Island, and a new chlorination facility was constructed in association with the new interconnection to Brooklyn that is under development.

An interconnection to the New Jersey systems would involve the installation of new transmission lines between existing distribution systems in New Jersey and Staten Island. Water from New Jersey would be supplied to Staten Island and blended with City water. The connection to the City's distribution system through Brooklyn would be maintained to allow for bidirectional flow. To allow for conveyance from Staten Island to the City's distribution system, equipment and operating practices would need to be upgraded, and the existing chlorination facilities on Staten Island would need to be used for treatment to ensure uniform water quality and avoid aesthetic concerns associated with mixing water from New Jersey and the City's distribution system.

15.4.2 KEY COMPONENTS OF THE ALTERNATIVE

Overall, the Interconnections to Water Supplies in New Jersey Alternative would require the installation of transmission mains to transport water from New Jersey, construction of a booster pumping station, and changes to existing chlorination facilities to manage water quality. It is anticipated that interconnections from New Jersey would cross the Arthur Kill through transmission mains installed underwater to connect with the City's distribution system on Staten Island. In general, construction effects, while temporary in nature, would likely last more than 2 years.

15.4.2.1 Transmission Main Installation

DEP worked with the New Jersey suppliers to determine how water could likely be supplied from New Jersey to the City's distribution system. Based on previous designs, it is likely that a transmission main would be constructed to cross the Arthur Kill. It is anticipated the Arthur Kill crossing would be completed using trenchless technologies to avoid disturbance of the waterbody or surrounding wetland and shoreline areas (the transmission main would be pulled through the ground with a tunneling device to reduce surface disturbance). The new 54-inch transmission main would start at the new booster pumping station near the Howland Hook Marine Terminal in Staten Island and continue approximately 15,000 feet until it would interconnect with existing DEP water distribution mains near the intersection of Forest and Richmond Avenues in Staten Island. A sample configuration is shown on **Figure 15.4-2** and represents one option for connection to the existing distribution system on Staten Island.

Figure 15.4-2: Configuration of Key Components of the Staten Island Interconnections to New Jersey Water Supply Alternative

The transmission main would be installed via open-cut construction. Under traditional open-cut construction methods an open trench is constructed, the transmission main is placed in the trench, and then the trench is backfilled within utility easements along existing asphalt roadways. Once it leaves the marine terminal property, the main would run east from the new pump station along Richmond Terrace until South Avenue then south until Forest Avenue and turn east. Construction would take place largely within the westbound traffic lane for the bulk of the Richmond Terrace Path and trenchless methods of construction would occur to bring the new transmission main under existing train tracks along the route.

15.4.2.2 Booster Pumping Station

To facilitate the connection and ensure adequate delivery of water to the City, it would be necessary to construct a new booster pump station. The station would help to boost the flow capacity of the water traveling from New Jersey to New York on Staten Island. The locations of any necessary booster pump station would likely require property acquisition and construction of the buildings to house the pump systems. It is anticipated that the pump station would be approximately 45 by 120 feet and house up to 6 pumps.

15.4.2.3 Treatment

In addition to transport of water, consideration would also need to be given to treatment that may be necessary prior to the water from the New Jersey suppliers entering the City's distribution system. Since different treatment methods are in use by many of the New Jersey water suppliers, additional disinfection facilities would likely need to be constructed to achieve consistency in water treatment. Any treatment regime selected as part of the Interconnections to Water Supplies in New Jersey Alternative must be in full compliance with federal and State drinking water requirements. Because of the different treatment methods mixing the supplies would need to be carefully coordinated to protect public health. It is anticipated that existing chlorination facilities on Staten Island could be used in order to add any additional chemicals to support blending of the New Jersey and New York City water supplies with only minor improvements and/or expansions at these locations.

15.4.3 POTENTIAL IMPACTS OF THE INTERCONNECTIONS TO WATER SUPPLIES IN NEW JERSEY ALTERNATIVE

This section provides a qualitative description of the potential for impacts or effects associated with the Interconnections to Water Supplies in New Jersey Alternative. A discussion of how the potential environmental impacts or effects from the construction and operation of the Interconnections to Water Supplies in New Jersey Alternative compare to repair and rehabilitation is provided below for project areas in the State. Since the Interconnections to Water Supplies in New Jersey Alternative would provide increased augmentation to support temporary shutdown of the RWBT, temporary effects associated with inspection and repair and WSSO would still occur even with the interconnection project. The interconnection project would replace augmentation that would be supplied by the repair and rehabilitation under Upstate Water Supply Resiliency. Therefore, only a comparison of impacts and effects between Interconnections to Water Supplies in New Jersey and the repair and rehabilitation are provided

in this analysis. A discussion of community facilities and services, historic and cultural resources, and hazardous materials is not provided as the effects of the alternative would be similar to Upstate Water Supply Resiliency. A discussion of Critical Environmental Areas, shadows, solid waste and sanitation services, and greenhouse gas (GHG) emissions and climate change is not provided, as these impact categories were screened out from further assessment.

15.4.3.1 Land Use, Zoning, and Public Policy

Repair and rehabilitation would consist of construction and operation of an active water supply use in lands already designated for such activities. As compared to the repair and rehabilitation, the components of the Interconnections to Water Supplies in New Jersey Alternative are expected to be less compatible with surrounding land uses since there would be multiple sites where work is required that could be closer to sensitive uses or resources. Unlike the repair and rehabilitation, which has a large geographic extent and is contained largely within existing water supply properties, the interconnections would concentrate associated facilities over a more populated and dense land use area in the City and may result in temporary adverse impacts if access to properties is limited during the construction of new facilities. The interconnections could require acquisition of new properties for water supply purposes, and it is possible that the new transmission lines, pump station, or expansions of existing chlorination facilities would need to be sited in areas that require zoning reviews for compliance and/or Uniform Land Use Review Procedure approvals. The work could occur in closer proximity to sensitive receptors than the repair and rehabilitation and the active construction period would be concentrated to a smaller area and last longer. This alternative would not have any effects on public policy. Unlike the repair and rehabilitation, there may be temporary impacts to land uses and zoning in the City. Therefore, the Interconnections to Water Supplies in New Jersey Alternative would not likely result in significant adverse impacts to land use, zoning, and public policy.

15.4.3.2 Open Space and Recreation

Construction of the repair and rehabilitation may have temporary effects to open space and recreation since construction activities may temporarily limit or change access to recreational areas at a limited number of study areas. As compared to the repair and rehabilitation, the components of the Interconnections to Water Supplies in New Jersey Alternative may cause impact to open space and recreational resources. Construction of the booster pumping station may require the acquisition of parkland on Staten Island and construction of the transmission main from the pump station to the existing water supply distribution system in Staten Island may require a crossing of parkland. The work could also occur in closer proximity to parkland than the repair and rehabilitation. As shown in **Figure 15.4-2**, Mariner's Marsh Park (comprised of approximately 107 acres) on the northwestern tip of Staten Island is located adjacent to the transmission main that would be installed under this alternative. Furthermore, the active construction period for this alternative would be concentrated over a smaller area and last longer compared to the repair and rehabilitation. Therefore, the Interconnections to Water Supplies in New Jersey Alternative may have temporary and/or permanent impacts to open space and recreation.

15.4.3.3 Urban Design and Visual Resources

If new treatment systems are required adjacent to existing chlorination facilities or a new booster pumping station is required in association with the Interconnections to Water Supplies in New Jersey Alternative, the new structures could have the potential to change the views from public spaces, or affect the urban design of the neighborhoods in which they would be located. While the buildings would be constructed to be visually compatible with existing buildings, and subject to local approvals, including the Public Design Commission, similar construction is not warranted to support the repair and rehabilitation. For the repair and rehabilitation, a chlorination facility would be required at the Ashokan Screen Chamber and a dechlorination facility would be required at the Pleasantville Alum Plant. The first would take place within the existing facility and the second would only require a small structure to be added to the existing DEP-owned site. Comparatively, the construction of potentially new and larger structures on Staten Island could alter some views from public spaces on Staten Island and have a greater potential for impact to urban design and visual resources as compared to the repair and rehabilitation.

15.4.3.4 Natural Resources

Unlike the repair and rehabilitation that has the potential for temporary effects to natural resources from leak repair or treatment, the Interconnections to Water Supplies in New Jersey Alternative would require: the construction and installation of new transmission mains to transport water across the Arthur Kill between New Jersey and Staten Island, the construction of a booster pumping station, installation of a transmissions main via open trench construction to connect the new booster pumping station to the existing distribution system in Staten Island, and the expansion of existing chlorination facilities. Depending on the exact location of the transmission main, the construction could potentially lead to the alienation of, or impacts to, existing parkland, and potential effects on tidal wetland areas due to the construction of the transmission main across the Arthur Kill. Therefore, compared to the repair and rehabilitation, this alternative could result in greater impacts or effects to natural resources.

15.4.3.5 Water and Sewer Infrastructure

The Interconnections to Water Supplies in New Jersey Alternative would require construction of a greater amount of new, larger, and more complex facilities than the repair and rehabilitation including the construction of a booster pumping station, transmission mains, and expanded treatment systems within Staten Island. Treatment systems would be required, and most likely consist of chlorination facilities to ensure uniform water quality that meets regulatory standards for all systems. The Interconnections to Water Supplies in New Jersey Alternative would provide system redundancy for droughts and other emergencies, but would not repair or rehabilitate existing critical infrastructure. Following the RWBT temporary shutdown, it is anticipated that the Interconnections to Water Supplies in New Jersey Alternative would be available to provide water during the off-peak seasonal water demand period from September to May, with some potential availability in the peak season. This alternative would also benefit New Jersey water purveyors by providing additional transmission capacity to New Jersey. Interconnections could make the City's water supply available to New Jersey as an emergency source. At the same time, the amount of water available from New Jersey water supply purveyors is unknown at this time, and may not be sufficient to meet the augmentation needs of the RWBT temporary shutdown as

a stand-alone alternative. There is also potential risk associated with the use of water supply resources currently managed by other water purveyors. It is anticipated that new structures or facilities constructed to support the project would not significantly increase stormwater load and wastewater generation, and new or additional flows could be handled by the existing collection systems. Repair and rehabilitation would limit the ability of certain upstate customers to draw water from the Catskill Aqueduct during project-associated 10-week shutdowns of these facilities and would require potential changes to water treatment at upstate user taps in order to respond to the addition of chemicals at the Ashokan Screen Chamber. However, DEP is working to ensure adequate back-up supply is available to these customers prior to initiating any shutdowns. Therefore, the Interconnections to Water Supplies in New Jersey Alternative would likely result in slightly greater effects to water and sewer infrastructure as compared to the repair and rehabilitation during operation of the system under the RWBT temporary shutdown.

15.4.3.6 Energy

Compared to the repair and rehabilitation, Interconnections to Water Supplies in New Jersey Alternative would require greater power needs. For the repair and rehabilitation, additional energy demand could be required to support the chlorination facility at the Ashokan Screen Chamber and dechlorination facility at the Pleasantville Alum Plant, and the Catskill Aqueduct inspection. For Interconnections to Water Supplies in New Jersey Alternative, energy would be required to support the operation of multiple pumps at the booster pumping station, and any potential expanded treatment facilities on Staten Island. In addition, power from Staten Island may be required to drive equipment used to facilitate the trenchless crossing of the Arthur Kill. Therefore, the Interconnections to Water Supplies in New Jersey Alternative would have a higher overall energy demand to provide augmentation during the temporary shutdown.

15.4.3.7 Transportation

With respect to construction-related trips, there would be more worker trips to more locations in Staten Island for construction of the booster pumping station, transmission mains, and expanded treatment facilities in the vicinity of neighborhoods or other sensitive receptors, and this could result in temporary increases in traffic when compared to the repair and rehabilitation. Unlike the repair and rehabilitation, public roadways in the City may need to be closed for street activities associated with construction of in-road transmission mains, which would also result in increased traffic on adjacent roadways. In addition, the activities would displace any permitted on-street parking and potential bus service currently permitted in the construction area. Potential impacts to traffic could also occur as a result of increased worker and construction vehicle traffic and delivery of equipment, lane closures, and other construction-related effects.

Traffic associated with the Interconnections to Water Supplies in New Jersey Alternative during the RWBT temporary shutdown would use small local streets for employee traffic to access the potential expanded treatment facilities and any associated chemical deliveries on Staten Island. This could result in traffic impacts to the local network even if mitigation measures could be developed to address any significant adverse traffic impacts associated with the Interconnections to Water Supplies in New Jersey Alternative. Therefore, traffic associated with Interconnections to Water Supplies in New Jersey Alternative is anticipated to have greater impacts and effects than the repair and rehabilitation during both the construction and temporary operation phases.

15.4.3.8 Air Quality

Air quality effects would be greater under the Interconnections to Water Supplies in New Jersey Alternative than under the repair and rehabilitation. These greater air quality effects would predominately result from increased traffic (which could increase mobile air emissions), construction of new facilities, and the installation of transmission mains, which could result in increased dust and other emissions. In addition, construction as part of the Interconnections to Water Supplies in New Jersey Alternative is anticipated to take place for a longer period of time and in closer proximity to more sensitive receptors as compared to the repair and rehabilitation, where construction would be spread out along mostly rural areas and last for a period of less than 2 years. Therefore, the Interconnections to Water Supplies in New Jersey Alternative would likely result in slightly greater effects to air quality as compared to the repair and rehabilitation during operation of the system under the RWBT temporary shutdown.

15.4.3.9 Noise

If a new booster pumping station or expanded treatment facilities were built on Staten Island associated with the Interconnections to Water Supplies in New Jersey Alternative, the new structures could have the potential to generate noise that could affect sensitive resources in the vicinity of the sites where they would be located. This would be the case even if the buildings were constructed to be enclosed and subject to the requirements of local building codes, including the City noise code and performance standards. Compared to the repair and rehabilitation, there would be a greater number of receptors that would be located in closer proximity to construction activities and the construction period would be greater under the Interconnections to Water Supplies in New Jersey Alternative. Therefore, the potential for impacts to noise-sensitive receptors in the City from construction under this alternative is anticipated to be greater than those that would occur as a result of the repair and rehabilitation.

15.4.3.10 Neighborhood Character

If a new treatment system or new pumping stations were built on Staten Island associated with the Interconnections to Water Supplies in New Jersey Alternative, the new structures could have the potential to change the views from public spaces, affect urban design, and temporarily affect access to open space and recreation, traffic, and noise for the neighborhoods in which they would be located in a greater capacity than repair and rehabilitation. However, the buildings would be constructed to be visually compatible with existing buildings and subject to local code approvals, including land use and zoning regulations, performance standards, noise codes, and the Public Design Commission. Therefore, as with Upstate Water Supply Resiliency, the Interconnections to Water Supplies in New Jersey Alternative would not result in significant adverse effects to neighborhood character.

15.4.3.11 Public Health

The amount of water available from New Jersey water supply purveyors is unknown at this time, and may not be sufficient to meet the augmentation needs of the RWBT temporary shutdown as a stand-alone alternative, as is feasible with the repair and rehabilitation. In addition, connection of the New Jersey system with the City's system could require construction of new treatment

facilities to ensure uniform water quality that meets regulatory standards for all systems. However, as part of the repair and rehabilitation, new treatment chemicals would be added to control biofilm regrowth within the aqueduct in order to maintain or improve its hydraulic capacity. For upstate users who draw water from the aqueduct, additional treatment systems, operational changes, or monitoring may be required to manage changed water quality conditions. However, under both projects, all changes to treatment would meet the requirements of the Surface Water Treatment Rule and the New York State Department of Health. Therefore, adverse effects to public health are not anticipated in association with either project. Air and noise emissions may temporarily increase during construction of Interconnections to Water Supplies in New Jersey Alternative, although not to levels that are anticipated to impact public health. If found to meet the augmentation needs necessary to support the RWBT temporary shutdown, the potential for impact to public health under the Interconnections to Water Supplies in New Jersey Alternative would be comparable to the repair and rehabilitation.

15.5 ALTERNATIVE 3: RWBT LEAK STABILIZATION

In addition to the Interconnection to Water Supplies in New Jersey Alternative, WFF included a repair alternative, RWBT Leak Stabilization, which was still under investigation at the time the previous EIS was released. As presented in the previous EIS, the Leak Stabilization Alternative would include chemical treatment on the aqueduct water, in an attempt to stabilize and repair the leaking aqueduct. This alternative is based on a conceptual plan that considered the addition of lime and carbon dioxide at the Rondout Effluent Chamber, and/or at one or more RWBT shaft locations. This alternative would also include mineral acid (possibly sulfuric acid) or carbon dioxide addition just prior to water entering West Branch Reservoir to return the water's pH to a level meeting drinking water standards, and prevent precipitation of calcium carbonate prior to discharge into the Reservoir. It was anticipated that the Leak Stabilization Alternative would allow for short-term treatment where the RWBT would be operated at a low flow with a high concentration of calcium and carbonate to induce the formation of scale and deposits within the leaks and cracks of the RWBT to seal them. Following this initial "repair" period, the tunnel would be operated at normal flow rates at a maintenance dose to maintain the adjusted raw water chemistry and, thereby, maintain the crack sealing accomplished during the repair period.

At the time of the previous EIS publication, a pilot study was underway to determine the feasibility of this alternative. The primary goal of the pilot study was to investigate various chemical dosing programs that could be used to adjust the chemistry of the water to reduce the aggressiveness of the Rondout Reservoir water supply, and form a calcium carbonate scale within simulated aqueduct cracks to determine if reduced leakage through the RWBT and protection of the surrounding bedrock would be feasible by using this scaling to seal the cracks. The pilot study underway at the time of publication of the previous EIS is now completed. The following sections describe the Leak Stabilization Alternative and the results of the pilot study conducted for this alternative, and details related to Leak Stabilization that would be advanced under this alternative.

15.5.1 PILOT STUDY RESULTS

Studies investigating the RWBT leaks indicated that they are primarily a result of chemical reactions between the flowing water and the construction material of the RWBT. Because of its low pH and alkalinity, water from the Rondout Reservoir is likely to be corrosive to the cement lining of the aqueduct, and to the aqueduct's surrounding geology. Limestone within the cement lining and bedrock contains about 50 percent calcium carbonate, thus it dissolves in the slightly acidic aqueduct water. Water combined with carbon dioxide forms carbonic acid. Carbonic acid is a relatively weak acid, but given enough time, it weathers limestone, increasing the diameters of the fractures.

The use of calcium and inorganic carbon to stabilize water, reduce corrosiveness, and form a scale within cracks that would eliminate or minimize leaking is founded on sound chemistry concepts, and the studies were undertaken to further develop the chemical stabilization strategy.

The results of pilot-scale studies indicate that the Leak Stabilization Alternative could provide the City with a long-term treatment option to prevent the formation of further cracks in the

RWBT by managing the pH of the RWBT aqueduct water. The existing raw aqueduct water is characterized by a chemical composition that leads to dissolution of aqueduct scale and, where it leaks from the tunnel, to the surrounding geology. Even with the construction of the bypass tunnel, results of the study showed that Leak Stabilization could have the ability to maintain and potentially repair cracks that are located in the remaining portion of RWBT. However, as described below, the viability of this alternative to repair existing leaks on a full scale is unknown, as is the time needed for effective scaling to develop, and its integrity as a permanent solution.

Scale deposition was observed during the pilot study. However, the rate of formation of scale was not uniform throughout the length of the pilot study piping, and the efficacy and dosing of different chemical combinations varied. The dose rate that would be effective for full-scale chemical addition under the RWBT Leak Stabilization Alternative, as well as the most effective combination of chemicals to achieve a uniform scale in the aqueduct itself are unknown. Furthermore, the time that it would take for the scale to form and effectively seal the leaks along the length of the RWBT is also unknown. Therefore, there is a high degree of uncertainty regarding how effective Leak Stabilization would be as a permanent solution to repairing the leaks along the RWBT.

In addition, the RWBT water used in the pilot study was found to dissolve scale (over a period of weeks) that had deposited. If Leak Stabilization were pursued and proved successful in addressing RWBT leaks, continuous chemical addition (at a maintenance dose) would be necessary to maintain the sealed leaks and to implement long-term management of the water stability. Moreover, sudden changes in flow through sealed or partially sealed cracks were observed during disruptions to the pilot system (start-up/shut-down cycles). During future RWBT unwatering events, groundwater would be expected to seep into the tunnel and dissolve scale due to its aggressive composition. Therefore, it is not clear how future unwatering of the RWBT would affect sealed or partially sealed leaks.

While the pilot study did not reveal a greatly reduced capacity of the simulated aqueduct, there is uncertainty whether this would be the case during full-scale operations under the Leak Stabilization Alternative. There is the possibility that, if scale formed in the RWBT it could negatively affect the capacity of the tunnel and, therefore, would not meet the objectives of WFF to ensure the long-term reliability of the City's water supply.

Though initially conceived as an alternative to bypass tunnel construction, design and construction of the project would take place after the proposed repair of RWBT. Therefore, this alternative is considered as an alternative to the inspection and repair. While the Leak Stabilization Alternative could result in an extension of the life of an already aging structure, it still leaves the potential for additional leaks to occur or existing leaks to increase in the future. It may not be sufficient to meet the City's needs for a reliable high-quality water supply as a stand-alone alternative, as is feasible with the inspection and repair.

In addition, because its operation would likely be long-term and include operation and maintenance costs associated with long-term chemical addition at the Rondout Effluent Chamber and construction and maintenance of the facility, this alternative would be far less cost effective than the proposed components of Upstate Water Supply Resiliency. While overall it is

anticipated there would be fewer effects associated with construction compared to Upstate Water Supply Resiliency, potential effects to Outside Community Connections that could result from changes in water chemistry (during both short and long-term operations) would have to be investigated. Furthermore, localized monitoring at leak sites would be required to determine any natural resources effects that may result from "liming" due to the change in RWBT water chemistry.

Connection of the bypass tunnel to the RWBT, decommissioning of the leaking section of the RWBT in Roseton, and repairs of the RWBT leaks near Wawarsing are necessary to ensure DEP can continue to efficiently and effectively deliver water from its Delaware System to its customers. The RWBT diverts water from the Delaware System. If the RWBT bypass were not connected, access to the Delaware System would be at risk, the leaks would continue, water would be lost, and there is a potential for the leaks to worsen in the future. Since the Delaware System can supply up to 50 percent of the water needed to meet customer demand, alternatives that do not facilitate the complete repair or bypass of the leaking segments of the RWBT in Roseton and near Wawarsing are not feasible.

The discussion of the Leak Stabilization Alternative in the previous EIS indicated that potential impacts in all environmental impact areas for the Leak Stabilization Alternative would be fully assessed in the second EIS, or a subsequent environmental review, as appropriate, if the alternative was determined to be a feasible alternative that achieves the same goal as connection of the bypass tunnel. Since results of the pilot testing found that Leak Stabilization Alternative is not a suitable alternative to the bypass tunnel connection and repairs near Wawarsing or to the inspection and repair, the potential for significant adverse impacts is not addressed in this section.

15.5.2 SUMMARY COMPARISON OF ALTERNATIVES

A comparison of the alternatives to Upstate Water Supply Resiliency is shown in **Table 15.5-1**.

Table 15.5-1: Comparison of Alternatives

Category	Upstate Water Supply Resiliency	No Action	Interconnections to Water Supplies in New Jersey	Leak Stabilization
Purpose and Need	Allows shutdown of the RWBT to connect the bypass tunnel and supports overall WFF goal to permanently address leaks in the RWBT	Does not address overall WFF goals because it does not address leaks in the RWBT	Allows shutdown of the RWBT and supports overall WFF goal to permanently address leaks in the RWBT	Does not address overall WFF goals because its ability to both adequately repair leaks in the RWBT and maintain any leaks it does repair is unknown
Feasibility	Feasible	Not feasible	Feasible	Not feasible for Leak Repair
Risk	Acceptable	Much greater than Upstate Water Supply Resiliency	Acceptable	Greater than Upstate Water Supply Resiliency
Cost	Feasible	NA	Greater than Upstate Water Supply Resiliency	Greater than Upstate Water Supply Resiliency
Time to Complete	Feasible	NA	Greater than Upstate Water Supply Resiliency	Greater than Upstate Water Supply Resiliency (long-term operations needed)
Environmental Impacts	Potential impacts to wetlands	Possible risk to the water supply as a whole since RWBT leaks would continue	Greater than Catskill Aqueduct Repair and Rehabilitation	Possible risk to the water supply since RWBT leaks would continue for an unknown period of time after project implementation, with unknown effectiveness. Possible effects to natural resources and Outside Community Connections
Note: NA = Not Applicable				

Unavoidable significant adverse impacts are defined as those that meet the following two criteria:

- There are no reasonably practicable mitigation measures to eliminate the impacts; and
- There are no reasonable alternatives that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts.

For WFF, unavoidable significant adverse impacts - to the extent they can be identified at this time – were summarized in the previous EIS.

For Upstate Water Supply Resiliency, a potential significant adverse impact to Natural Resources in Roseton was identified. Lowering of groundwater levels as a result of the leak repairs in Roseton would potentially result in the loss of wetlands (referred to as Wetlands A, B, C, D, and E), and potential impacts to riparian areas adjacent to streams (referred to as Stream Segments 3, 3B, and 4). DEP will implement a monitoring program prior to, during, and after the RWBT temporary shutdown to assess the impacts to these wetlands and should impacts be measured, would mitigate as required. Further detail is provided in Chapter 11, "Proposed Rondout-West Branch Tunnel Inspection and Repair." Therefore, Upstate Water Supply Resiliency would not result in any unavoidable significant adverse impacts.

Construction and operation of Upstate Water Supply Resiliency to support Water for the Future (WFF) would involve the use of various construction materials, materials for operation and maintenance, fuels, and energy for construction and operation. Some of the materials that would be used for Upstate Water Supply Resiliency are nonrenewable resources, and are considered irretrievably and irreversibly committed, because reuse is not possible or is highly unlikely.

Construction materials include concrete and other materials that would be used to construct the repairs along the RWBT and Catskill Aqueduct, including access roadways and new facilities (vents, boatholes), materials for operation and maintenance and minor use of fuels to support equipment used during the construction and operation of the New Paltz Temporary Transmission Water Main, upgrades at the Ashokan Screen Chamber and Pleasantville Alum Plant, and installation of siphons at the Rondout Reservoir. During repair of the RWBT and Catskill Aqueduct, construction of the chlorination facility at the Ashokan Screen Chamber and the dechlorination facility at the Pleasantville Alum Plant, and installation of siphons at Rondout Reservoir, fuel would be used for operation of construction equipment (e.g., various trucks, cranes, pressurized washing equipment). The RWBT and Catskill Aqueduct themselves do not require electricity to deliver water, since the water supply system relies on gravity, but chlorination and dechlorination at the Ashokan Screen Chamber and Pleasantville Alum Plant, respectively, would require the use of electricity and chemicals for operation during the RWBT temporary shutdown.

However, without Upstate Water Supply Resiliency, the bypass tunnel would not be able to be connected to the RWBT, and the RWBT would continue to leak both in the Roseton area and near the Wawarsing area. With WFF, DEP would be able to ensure the long-term safe and reliable transmission of drinking water from the watershed in sufficient quantities to consumers to meet all current and future water demands.

Therefore, Upstate Water Supply Resiliency would not result in irreversible or irretrievable impacts to resources.

A. INTRODUCTION

This chapter of the Final Environmental Impact Statement (FEIS) summarizes and responds to all substantive oral and written comments received during the public review period on the Water for the Future (WFF): Upstate Water Supply Resiliency (UWSR) Draft Environmental Impact Statement (DEIS) and the New Paltz Temporary Transmission Water Main Supplemental Environmental Impact Statement (SEIS). The public review period for the UWSR DEIS began on September 19, 2016 with issuance of the Notice of Completion and DEIS for Upstate Water Supply Resiliency by the New York City Department of Environmental Protection (DEP). The public review period for the SEIS began on September 6, 2017 with issuance of the Notice of Completion and SEIS for the New Paltz Temporary Transmission Water Main. The DEIS and SEIS were prepared in accordance with the New York State Environmental Quality Review Act (SEQRA) and the New York City Environmental Quality Review (CEQR) procedures and regulations and the guidance of New York City's *CEQR Technical Manual*.

Copies of the DEIS were made available for public review at various locations in New York, including the Town of Newburgh Town Hall, the Town of Yorktown Town Hall, the Town of Wawarsing Town Hall, the State University of New York (SUNY) Sullivan Hermann Memorial Library in Loch Sheldrake, and DEP offices located in Queens, Valhalla, and the City of Kingston. The document was also made available for public review on DEP's website.[1] Written comments were accepted throughout the public comment period, which closed on November 14, 2016. DEP held a series of public meetings at various locations to solicit public comments on the DEIS during the comment period. These meetings were held on October 20, 2016 at the Ellenville Government Center, 2 Elting Court, Ellenville, NY; October 24, 2016 at the Yorktown Town Hall, 363 Underhill Avenue, Yorktown Heights, NY; October 25, 2016 at the Town of Newburgh Town Hall, 1496 Route 300, Newburgh, NY; and October 28, 2016 at SUNY Sullivan, 112 College Road, Loch Sheldrake, NY.

Copies of the New Paltz Temporary Transmission Water Main SEIS were made available for public review at various locations including the Town of New Paltz Town Hall, the Village of New Paltz Village Hall, and DEP offices located in Kingston and Queens. The document was also made available for public review on DEP's website.[2] Written comments were accepted throughout the public comment period, which closed on October 10, 2017. DEP held a public meeting to solicit public comments on the New Paltz Temporary Transmission Water Main SEIS

[1] The DEIS was made available at the following link: http://www.nyc.gov/dep/upstatewatersupplyresiliency
[2] The SEIS was made available at the following link: http://www.nyc.gov/dep/upstatewatersupplyresiliency

on September 27, 2017 at the Town of New Paltz Community Center, 3 Veterans Drive, New Paltz, NY.

Section B below identifies the organizations and individuals that provided comments on the UWSR DEIS and New Paltz Temporary Transmission Water Main SEIS.

Section C summarizes and responds to each substantive comment. The comments are organized by subject area. Following each comment is the name of the organization or individual that made the comment, as listed in Section B. To consolidate the Response to Comments, where multiple comments were made on the same subject matter, these have been grouped together by theme, and where appropriate, a summary may be provided that conveys the substance of a specific comment(s), but does not necessarily repeat the comment(s) verbatim. Individual commenters were then listed together as authors of the illustrative comment. Responses to each comment follow.

B. ORGANIZATIONS AND INDIVIDUALS THAT COMMENTED ON THE UWSR DEIS AND NEW PALTZ TEMPORARY TRANSMISSION WATER MAIN SEIS

The following organizations and individuals commented on the UWSR DEIS and New Paltz Temporary Transmission Water Main SEIS during the comment periods:

1. Hank Bartosik, oral comments on October 20, 2016. (Bartosik)
2. Vernon Benjamin, Town of Saugerties, written comments dated November 14, 2016. (Benjamin)
3. Louis Chiarella, National Marine Fisheries Service, written comments dated December 13, 2016. (NMFS)
4. Carol Cryer, oral comments on October 25, 2016. (Cryer)
5. Ted Cryer, oral comments on September 27, 2017 (T. Cryer)
6. Michael Dulong, Riverkeeper, oral comments on October 24, 2016, and written comments dated November 14, 2016. (Dulong)
7. Dean Frazier, Delaware County Department of Watershed Affairs, written comments dated November 9, 2016. (Frazier)
8. Pete Golod, Upper Delaware Council, written comments dated November 2, 2016. (Golod)
9. Joan Homovich, written comments dated November 14, 2016. (Homovich)
10. Ray LaBonte, oral comments on October 20, 2016. (LaBonte)
11. Gerald Moerschell, Town of New Castle, written comments dated November 10, 2016. (Moerschell)
12. Diane Tharp, North Delaware River Watershed Conservancy, Ltd., written comments dated November 4, 2016. (Tharp)
13. Bob Waterhouse, oral comments on October 24, 2016. (Waterhouse)
14. Mike Wendel, oral comments on October 20, 2016. (Wendel)

C. COMMENTS AND RESPONSES

18.1 GENERAL COMMENTS

Comment 1 Is it [the Draft Environmental Impact Statement] available here tonight [October 20, 2016], or is it only online? (LaBonte)

Response 1 A hard copy of the DEIS was available at each public hearing. The DEIS is also available online at the DEP website (http://www.nyc.gov/dep/upstatewatersupplyresiliency) and at numerous repositories, including the Town of Newburgh Town Hall, the Town of Yorktown Town Hall, the Town of Wawarsing Town Hall, the SUNY Sullivan Hermann Memorial Library in Loch Sheldrake, and DEP offices in Queens, Valhalla, and Kingston, NY. In addition, hard copy, digital and/or letters containing the link to DEP's website were also widely distributed to interested parties.

Comment 2 I wish to point out first that the September 19 Notice of Completion of the Draft Environmental Impact State[ment] from Ms. Licata misidentifies the close of the public comment period on November 14, 2016, as a Friday, whereas the date is actually the following Monday (today). (Benjamin)

Response 2 Comment noted. Comments were accepted through Monday, November 14, 2016.

Comment 3 I also call attention to the document's failure to include the Town of Saugerties or the Village of Saugerties as Interested Agencies in this proceeding. Although the Town of Saugerties (which includes the incorporated Village) lies outside the Ashokan Reservoir watershed area and does not have any components associated with the Catskill Aqueduct, the lower Esopus Creek, which flows from the Reservoir, passes through our communities into the Hudson River. The Scope of Work and DEIS specifically affirm that the Interim Release Protocol allows for the control of turbidity through the Release Channel (as well as through the application of alum to waters entering the Kensico Reservoir). Consequently, we respectfully request that the Town of Saugerties and the Village of Saugerties be listed as Interested Agencies in any further communications regarding this matter. (Benjamin)

Response 3 The Notice of Completion included a list of interested and involved agencies, including the Town of Saugerties and Village of Saugerties. Both the Town and Village received the Notice of Completion and a CD containing the DEIS by regular mail.

Comment 4 You mentioned repair of leaks where feasible. What are the reasons repair is not feasible? What happens then, if it continues to leak in some communities? (Bartosik)

Response 4 During the RWBT temporary shutdown, inspection and repair work would include an inspection of the sections of the RWBT upstream and downstream of the bypass connection points and internal repairs to the RWBT in the Wawarsing crossing.

DEP plans to address known leaks in the RWBT, both in Wawarsing and Roseton. Should any areas outside of the Wawarsing crossing be identified as leaking during the inspection as requiring repair, that work would be performed during the RWBT temporary shutdown. As noted in the EIS, the leaking portion in Roseton will be addressed by the construction of a bypass tunnel. The RWBT repairs in Wawarsing, once completed, would be anticipated to result in the permanent cessation of leaks.

As described in the EIS, there are known leaks along the Catskill Aqueduct. Repairs are feasible at some leak locations (i.e., valve locations and within Cut-and-Cover Tunnel segments), while others cannot be easily accessed and will continue to leak (i.e., pressure tunnel leaks). DEP will seek to repair leaks where feasible based upon prior investigations of the aqueduct and known leaks. However, given the age of the aqueduct, accessibility and the site specific nature of some leaks, it is possible that some of the planned leak repair measures could prove incomplete or unsuccessful.

During repair and rehabilitation, DEP would add chlorine dioxide or sodium hypochlorite to the aqueduct to maintain capacity improvements associated with biofilm removal by preventing regrowth. At locations where leaks cannot be repaired or are not successful, local dechlorination systems would be installed to remove chlorine dioxide, sodium hypochlorite, and/or chlorine residual from these waters before it is released to the environment. During operation of these passive dechlorination systems, each of the locations would be routinely visited to conduct minimal maintenance, including inlet cleaning and replacement of the carbon filtration media used to remove sodium hypochlorite and/or chlorine residual from leak waters. Additional information can be found in Section 9.19 of the FEIS.

During temporary chlorination, DEP is also committed to developing and working with owners to implement an Action Plan for potentially affected private drinking water supply wells, if required, within the Lucas Turnpike

and Mossybrook Road study areas (see FEIS **Figures 9.20-1** and **9.20-2**), where repairs of leaks are not feasible. Additional information on the Action Plan, if required, is also provided within Section 9.19 of the FEIS.

Upon completion of the repair and rehabilitation efforts and the termination of chlorination efforts, those locations where leak repairs were not completely successful would continue to release raw untreated aqueduct water to the environment as occurs today.

Comment 5 Will the leaks be monitored to determine impacts on communities? (Bartosik)

Response 5 DEP plans to address known leaks in the RWBT, both in Wawarsing and Roseton. Therefore no leaks would be anticipated to continue or require monitoring.

For leaks along the Catskill Aqueduct, during operation of the chlorination and dechlorination systems, DEP will monitor leaks at proposed dechlorination sites, as well as monitoring of private supply wells, if required, pursuant to the Action Plans discussed within the FEIS. These efforts would begin prior to chlorination and continue until the end of the RWBT temporary shutdown in 2023. Following completion of the RWBT temporary shutdown, chlorination of the aqueduct would cease. These dechlorination systems would be removed and these sites would be returned to baseline conditions.

Comment 6 Will the communities be advised of potential adverse impacts? (Bartosik)

Response 6 The UWSR FEIS details the analysis of potential impacts and description of mitigation measures. As described in Section ES-7, with mitigation measures in place, potential significant adverse impacts as a result of Upstate Water Supply Resiliency would be fully mitigated. Upstate Water Supply Resiliency would not result in any unavoidable significant adverse impacts.

Comment 7 The following two comments were received regarding municipalities who draw water from DEP's aqueducts and the environmental review process of water supply infrastructure projects that may be planned by these communities.

- My first question is in regard to the SEQR. DEP has followed a full SEQR protocol in its Environmental Review of areas involved in the ongoing Catskill and Delaware Aqueduct repair work. My question is: Why has the same full SEQR protocol not been mandated by DEP for

those municipalities affected by the upcoming aqueduct repair work? If all municipalities were held to the same SEQR standards, it would yield consistency to the overall environmental review of the aqueduct repair project. If municipalities are left to subjectively interpret SEQR, grave environmental concerns may be well overlooked. (Cryer)

- We understand the city has committed not to take the Catskill Aqueduct out of service unless its "customers are able to sufficiently manage alternative water supplies."[3] This laudable commitment must be incorporated into the Final Environmental Impact Statement and the Findings Statement.[4] While this guarantee is a crucial backstop for communities dependent on the Catskill Aqueduct, DEP still has a duty to work with those communities to identify, prevent, and/or mitigate potential adverse impacts to upstate water supplies at this early stage of planning. Unfortunately, the DEIS relegates those important plans to a footnote explaining that their review will be left to the communities to complete separately. Each preliminary water supply replacement plan should be described and assessed to the fullest extent possible in the final environmental impact statement. (Dulong)

Response 7

As stated in Section 9.20-3 of the FEIS, "DEP would coordinate closely with Outside Community Connections to confirm they have access to adequate water supply independent of the upper Catskill Aqueduct prior to any temporary shutdown of the aqueduct required for the repair and rehabilitation."

As Lead Agency, DEP evaluated and disclosed the potential for impacts from Upstate Water Supply Resiliency. There are two Outside Community Connections on the Rondout-West Branch Tunnel (RWBT) and 15 Outside Community Connections that receive water supply from DEP's Catskill Aqueduct. Of these 15, 9 currently rely on the Catskill Aqueduct as their primary drinking water supply. It is the responsibility of each of the 11 Outside Community Connections using the RWBT or Catskill Aqueduct as their primary water supply to have an alternate or back-up supply in place for use when the aqueduct may not be available due to maintenance or other reasons. While short-term supplies exist, several Outside Community Connections are currently in the process of constructing more robust back-up supplies to provide a source of water when the aqueducts are offline. Construction and operation of new water

[3] DEIS at ES-13; id at 9.20-3.
[4] 6 NYCRR § 617.11(d)(5).

supplies for these Outside Community Connections has independent utility since they provide an additional source of water that may be more cost effective than purchasing water from the City, and would provide water for these communities whenever DEP's aqueducts are unable to, including but not limited to, future shutdowns for periodic inspection or maintenance and the temporary shutdowns planned as part of Upstate Water Supply Resiliency. Review of these water supply projects is not required as part of the WFF: UWSR FEIS because, as described in the SEQR handbook for coordinated reviews, the lead agency 'makes the determination of significance and oversees the development and review of any required impact statements.' DEP would not be the lead agency for these reviews of any new water supplies. Each municipality developing a secondary supply would be required to complete any applicable environmental reviews, including coordinated reviews, and would be expected to adhere to the requirements of SEQRA under 6 NYCRR Part 617. In the event that independent back-up supply projects in New Paltz are not completed in advance of the proposed Catskill Aqueduct shutdowns and to ensure any delays to the construction of the repair and rehabilitation project are avoided, DEP is proposing a temporary pipeline as an alternative way to supply water to New Paltz during the planned shutdowns (New Paltz Temporary Transmission Water Main).

The Town and Village of New Paltz is currently dependent on the Catskill Aqueduct as its primary water source. New Paltz is considering undertaking independent projects to provide back-up water supply. Projects may include the development of a new well field (for use during shutdown periods and other emergencies) and upgrading their existing reservoir system, including the installation of flashboards and dredging to provide several additional days of storage capacity. New Paltz also plans to implement demand management initiatives in order to reduce demand during the CAT-RR shutdown periods.

As described in the New Paltz Temporary Transmission Water Main SEIS and Section 9.18 of this FEIS, in the event that New Paltz does not have a back-up water supply in time for the extended CAT-RR shutdowns, DEP is proposing an alternative temporary overland pipeline connection to the Catskill Aqueduct Wallkill Pressure Tunnel to convey water to New Paltz's existing raw water line along Mountain Rest Road during the proposed Catskill Aqueduct shutdowns. This project was further described in the New Paltz Temporary Transmission Water Main SEIS.

The Towns of New Windsor, Newburgh, and Marlborough also rely on New York City's water supply as their primary source of potable water. The Town of New Windsor receives water from the Catskill Aqueduct, and the Towns of Newburgh and Marlborough receive water from the Delaware Aqueduct, both of which would be taken out of service at different times to support WFF.

The Town of New Windsor has undertaken the development of a well field that would provide up to 6.4 mgd of groundwater resources to provide redundancy in its water supply during Catskill Aqueduct shutdowns. As part of this project, the Town of New Windsor, in coordination with the Town of Newburgh, will construct two-way interconnections between these municipalities. These interconnections would allow the Town of New Windsor to receive up to 1.5 mgd from the Town of Newburgh during the CAT-RR shutdowns in the fall of 2018, 2019 and/or 2020. Conversely, the Town of Newburgh would have the ability to receive up to 2 mgd from the Town of New Windsor during the RWBT Bypass connection, when the Delaware Aqueduct is out of service. The project would be undertaken by the Town of New Windsor. A negative declaration was issued by the Town of New Windsor on April 1, 2016. In addition, during Delaware Aqueduct shutdowns, the Town of Marlborough has the ability to receive water from the Town of Newburgh. The Town of Cornwall also receives water from the Town of New Windsor.

The High Falls Water District (HFWD) also relies on the Catskill Aqueduct as its primary water supply, and has significant tank storage volume on hand to constitute the availability of an approximately three-week back up water supply. Given that the Catskill Aqueduct shutdowns to support CAT-RR are of 10-week durations, DEP is working with HFWD to support an alternative plan to ensure the continued supply of water when the Catskill Aqueduct is out of service. Specifically, HFWD is proposing to purchase a truck to transfer water from the Rosendale Water District during Catskill shutdowns. Based on an approximate demand, the daily transfer of water would not be expected to exceed 30,000 gallons and would only occur when the Catskill Aqueduct is out of service. The project and all required environmental analyses and permits would be jointly undertaken by the Towns of Rosendale and Marbletown.

Comment 8 The following comments were made regarding the assessment of potential impacts to the City of Newburgh and lower Esopus Creek.

- The City of Newburgh is in crisis after the discovery of perfluorooctane sulfonate (known as "PFOS") contamination in Lake Washington, Newburgh's primary water supply. DEP still has a duty to work with those communities to identify, prevent and/or mitigate potential adverse impacts to upstate water suppliers. The DEIS relegates those important plans to a footnote explaining that their review will be left to the communities to complete separately. By omitting important potential significant impacts to the City of Newburgh and lower Esopus communities, DEP's DEIS for its "Water for the Future Program: Upstate Water Supply Resiliency" project lacks the detail necessary to take a hard look at the relevant areas of environmental concern and identify specific mitigation measures to avoid or minimize all potentially significant environmental impacts (7 Jackson, 6 N.Y.2s at 417). We urge DEP to evaluate these potential impacts prior to finalizing the environmental impact statement. (Dulong)
- We urge full consideration and mitigation of the collateral impacts of the Catskills water supply operations in the very worthwhile work being done to protect the Delaware resources as well. (Benjamin)

Response 8

As discussed in Section 9.19, customers who draw from the Catskill Aqueduct are required to have a backup supply. DEP continues to work with communities where backup supplies were considered insufficient as they address the need for improvements from this project or any other Catskill Aqueduct shutdown. Newburgh has relied on Catskill Aqueduct as a back up supply while addressing the issue of PFOS contamination. Development of a new treatment system by the City of Newburgh to address PFOS contamination is a project that is entirely independent from Water for the Future and DEP's work proposed along the Catskill Aqueduct. An environmental review of water supply projects for the City of Newburgh, which are functionally independent from the DEP's project, is therefore not required as part of this FEIS (see Response 7).

The City of Newburgh relies on Lake Washington as its primary water supply and Brown's Pond and the Catskill Aqueduct as part of its back-up water supply. The City of Newburgh is currently working with NYSDEC to install adequate treatment to remove low levels of perfluorooctanoic acid (PFOA) and PFOS within Lake Washington. As part of this effort, Newburgh has temporarily transitioned to alternative sources of water (Catskill Aqueduct and/or Brown's Pond) and NYSDEC has funded and completed a water discharge facility that allows Catskill Aqueduct water to be transferred to Brown's Pond in advance of an aqueduct shutdown to

ensure that the City of Newburgh has a sufficient supply of water should its Lake Washington supply remain unavailable. To address PFOS contamination, a filtration system has been installed and is currently undergoing testing and anticipating startup in early 2018. It is anticipated that Newburgh would resume drawing water from its own supplies prior to any Catskill Aqueduct shutdowns.

Brown's Pond is also a back-up water supply for the Town of New Windsor and eventually for the Towns of Newburgh and Marlborough via a future interconnection with the Town of New Windsor. As a result, DEP is undertaking a project with the City of Newburgh that provides funding if they operate their system to ensure that Brown's Pond is at least 80 percent full and has adequate water quality by October 1 of each of the Catskill Aqueduct shutdown years (2018, 2019, and 2020) and Delaware Aqueduct shutdown year(s) expected to occur in 2022. Maximizing available storage and maintaining water quality in Brown's Pond in advance of the Catskill and Delaware Aqueduct shutdowns would also provide additional reliability and resiliency to the neighboring Towns of New Windsor, Newburgh, and Marlborough's water supply systems via intermunicipal pipeline interconnections. These projects would undergo/have undergone separate environmental review by the local municipality. DEP is not Lead Agency for these reviews.

As discussed in the FEIS, DEP would confirm that these outside communities have access to adequate water supply prior to embarking on an aqueduct shutdown.

With regard to lower Esopus Creek, the DEIS included a comparison of typical operations to WFF System Shutdown Operations (WSSO) for a range of hydrologic conditions represented by an 81-year historic record. This analysis showed that conditions in lower Esopus Creek, with regard to spills and releases from Ashokan Reservoir, would be within the range of what could occur under typical operations and are not anticipated to result in significant adverse impacts to lower Esopus Creek. Community releases would continue during WSSO and the results of the high flow analysis for the Ashokan Reservoir shows there is a small increase in the probability of high flows, but that the incremental change does not represent a significant adverse impact to lower Esopus Creek. Further, unwatering of the Catskill Aqueduct and discharges to Esopus Creek or its tributaries associated with the Catskill Aqueduct Repair and Rehabilitation project would also not affect lower Esopus Creek. The aqueduct would continue to be operated in accordance with the Interim Release Protocol (IRP) for Ashokan Reservoir, or its successor, and the short-term duration

of aqueduct unwatering to the Esopus Creek or its tributaries would be substantially less than flows experienced by lower Esopus Creek from the Ashokan Release Channel flows.

Therefore, impacts to both the City of Newburgh and lower Esopus Creek and surrounding communities as they relate to WFF: UWSR were considered in the DEIS and further assessment is not warranted.

Comment 9

It is artificial and improper to segment this environmental review from the "separate" review of the Interim Release Protocol. Deferring a discussion of these impacts during the discussion of the period when the Catskill supply will be exclusively relied upon for providing water to New York City customers only serves to delay and obfuscate how to ensure that the supply processes will not cause collateral damages on the lower Esopus Creek communities. Our principal reason for commenting on the DEIS is to ensure that collateral damages to the lower Esopus Creek resulting from the operation of the Ashokan Reservoir are mitigated in this SEQRA review. We wish to ensure that discharges into the lower Esopus Creek be completely avoided or, if necessary, not consist of or include turbid waters or waters in such velocity and quantity as to deleteriously impact upon the streambanks, biota and general well-being of the lower Esopus Creek. (Benjamin)

Response 9

Operating rules for the Ashokan Release Channel are defined by the IRP developed by the New York State Department of Environmental Conservation (NYSDEC) and included in a NYSDEC Consent Order with the City (NYSDEC Case No.: D007-0001-11) for normal operation of the City's water supply. The separate Catalum SPDES Permit EIS is being prepared to analyze the potential for impact from operation of the Release Channel under the IRP for Ashokan Reservoir as part of DEP's request to modify their Catalum SPDES Permit. This DEIS evaluated a unique circumstance -- the rehabilitation of the Catskill Aqueduct, WFF Shutdown System Operations, and Inspection and Repair of the RWBT -- all of which are part of a one-time capital improvement program and are occurring during the finite period of time those projects are undertaken. During this one time program, and as described in DEIS Chapter 10 (WSSO), DEP would rely on the provision in Section 7c of the IRP for Ashokan Reservoir to support the Delaware Aqueduct repairs, which would result in the temporary reduction of spill mitigation releases from Ashokan Reservoir. However, DEP would seek to maintain minimum community releases in accordance with the IRP for Ashokan Reservoir (or its successor) for the duration of WSSO. Results of the analysis for lower Esopus Creek are presented in Section 10.4.5 of the FEIS, including plots

and tables that present the range of flows from releases and spills to lower Esopus Creek. As compared to typical conditions under the IRP for Ashokan Reservoir, conditions during WSSO would be within the range of what could occur under typical operations and are not anticipated to result in significant adverse impacts to lower Esopus Creek.

Comment 10 Based upon the information in the DEIS, it appears that the actions associated with the proposed plan may affect tributaries and wetlands of the Hudson River, including diadromous fish habitat. Potential impacts include stream diversions, in-water construction, inundation of freshwater discharge, leakage of chemical contaminants, and loss of wetland habitat. Based upon the location of the project and the nature of the work, adverse effects to essential fish habitat (EFH) are possible due to the impacts to water quality and prey species. (NMFS)

Response 10 The DEIS determined the proposed action would have no significant adverse effect on water quality, wetlands, or aquatic communities. As indicated in Section 11.9.5.30 of the FEIS, the cessation of the Roseton leaks would initiate the restoration of the natural hydrologic regime for the affected stream segments and wetlands, returning the aquatic and benthic resources to a naturally functioning system typical of the region of the RWBT that existed prior to the leak. Additionally, although baseline fish surveys completed in the Roseton Study Area did not identify the presence of EFH species or their prey in this area (FEIS Section 11.9.5.14), following decommissioning the stream segments are expected to provide a hydrologic regime that would support EFH prey species, should they occur. Likewise, the repair and rehabilitation of the Catskill Aqueduct would require some in-water construction, with most occurring in waters with known downstream barriers (man-made and/or natural) to alewife and blueback herring (known collectively as river herring) migration. For any water without downstream barriers, stream diversion and protective measures would limit or preclude any impacts. Additional detail, particularly as it relates to EFH prey species (i.e., river herring) is provided in Response 11 through Response 14 below.

Comment 11 River herring spend most of their adult life at sea, but return to freshwater areas to spawn in the spring. These species are believed to be repeat spawners, generally returning to their natal rivers. (NMFS)

Response 11 As noted above, most watercourses have downstream barriers that would preclude upstream movement by river herring to the proposed work areas with the exception a limited number of sites. Migratory river herring use of the lower Croton River (below the new Croton Dam), lower Pocantico

River, and lower Saw Mill River would be unaffected by the proposed action. In the case of the Saw Mill River, work in the Washington Avenue Study Area (Village of Pleasantville) may be accessible to river herring but would take place in the far upstream reaches of the river, many miles from areas with documented river herring in the City of Yonkers (northernmost documentation of river herring). While river herring are known to travel great distances upstream to spawn, an urban stream like the Saw Mill River most likely contains barriers that either greatly reduce or eliminate access to the repair and rehabilitation work site(s).

Comment 12

Inundation from the dewatering process, leakage of contaminants such as chlorine dioxide, sodium hypochlorite, and disinfection by-products (DBPs) resulting from biofilm removal, construction activities that generate noise or turbidity, and other actions associated with the project may impact fish health or impede migration of diadromous fishes to their upstream spawning and nursery grounds. Increases in turbidity due to the resuspension of sediments into the water column by the inundation of large volumes of water or from in-water construction may degrade water quality, lower dissolved oxygen levels, and potentially release chemical contaminants bound to fine-grained sediments. Suspended sediments can also mask pheromones utilized by migratory fishes to reach their spawning grounds, and can smother immobile benthic organisms and demersal newly-settled juvenile fish. (NMFS)

Response 12

The context of this comment pertains to anadromous fish habitat, particularly that of river herring. The actions identified in Comment 12 are not anticipated to threaten river herring because existing downstream barriers impede upstream herring migration within tributaries associated with the repair and rehabilitation work sites. Furthermore, the localized nature of the repair and rehabilitation work in conjunction with protective measures that would be implemented during construction activities, as noted in the FEIS (see Chapter 9), is not anticipated to affect potential herring spawning and nursery grounds downstream of the work sites.

Unwatering of the Catskill Aqueduct would be an infrequent event and conducted in a manner to limit potential water quality impacts, such as increases in turbidity. In addition, unwatering would only involve the release of untreated, raw aqueduct water. FEIS Sections 9.4 to 9.18 analyzed site-specific effects of aqueduct unwatering on receiving waterbodies. Unwatering may occur twice a year during construction of the repair and rehabilitation. During long-term operation of the Catskill Aqueduct, these events would occur less frequently and would only require unwatering to local streams if a particular segment required

inspection or maintenance. Based on site-specific modeling conducted for the FEIS, velocities would quickly dissipate downstream of the unwatering locations and there would be no significant adverse impacts to water quality from unwatering at or downstream of these sites. In addition, scour protection measures would be in place, as necessary, at locations where unwatering releases would occur further limiting or eliminating potential impacts. In addition, protective measures as described in Section 9.20 of the FEIS would be put in place prior to and maintained during all construction activities to limit or eliminate potential impacts to surface waters and aquatic resources including the control of sedimentation or turbidity. These measures would be protective of juvenile fish, demersal early life stages of fish, and benthic invertebrates.

The potential effects of dechlorination, specifically DBPs and chloride, on natural resources was addressed within Section 9.20.2.6 of the FEIS. While the level of chlorine residuals and DBPs at locations where release to surface waters may occur is anticipated to be low, dechlorination systems would be installed, where appropriate, to treat chlorinated water from the Catskill Aqueduct prior to discharge or release into the environment. Discharges from these dechlorination systems would meet applicable water quality standards for chlorine residuals and these standards have been established to be protective of human health and the environment. Any potential effects associated with DBPs are likely to be reduced through treatment at the local dechlorination systems, volatilization, photodegradation, biodegradation, and/or an overall reduction of concentrations when entering larger volumes of water.

Biofilm removal would also not result in the release of contaminants to surface waters. Biofilm wash waters would be treated to meet applicable water quality standards prior to discharge to surface waters or release back into the aqueduct.

There would be no significant adverse impacts to water quality from in-water construction. Protective measures, as noted in Section 9.19 and 9.20, would be put in place before and during any construction. Likewise, where applicable, water-tight barriers would be installed prior to in-water construction to limit or prevent construction-related water quality impacts. Based on the analyses presented in the DEIS, the repair and rehabilitation would not result in significant adverse impacts to downstream reaches accessible to river herring, juvenile fish, demersal early life stages of fish, and benthic invertebrates.

Comment 13 Eggs and larvae of all fish species are especially sensitive to chemical pollutants. Potential impacts of chlorine dioxide, sodium hypochlorite, and DBPs contamination on cold-water trout streams in the project area are considered in the FEIS; however an analysis should be provided for impacts of these contaminants on streams with anadromous fish habitat.

Although potential leakage of these contaminants may be temporary and transient resulting in minimal immediate mortality, sub-lethal effects on fish populations may result from such contamination. Sub-lethal impacts are particularly important in larval fish, and include a reduction in ability to effectively forage and to avoid predation, ultimately causing mortality and impacting population size.

To minimize impacts to EFH (anadromous forage species) for juvenile bluefish, windowpane flounder, summer flounder, scup and little skate, we offer the following EFH conservation recommendation pursuant to Section 305(b)(4)(A) of the MSA. (NMFS)

- Avoid in-water work March 1 to June 30 of each year to minimize impacts to migrating and spawning diadromous fishes.
- Any in-water work undertaken at other times of the year should be designed to allow movement of fish past the work site.

Response 13 None of the listed EFH or anadromous forage species are present in the proposed project work areas. As stated earlier, most of the repair and rehabilitation in-water work sites occur in waters with known downstream man-made or natural barriers to river herring migration. In addition see also Response 12 that discussed potential impacts associated with contaminants that may occur as a result of the proposed action.

Comment 14 Noise from construction activities including stream diversions, culvert drain replacements, bridge repair, and streambank restoration and protection may also result in adverse effects. (NMFS)

Response 14 The repair and rehabilitation construction activities would generate noise in the immediate vicinity of the work site. In-water construction however would occur over a finite period of time, typically lasting days or weeks per site, and would not affect potential herring spawning and nursery grounds downstream of the work sites.

Comment 15 The leakage (RWBT) is 35 million gallons? I thought I heard 25 million gallons, indicating that it is getting worse or is a more critical problem? (T. Cryer)

Response 15 As noted in the FEIS, the RWBT segment of the Delaware Aqueduct is leaking up to 35 million gallons per day.

18.2 PROPOSED CATSKILL AQUEDUCT REPAIR AND REHABILITATION

Comment 16 When the NYCDEP takes the Catskill Aqueduct completely "out-of-service" for this project; we will have to withdraw water from the New Croton Aqueduct (NCA). This is our backup supply; however, its use will cause an extreme financial hardship for the town of New Castle & the village of Pleasantville. Specifically, we will have to pay an additional $500,000 to $700,000 per year in electrical pumping costs. This represents an over-budget increase of about 15% for the annual operating cost of our Millwood Water Treatment Plant (MWTP). (Moerschell)

Response 16 As stated in Chapter 9 of the FEIS, three shutdowns of the Catskill Aqueduct, lasting up to 10 weeks each, would be spaced over a period of three years from 2017 to 2019. These 10-week shutdowns would allow for repair and rehabilitation activities to occur, and would generally take place between October and December to coincide with the lowest water demand period of the year. Depending on time constraints and other factors, additional shutdowns may be planned, but these would be of similar, short duration. The commenter states the cost of operating the New Croton Aqueduct supply pumps to feed the Millwood Water Treatment Plant for a year would cost between $500,000 to $700,000. Actual pumping costs associated with the temporary shutdowns would be less than estimated since shutdowns planned as part of Water for the Future: Upstate Water Supply Resiliency project are on the order of 10 weeks, representing about 20 percent of the year. Costs may even be further reduced since planned shutdowns would coincide with periods of lower demand, or be staged such that water would be available as back-feed from Kensico Reservoir, requiring less pumping. Additionally, it is important to note that the project provides an overall benefit to the communities who draw water from the Catskill Aqueduct since it will extend the life of the aqueduct and reduce the risk of failure or the need for an unplanned outage.

Comment 17 Historically, based upon our experience regarding the chlorination of the raw water coming from the Catskill Aqueduct water, and monitoring the formation of DBPs before and after the Millwood WTP was placed in service; we feel that this chlorination program will be extremely unwise and costly for both the City and its wholesale customers. Therefore, we respectfully request that you reconsider the implementation of this program. (Moerschell)

Response 17

Over the years, the capacity of the Catskill Aqueduct has been reduced, mainly as a result of the accumulation of biofilm (a harmless, naturally occurring layer of microorganisms) along the aqueduct's interior surface. The repair and rehabilitation seeks to restore the aqueduct's capacity closer to its historical maximum capacity of 660 mgd by removing this layer of biofilm. By removing the layer of biofilm and adding air vents to enhance the flow of water through the aqueduct, repair and rehabilitation would provide additional capacity to convey water (i.e., water supply augmentation) to facilitate the RWBT temporary shutdown. The addition of chlorine-based chemicals (i.e., chlorine dioxide and sodium hypochlorite) to the aqueduct is required in order to facilitate biofilm removal and to limit future regrowth over the duration of the RWBT temporary shutdown.

As stated in Section 9.19.2.5 of the FEIS, "(t)he doses for sodium hypochlorite and chlorine dioxide were selected to limit the potential for public health effects to the City's water supply and Outside Community Connections that rely on the Catskill Aqueduct as a primary or secondary drinking water supply." To set the doses, DEP evaluated potential increases in DBP formation following chlorination of Ashokan Reservoir raw water under a range of sodium hypochlorite and chlorine dioxide doses and found Outside Community Connections and the City would still be able to meet all regulatory requirements for DBPs for doses planned as part of repair and rehabilitation. Only one chemical would be used at a time, chlorination would be temporary and conducted mostly at the lower doses proposed under the repair and rehabilitation; in such event, changes in water quality would likely be less than projected in the FEIS.

Comment 18

DEP and the City of Newburgh should draft an action plan to guide the contracting and construction process and evaluate it in the final environmental impact statement. The plan would help guarantee that DEP's Water for the Future Program could proceed on schedule while protecting Newburgh residents, and it would go a long way toward quelling community concerns about the shutdown. (Dulong)

Response 18

The City of Newburgh, as an independent municipality and owner/operator of its water system, is developing plans to bring their water supply back into service following concerns over water quality that necessitated a switch to their emergency backup to the secondary supply of Brown's Pond and a tap from DEP's Catskill Aqueduct connected to Brown's Pond. While it is currently anticipated that a treatment system for the City of Newburgh's water supply system would be available in advance of the first CAT-RR shutdown, DEP intends to monitor the

situation and will continue to closely coordinate with the City of Newburgh. See also Response 7 and Response 8.

Comment 19 Is it common practice per DEP and acceptable for municipal wells to be drilled in the heart of a residential neighborhood of over 100 homes? Is it acceptable for those 100 residences to lose their private wells as a new municipal well taps the aquifer which recharges those private wells? Is it acceptable for a municipality to avoid a full SEQR review by proclaiming negative declaration solely for expediency? [In addition,] should the Plains Road aquifer eventually become fully dewatered, what environmental protections are in place to prevent the storage of natural gas, and other toxic waste from being stored in the grave of the depleted aquifer? (Cryer)

Response 19 DEP is coordinating with all municipalities drawing water from DEP's aqueducts to ensure they have access to adequate back-up supply for times when DEP must take their infrastructure offline. See also Comment 7. As Lead Agency for this project, DEP has fully complied with SEQRA requirements to analyze potential adverse environmental impacts from its project. Any required SEQRA processes for projects undertaken by other municipalities which have independent utility are the responsibility of the lead agency for those projects.

18.3 PROPOSED WATER FOR THE FUTURE SYSTEM SHUTDOWN OPERATIONS

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. In 2007, the Decree Parties (New York, Pennsylvania, New Jersey, Delaware, and the City of New York), through unanimous consent, stipulated to the first of a series of flexible flow management programs that were implemented to better manage flow within the Delaware River. On October 27, 2017, after the issuance of the DEIS and before the issuance of this FEIS, the terms under which the operation of the Delaware System reservoirs governed by an interstate agreement between the Decree parties, were modified in certain respects. The analyses in the EIS are based on the prior FFMP that was in effect during the development of the DEIS. While there are some differences in the policies, the overall operational framework for the Delaware Reservoirs remains very similar. Based on a preliminary, qualitative review of the 2017 FFMP policy, DEP does not anticipate that the operating rules under the new policy would cause a change to the conclusions for WSSO presented in the DEIS. The 2017 FFMP will remain in effect until May 31, 2028 unless renewed, modified, or terminated during an interim review that must be completed by May 31, 2023.

Therefore, the responses to public comments on the DEIS that are focused on Delaware System operations and the FFMP are consistent with both the current and prior versions of the FFMP.

Comment 20 I understand that the Rondout is one of four reservoirs in New York City's Delaware system, and plays a critical role in New York City's overall water supply system. Does the Rondout Reservoir supply Long Island, NY as well? Will the proposed aqueduct work have any sort of effect/impact to Long Island, NY water supplies? (Golod)

Response 20 New York City's Delaware Water Supply System, including Rondout Reservoir, provides water to the City of New York and customers along its aqueducts. The proposed surface water project would not affect the groundwater aquifers on Long Island, NY.

Comment 21 Will reservoirs be looked at individually and lowered to different levels based on their capacity, their drainage area, the size of their release valves, size of their spillways, actual attenuation, amount of precipitation in that area (PMP) and the height of major flood stage below the dam? Will maximum releases be initiated at all reservoirs when the reservoirs go above predetermined levels? (Tharp)

Response 21 Each reservoir's performance during the RWBT temporary shutdown (e.g., elevation, releases, spills) was considered individually, and also collectively in the FEIS as part of the water supply system in order to optimize use of the system to meet multiple, competing objectives. DEP utilizes the OST Model, a comprehensive linked water supply/water quality decision support tool, to manage the water supply system, and this model uses the release capacity, drainage area, local inflows, and weather forecasts to determine releases and manage flows out of each reservoir to meet regulatory requirements. Results of these analyses completed for the DEIS under WSSO are presented for each waterbody downstream of each reservoir. Releases from the Delaware System reservoirs are managed in accordance with the FFMP (further discussed below in Response 24), and would be adjusted up to the maximum release capacity based on current hydrologic conditions, as needed, to meet the Combined Seasonal Storage Objective (CSSO) target.

Comment 22 In the NYCDEP Final Scope of Work issued in September 2015 in Section 8.1.2, the NYCDEP makes this statement: All of the Delaware System reservoirs would be drawn down in advance of the temporary shutdown, and an increase in releases for these reservoirs would be required during the temporary shutdown to maintain reservoir elevations at their normal levels and reduce the likelihood of spills." In the current statement (10.1-14), the City uses the term "typical" levels. In the 8.1.2 statement, the City

uses the word normal. What is the difference between "normal" and "typical" terms and why did the NYCDEP change the terms? (Tharp)

Response 22

The term was changed to "typical" for the DEIS to distinguish system operations from normal hydrologic conditions. That is, system operations with the RWBT in use are *typical* compared to operations proposed under WSSO. Whereas, "normal" in this context often refers to normal hydrology conditions (i.e., conditions with sufficient rainfall as opposed to a drought condition). In a SEQRA/CEQR context, typical refers to the conditions anticipated to occur in the future without the proposed action, and WSSO represents the future condition with the proposed action.

Comment 23

The following comments were received regarding typical water levels that may occur at the Delaware System reservoirs under WSSO.

- What is the "typical level" during dry, normal and wet conditions? Using historical data does not model all of the scenarios that could occur during an 8 month shutdown when diversions will not be made. How can historical data be used to model an event that has never occurred in the history of the reservoir system? Many times in the past 12 years, reservoirs were at historical "normal" levels: yet, we experienced catastrophic flooding in the Delaware River Basin. (Tharp)
- NYCDEP lists the same scenario for Cannonsville and Neversink as above for Pepacton: that no further analysis downstream is warranted and releases will be made in compliance to FFMP. Again, what are typical levels during wet hydrological conditions? According to past NYC performance it may be full to spilling. Thus, we may have 11 feet above these "typical conditions." at Pepacton. In 2006 there was a wall of water 11 feet high coming over the spillway at Cannonsville causing catastrophic flooding. Could this be a probable scenario if FFMP releases are followed? (Tharp)

Response 23

Historical data used in the modeling represents the range of conditions that can reasonably be expected to occur during the RWBT temporary shutdown. Further, by modeling the system under typical conditions with the RWBT in service and under WSSO with the RWBT temporarily out of service, DEP can quantify the incremental changes to the reservoirs and downstream receiving waterbodies due to the proposed operational changes.

Each reservoir study area includes plots and tables that present the results of the modeling and include the range of water surface elevations modeled under typical conditions and average water surface elevations estimated for WSSO. Under typical conditions, wet conditions result in higher water surface elevations, while drier conditions result in lower water surface elevations. Refer to **Figure 10.3-9** for water surface elevations for Pepacton Reservoir.

In addition, the DEIS included High Flow Condition analyses for each study area downstream of each reservoir specifically to evaluate the potential incremental change in high flows that are capable of causing flooding. These analyses include the storm events in 2004, 2005, and 2006, as well as other extreme storms that occurred in the past 81 years. The results of the High Flow Condition analyses for the Delaware System reservoirs (see FEIS Sections 10.3.2.2, 10.3.4.2, and 10.3.6.2) is that there is a small increase in the probability of high flows, but that the incremental change does not represent a significant adverse impact.

Comment 24 The following comments were received regarding the conclusions of the High Flow Conditions analysis for the Delaware System.

- The DEIS states "...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…" How is a mere 0.5% at major not a case for better planning? The downstream area below Pepacton Reservoir is rural area but the residents think that an increase of 0.5% or maybe the full 2% for a flow of 18,000 cfs is too much when it could have been prevented. With this possibility considered, why are there no siphons for Pepacton Reservoir with its small release chamber? (Homovich)
- The DEIS states, "Therefore, there would be no significant adverse impact to East Delaware River downstream of Pepacton Reservoir from WSSO and no further analysis of East Delaware River downstream of Pepacton Reservoir is warranted…." How large does the impact have to be before NYCDEP considers it adverse? I feel the low levels of the summer months have an adverse effect on tourism and that is one of the economic activities of the area. The impact of a flood event is felt for years. The flood events cause increases in flood insurance. The flood events cause increases in property taxes and the infrastructure of the Town of Colchester and Delaware County are

impacted. Why for this time period cannot an all-out effort be facilitated to protect an area that cannot stand more problems? Please reconsider the siphon. What if the project is not finished due to problems and that last connection step is delayed? The siphon is a type of insurance that every effort has been done to protect the residents and lessen the environmental impact on the HUMANS! (Homovich)

Response 24

Historically, prior to the execution of the first FFMP in 2007, the Decree Parties' agreements for releases and diversions from the Pepacton, Neversink, and Cannonsville reservoirs were focused on drought mitigation, fisheries habitat, conservation release, and other operations designed to minimize impacts of low flow conditions. The 2007 FFMP included new provisions to release water and create a storage void in the Delaware System reservoirs to further limit spills downstream, beyond the existing attenuating impact of the reservoirs, when conditions are forecasted to be wet. Modeling of the historical storm events from 2004 to 2006 has shown that FFMP operations successfully increase attenuation as compared to prior operating policies. Additionally, during the RWBT temporary shutdown when diversions are zero, the FFMP will compensate for reduced diversions by increasing releases to maintain the CSSO target. Prior to, and during, the RWBT temporary shutdown, the FFMP would be used to guide releases to ensure adequate water exists downstream for ecological, recreational, and economic purposes depending on forecasted inflows.

The FEIS presents analyses undertaken to determine the need for additional infrastructure. A modeling analysis to determine the operational requirements necessary for managing the system during the shutdown period found sufficient release capacity exists at Pepacton, Cannonsville, and Neversink reservoirs to manage flows during WSSO (Section 10.3 of FEIS), which have capacities of approximately 450 mgd, 970 mgd, and 125 mgd, respectively. For comparison, it was determined Rondout Reservoir does not to have sufficient release capacity since its current release works can only convey 15 to 20 mgd. In addition to releases, the level of spills was modeled and would not be substantially higher than what could occur under typical operations.

Pepacton Reservoir is managed as a water supply reservoir, though, as is the case for other DEP reservoirs, it does attenuate flooding. Based upon DEP's analysis detailed in the DEIS, the increased probability of flows that could result in flooding during the limited 8-month shutdown period was determined to not result in significant adverse impacts downstream of

the reservoirs because it was slight and not unlike flooding that can typically, and has in the past, occurred downstream.

Further, per Chapter 2, Section A. Paragraph 320, of the *CEQR Technical Manual*, CEQR requires establishment of a reasonable worst case scenario for analysis as part of an environmental review and states "From the range of possible scenarios that are considered *reasonable and likely*, the scenario with the worst environmental consequences is chosen for analysis." Therefore, while there is a slight chance hydrologic conditions could align to slightly increase the probability of potential flooding; operations under WSSO are not likely to increase flooding during storm events under a range of hydrologic conditions. However, as noted above, the reservoir itself, whether 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. During WSSO, DEP will also be proactively monitoring reservoir conditions and would adjust operations accordingly.

Comment 25

Several comments were received asking for clarification on how WSSO follows the Delaware River Basin Commission's FFMP and in doing so, increases releases during the RWBT temporary shutdown. They are summarized below:

- The fact that the Delaware River Basin experienced 3- one hundred year flood events in 2004, 2005 and 2006 causing loss of life and millions of dollars of damages to homes, businesses, infrastructure and communities must be considered in the plans for this shut down event. These floods occurred even though the City was diverting millions of gallons of water from the Delaware for their water supply. It is imperative that during this shutdown when none of the Delaware water will be diverted to the City for their water supply that the probability of catastrophic flooding is reduced to the greatest extent possible. This must be accomplished through a specific flood reduction plan that increases releases to provide storage space in all of the reservoirs for sudden storm events during the 8 month shut down. The DEIS with its vague, confusing and sometimes contradictory language does not adequately address the possibility for catastrophic flooding for the reasons and questions presented below. Considering that the 8 month closure of the Delaware Aqueduct is an unprecedented event adding greater risk to the probability of flooding during the closure why aren't greater releases being considered to maintain the reservoirs creating the void space necessary to prevent disastrous flooding since this water

will not be used by the City for its water supply? The City states that these increases in releases would be required but isn't this statement contradicted in Section 10.3-13 stating that the City will continue to follow FFMP releases? (Tharp)

- The Water Shutdown System Operations (WSSO) is neither a typical situation nor an act of nature. It is a man-made event and flooding can be greatly minimized by an effective plan by the NYCDEP. The WSSO can be the cause of higher flood crests if the City has no plan in place to increase its releases to compensate for the 500-600 mgd that will not be diverted. A shutdown should not begin until each individual reservoir is at a scientifically determined "safe" capacity to minimize the risk of flooding in consideration of the size of the release valves. The risk for flooding should be modeled under the worst case scenario of the wettest hydrological conditions because this, indeed, may be what will occur during the shutdown. The NYCDEP manages the reservoir system and thus is responsible for damages from a plan that does not protect the public from flooding due to failure to take the necessary steps prior to shut down and during shutdown until the tunnel reopens. (Tharp)
- Shouldn't releases be increased to avoid spilling reservoirs to compensate for the 500-600 mgd that the City will not be diverting? Since the City will not be using this water for their water supply why not build in additional releases to protect from flooding, dam failure and for the safety of the public? (Tharp)
- The DEIS states, "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…" If the FFMP is the rule for the time period, how are you going to increase the called for discharges by 181 mgd? (Homovich)

Response 25

As set forth in the FFMP, CSSO releases are determined based on forecasted inflows, releases, diversions, and snow melt over the next seven days, along with the current usable storage volume in the reservoir. The FFMP is designed to account for larger inflows or smaller diversions by increasing releases. The high flow analyses presented for each study area downstream of each reservoir specifically evaluates the potential incremental change between typical and WSSO for high flows from spills and releases that are capable of causing flooding during WSSO. In a SEQRA/CEQR context, typical refers to the conditions anticipated to occur in the future without the proposed action, and WSSO represents the future with the proposed action. These analyses include the storm events

in 2004, 2005, and 2006, as well as other extreme storms that occurred in the past 81 years. The results of the high flow analysis for the Delaware System reservoirs show a small increase in the probability of high flows that would not represent a significant adverse impact. As described in the Response 24, on the whole, operations under WSSO are not likely to increase flooding during storm events under a range of hydrologic conditions and rare events that are not 'reasonable or likely' do not require evaluation in detail per SEQRA/CEQR.

During WSSO, DEP will also be proactively monitoring reservoir conditions and would adjust operations accordingly.

Comment 26

Several comments were received requesting clarification of the CSSO targets for the Delaware System Reservoirs under WSSO.

- The FFMP has only a target of 90% capacity from October to March 15 and then 90% to over 100% from March to May. To follow the FFMP when the City will not be using the water for 8 months is illogical and dangerous. It is unbelievable that this statement continues to be used by the NYCDEP. The Flood Analysis Model and other studies proved that full reservoirs contributed to higher flood crests and reservoirs with voids mitigated flooding. (Tharp)
- Will there be a specified elevation at each reservoir prior to the shutdown to prevent a major flooding event? For example, on October 1, 2022, tunnel closure will begin when all Delaware Reservoirs are at no greater than 70% capacity. Then additional releases will be made during the 8 month period to keep the reservoirs at this capacity. As inflows increase, releases increase. In this way, there is far less probability that major flooding will occur. Why isn't such a scenario being considered by the NYCDEP rather than following the FFMP? What levels will the Delaware System reservoirs be drawn down to in advance of closing? (Tharp)
- Scientific data shows a direct relationship between voids in the reservoirs and reduced flow rates in the tributary during major storm events. Every foot of void space contributes to a reduced flood crest and less economic loss. By making the above statement, the City is once again taking no responsibility for flooding should it occur from the mismanagement of the reservoirs during the shutdown. Why wouldn't the City be willing to prevent flooding to the greatest extent possible during this shutdown by putting forth a specific plan to increase releases as necessary? (Tharp)

- What if the reservoirs are around 100% full on October 1, 2022? Will they still begin the shutdown? (Tharp)

Response 26

While larger storage voids do increase attenuation of infrequent storm events that have the potential to result in downstream flooding, creating these voids reduces the amount of water available to meet other required objectives (e.g., water supply, downstream fisheries habitat, recreation, etc.). The FFMP, as its predecessor agreements, is designed to balance multiple goals and objectives. Therefore, during WSSO, the FFMP will continue to guide releases for flood risk management, while also maintaining storage to supply water for other needs in the event of a drought. A High Flow Condition Analysis was conducted to evaluate the potential for increased probabilities of high flows under WSSO as compared to typical operations as described in Response 23.

WSSO does not include pre-determined water surface elevation targets for Pepacton, Cannonsville, and Neversink reservoirs. Reservoir releases determined per the FFMP take into account forecasted inflows, releases, anticipated diversions, snow water equivalent, and the current usable reservoir storage. The FFMP is designed to account for large inflows by increasing releases. Therefore, the physical void in reservoir storage can, and often does, increase to more than 10 percent of available storage to account for forecast-based availability of water from future inflows and snowmelt (leaving the reservoirs less than 90 percent full).[5] Releases as part of WSSO would be adjusted up to the maximum capacity based on current hydrologic conditions as needed to meet the CSSO target.

Modeling conducted to support the FEIS indicated there is a low likelihood that the Delaware System reservoirs would be full on October 1, 2022, because DEP would be diverting at higher than typical rates over the preceding summer months and continuing to release water per the FFMP. By preferentially using the Delaware System during the summer before the RWBT shutdown, a void would be created in the Delaware Reservoirs by the time the shutdown commences. Modeling assumptions for the FEIS did not assume delay of the RWBT temporary shutdown in the event of wet conditions or high reservoir water surface elevations in the Delaware System. However, it should be noted that the reservoir itself under typical operations or the temporary shutdown would reduce flood

[5] Note that in the recently agreed to 2017 FFMP, the Conditional Seasonal Storage Objective differs from the prior policy in that it is 85 percent from November 1 to February 1, ramping down to 85 percent from June 15 to November 1, and ramping back up from February 1 to April 15.

peaks downstream by attenuating flows from upstream of the reservoir, even when the reservoir is full and spilling. During WSSO, DEP will also be proactively monitoring reservoir conditions and would adjust operations accordingly.

Comment 27 Comments were received regarding the provision for demobilization or delaying of the RWBT shutdown during conditions when reservoirs are full.

- What if during the shutdown the reservoirs rise to a capacity of 110% as occurred at Cannonsville in 2006? Will the temporary shutdown be demobilized for this condition? (Tharp)
- The DEIS states, "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…" There have been statements that there would be a 24-hour turn around if there was a call for this large storm event. If a large storm event occurred and there was a danger to severe flooding, how would this help? Was this turn around only when water supplies were in danger? (Homovich)

Response 27 The FEIS does not mention a "24-hour turn around" to bring the RWBT back online. In the event of the onset of a drought or other water supply emergency, DEP could make the decision to demobilize construction at the RWBT, bringing the tunnel back online (See FEIS Section 10.1.4). Depending on the phase of the shutdown, demobilization could occur over a varying timeframe on the order of several weeks. Therefore, demobilization would not be effective for managing storm events, because the length of time needed to demobilize construction of the bypass tunnel connection would not occur quickly enough to result in a reduction of flood risks. Response 24, Response 25, and Response 26 further describe the releases under the FFMP and WSSO. During WSSO, DEP will also be proactively monitoring reservoir conditions and would adjust operations accordingly. During WSSO, DEP will operate in accordance with the FFMP releasing water to maintain a storage void and in anticipation of storm events that could lead to spills.

Comment 28 In Final Scope of Work Appendix A: Response to Comments this statement appears in several responses: "The DEIS will disclose potential effect to all the System reservoirs during the proposed shutdown of the RWBT section of the Delaware Aqueduct. This assessment will include potential effect to water bodies downstream of the reservoirs …" (found in Responses to Comments 9, 15, 16, 17, 18, 22, 23, 25, 27, 29, 30, 32, 34,

38, 39 in one form or another)

My question here is where is the answer to the question as to what level the Pepacton Reservoir would be drawn down for the shutdown? The FFMP rules would be followed and that has low levels of release at anything below 90%. What is the safe level for the small release chamber of Pepacton Reservoir? What level do you consider safe for the residents? Flooding, even minor in the winter months, is devastating. You state in this document that winter and spring are high inflow periods. I see the graphs and charts but the levels are not there. (Homovich)

Response 28

Within the FEIS, each reservoir study area included plots and tables that presented the range of water surface elevations modeled under typical conditions and average water surface elevations estimated for WSSO. Under typical conditions, wet conditions result in higher water surface elevations, while drier conditions result in lower water surface elevations.

There is no pre-determined water surface elevation target under WSSO for Pepacton, Cannonsville, and Neversink reservoirs as described in the Response 26. During WSSO, releases will be adjusted up to the maximum capacity based on current hydrologic conditions, as needed, to meet the CSSO target, which are likely to be higher in the winter and spring. However, reservoir releases determined per the FFMP take into account forecasted inflows, releases, anticipated diversions, snow water equivalent, and the current usable reservoir storage. Therefore, during the RWBT temporary shutdown when diversions are zero, the FFMP will compensate for reduced diversions by increasing releases to maintain the CSSO target. The goal is to maintain the CSSO which has been shown to more effectively reduce downstream flooding than prior operating policies. Figures are presented for each downstream study area in FEIS Section 10.3. These tables and charts show higher releases on average during the RWBT temporary shutdown as compared to typical operations.

As discussed in the Response 24, analyses undertaken to determine the need for additional infrastructure found sufficient release capacity exists at the Pepacton, Cannonsville, and Neversink reservoirs to manage flows during the RWBT temporary shutdown (see Section 10.3 of the FEIS). Also as described in Response 24, it was determined the increased probability of flows that could result in flooding during the temporary 8-month shutdown period at Pepacton Reservoir would not result in significant adverse impacts downstream.

Comment 29 Several comments were received regarding experiences with past flooding events on the Delaware River and how those would compare to operations under WSSO.

- The studies show that during the storms of 2004, 2005 and 2006 very limited attenuation occurred at the peak outflow period because what little exclusive capacity the reservoir had at the beginning of the rainfall event was used up in the early precipitation of the event. (Tharp)
- Spills can occur during any month but are more frequent and of larger magnitude during high inflows months (March through May). One of the worst floods in magnitude occurred in April 2005. This would be towards the end of your work and approaching the June 1 deadline for 100% for the system reservoirs. Are you following those goals and how will this impact levels? (Homovich)
- 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 with a capacity to release up to approximately 470 mg over a sustained period. High releases do not occur unless levels are above 90% and the snow pack is high. In 1996 the snow pack was 5" and a 5" rain event occurred with the melting. This scenario could happen and what are the procedures to draw the reservoir down fast enough to prevent a long flood event…Jan. through April? (Homovich)

Response 29 The FFMP, which was first agreed to in September of 2007 in response to the flood events in 1996 and from 2004 to 2006, included specific provisions to release water and create a storage void in the Delaware System reservoirs when conditions are forecasted to be wet in order to limit spills downstream. See Response 24.

Comment 30 There were requests to evaluate the worst-case scenario for receiving waterbodies of the Delaware System.

- In the DEIS analysis, NYC has concluded that during the shutdown beginning October 2022 the risk of spills would be highly unlikely. However, as we all know, Mother Nature does not always cooperate. The following is a scenario for your consideration followed by questions. If beginning in late 2021 and continuing into 2022 turns out to be an outlier, resulting in exceptionally high precipitation and subsequent water levels in the reservoirs up until the October 1,2022 and then we experience episodes similar to Irene and Lee near that

time, creating spill risks higher than the projections assumed in the analysis. (Frazier)

- With regard to a worst case scenario, if an event similar to the one noted above were to occur, does the risk change? Would the scenario above cause DEP to delay the project to another year or risk excessive spills that could inundate and damage municipalities just below the dams? (Frazier)
- The DEIS states that, “the socioeconomic condition analysis for this DEIS would consider whether Upstate Water Supply Resiliency or a component would result in significant impacts due to: (1) direct residential displacement; (2) direct business displacement; (3) indirect residential displacement; (4) indirect business displacement; and (5) adverse effects on a specific industry using the above Analytical Framework." We request that a "socioeconomic condition analysis" as described above, be conducted under a worst case scenario for communities below the dams that would not otherwise occur within the normal ranges assumed in the analysis? (Frazier)
- Remaining within “typical levels” during a wet year is not conducive to pro-active flood mitigation or flood risk reduction from large, uncontrolled spills as has occurred in past so-called “typical years”. The assumption that the proposed operating scenario would pose no adverse impact is unsupported by any modeling of only wet year elevations. The conclusion that no analyses are needed because the release range would remain within the typical range presumes that the existing release schedule will be sufficient to provide flood risk reduction in a wet year. There is no modeling of the probability and size and frequency of a large flood exacerbating spills in the event of wet years such as occurred in 2004, 2005 and 2006. There is no mention of this scenario of full and spilling reservoirs even though this scenario could set the Delaware River Basin up for the largest flooding event in history, a major loss of life and perhaps dam failure because the valves at the reservoirs are inadequate to make the necessary releases. How can this environmental impact study not consider this scenario since it would have a major impact on the Delaware River Basin? The vagueness of the above statement places the millions of people in the Delaware River Basin in danger of catastrophic flooding! (Tharp)
- Obviously, it is very important for the City to consider drought conditions prior to and during this shutdown. However, it is equally

important to set up procedures if very wet conditions exist prior to and during tunnel closure. (Tharp)

Response 30

The analysis in the FEIS does not conclude that the risk of spills would be highly unlikely. Many of the years modeled resulted in reservoirs spilling as demonstrated in the tables and plots that presented the range and average spills for typical operations and WSSO at each downstream study area. The analysis in the FEIS does, however, determine that there is a minor increase in the probability of high flows downstream of the Pepacton, Cannonsville, and Neversink reservoirs due to large storm events that could result in flooding. However, the small, temporary increase in the probability of high flows downstream of the reservoirs during WSSO does not represent a significant adverse impact.

Combined diversions to the City from the Pepacton, Cannonsville, and Neversink reservoirs is limited to an average 800 mgd, which represents a small percentage (less than 2 percent) of inflows that have occurred historically during major storms. Further, the dams are designed to pass one half the probable maximum flood, which is substantially higher than any flood event experienced in the basin to date. Hydrologic analyses indicated negligible change in probabilities of floods above the typical ranges; therefore a dam failure analysis was not warranted.

As described in Response 24, on the whole, operations under WSSO are not likely to increase flooding during storm events under a range of hydrologic conditions and rare events that are not 'reasonable or likely' do not required evaluation in detail per SEQRA/CEQR.

Comment 31

In addition to potential downstream impacts from flooding, several comments were received regarding the adequacy of release works and capacity at each Delaware System reservoir.

- How does the modeling prove that these dams have sufficient release capacities if wet hydrological conditions exist for a period of 8 months, without jeopardizing the safety of the public? For example, it can take weeks or a month to achieve even a 5% void in Pepacton depending upon inflows with their current release valves. (Tharp)
- The DEIS states, "…and there would only be minor reductions in the ability of Pepacton Reservoir to attenuate large storm events…" With minor as the active voice, why no siphons at Pepacton to assist with lowering capabilities? (Homovich)

- An 8 month period takes us into the snowmelt/spring rains time period when inflow is dramatically higher. The 2005 flood occurred in April. Even at maximum releases, the release valves may not be "adequate" to handle these increased inflows without creating spilling reservoirs and possible devastating flooding. (Tharp)
- Were wetter than normal conditions taken into consideration during the modeling that determined that only Rondout reservoir needed additional siphons to release more water. (Tharp)
- Were the capacities compared to the size of the release valves taken into consideration? Pepacton holds 140 billion gallons but only has about one half the release capacity of Cannonsville which holds 95 billion gallons. (Tharp)

Response 31

Based on the results of the hydrologic modeling under typical operations and WSSO, the existing release works are more than adequate to manage reservoir storage per the FFMP operating policy under most scenarios (see Response 24). Reservoir releases determined per the FFMP take into account forecasted inflows, releases, anticipated diversions, snow water equivalent, and the current usable storage for each reservoir.

As stated in Response 23, results of the high flow analysis for the Delaware System reservoirs indicate there is a small increase in the probability of high flows, but that the incremental change does not represent a significant adverse impact.

Comment 32

The DEIS states, "During the pre-shutdown period, releases into the East Branch Delaware River would be lower than typical conditions by up to approximately 37 mgd." Why would the pre-shutdown period call for lower releases? Does this not call for more water that has to be discharged for the closure months? The discharges for the months of June through September can be as low as 150. If these will be lowered by 37 mgd, what will happen to the recreational activities on the East Branch Delaware River? How have you measured the economic impact? (Homovich)

Response 32

As described in the Response 25, the FFMP is designed to account for large inflows by increasing releases. Similarly, when diversions are high, releases are lowered to manage the CSSO. Therefore, during the pre-shutdown period, when DEP is diverting more water than typical, releases will be lower than typical based on the FFMP, which accounts for diversions to NYC. The estimated reduction in releases during the pre-shutdown phase of WSSO is within the range of typical conditions, and was not determined to result in significant adverse impacts downstream.

Comment 33 The DEIS states, "During this period, spills into the East Branch Delaware River would be lower than typical conditions by up to approximately 28 mgd." With the use of the word spills…are you saying that water over the spillway would be lower by 28 mgd? How can you predict that spills would be lower due to shutdown? I thought the plan was to prevent spills during this time period. During any spill event the process of lowering the Pepacton Reservoir takes weeks. The diversions are seldom used for this reservoir in the Delaware System. Neversink Reservoir is first but only after Rondout. (Homovich)

Response 33 Since reservoir inflows during WSSO are uncertain, a range of potential inflows were evaluated in OST under both typical operations and WSSO. The difference in conditions from the model indicates that, on average, spills will be up to 28 mgd less during the four months leading up to the shutdown under WSSO as compared to typical conditions.

Comment 34 The DEIS states: "During this period, spills into the East Branch Delaware River would be higher than typical conditions by up to approximately 258 mgd…" What is the base flow that this 258 mgd would be added? Is the 458 mgd (700 cfs) the base? The USGS gage for Downsville is in a man made channel. This was created for the Pepacton Reservoir releases. The natural channel was south of that. That section of the river has an artificial bank. Spills that occur do not leave the bank there but they do downstream before the 8 foot level. (Homovich)

Response 34 Since reservoir inflows during WSSO are uncertain, a range of potential inflows were evaluated in OST under both typical operations and WSSO. The difference in average conditions from the model indicates that, on average, spills will be up to 258 mgd higher during the temporary shutdown during the month of April. This value is calculated from subtracting the modeled average spills for April under typical conditions (172 mgd) from the modeled average spills estimated to occur during the temporary shutdown (430 mgd).

Comment 35 The DEIS states that "during WSSO for both spills and releases would remain within the range of typical operations" …How is it within the range if there are increases and decreases, as listed above, to the flow of the East Branch Delaware River? If these are not normal, the socioeconomic impact has not been fully measured. The mechanical aspect may be within the range but how have you measured the toll on the residents in the tailwaters? (Homovich)

Response 35

Modeling indicated that under typical conditions the average daily spills for each month can reach 1,200 mgd for Pepacton Reservoir, but is typically in the range of 10 to 220 mgd on average. Average conditions during the RWBT temporary shutdown are estimated to be in the range of 0 to 430 mgd, which differs from typical (higher in some months, lower in others), but does not exceed the typical range, which can reach 1,200 mgd. The figures from the FEIS referenced below provide a graphical representation of the data.

- **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
- **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

Comment 36

DEP must set forth plans to protect lower Esopus Creek during the respective shutdowns of the RWBT and the Catskill Aqueduct. The Ashokan Release Channel is currently operated under the Interim Ashokan Release Protocol, which guides the use of the channel to release water from the reservoir to optimize reservoir operations, control flooding, and guarantee a minimum flow for ecosystem and community benefits. The Channel often releases up to up to 600 million gallons of water per day to the Relic Channel/Little Beaverkill which flows to the lower Esopus. DEP states in the DEIS that it will modify Release Channel Operations during the shutdown of the RWBT by: reduc[ing] or eliminate[ing] all releases with the exception of community releases from the Ashokan Release Channel in accordance with Section 7.c. of the New York State Department of Environmental Conservation (NYSDEC)/DEP IRP for Ashokan Reservoir (September 27, 2013).[6] The IRP may be revised at any time with the agreement of the New York State Department of Environmental Conservation. It is foreseeable that DEP may deem it necessary to cease the community releases if Ashokan Reservoir storage levels fall below a certain threshold. Moreover, the Release Protocol sets forth storage volume goals called the Conditional Seasonal Storage Objective ("CSSO"), which alternates between 90% during the fall and winter and 100% during the spring and summer. DEP has implied it may deviate from the CSSO in order to keep the reservoir as close to full as possible for the duration of the RWBT shutdown, seeking to fill the

[6] Id. at ES-15; see id. at 10.4-4

reservoir in October 2022.[7] (Dulong)

DEP must identify two worst-case scenarios for Ashokan Reservoir due to the modified operations during the shutdown of the RWBT and examine the potential environmental impacts of each. First, DEP should identify the reservoir storage level at which community releases would cease, determine the likelihood the reservoir would be drawn down to that level, and examine the potential detriment to the lower Esopus ecosystem and communities.

Second, DEP should consider the likelihood for a major fall storm to cause spillage when the Ashokan Reservoir is at or near capacity in October 2022, and identify the potential downstream impact. (Dulong)

Response 36

As stated in Section 10.4 of the FEIS, "DEP would seek to maintain minimum community releases in accordance with the IRP for Ashokan Reservoir (or its successor) for the duration of the pre-shutdown and shutdown phases." Community releases would not cease under WSSO and therefore, this scenario does not need to be evaluated. In addition, demobilization is planned when dry conditions could lead to a water supply emergency. As stated in Section 10.4.5.2 of the FEIS, "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."

The FEIS also considered the potential for impacts to lower Esopus Creek from a major fall storm event based on OST modeling that included similar, historical events. The high flow analyses presented for lower Esopus Creek downstream of Ashokan Reservoir specifically evaluated the potential incremental change in high flows that are capable of causing flooding. These analyses include a number of extreme storms that occurred in the past 81 years. The results of the high flow analysis for the Ashokan Reservoir shows there is a small increase in the probability of high flows, but that the incremental change does not represent a significant adverse impact to lower Esopus Creek.

Further, as described in Response 24, on the whole, operations under

[7] Id. at ES-15 (Prior to the shutdown of the RWBT, "DEP would reduce flow to the City from the Catskill and Croton systems, thereby increasing the amount of water stored in those systems.")

WSSO are not likely to increase flooding during storm events under a range of hydrologic conditions and rare events do not require evaluation in detail per SEQRA/CEQR. Finally, while DEP would not plan to make releases larger than the community release levels during WSSO, DEP will also be proactively monitoring reservoir conditions and would adjust operations accordingly.

Comment 37

The shutdown of the Catskill Aqueduct could pose similar adverse impacts as the RWBT temporary shutdown. With the Catskill Aqueduct offline, any excess water in the Ashokan Reservoir will either rise over the spillway or be discharged through the Release Channel. These types of releases have been shown to have significant adverse impacts on the lower Esopus. DEP should set forth a modified Interim Release Protocol with targets for CSSO reduction in the lead up to the Catskill Aqueduct shutdown, as well as a modified protocol to reduce the potential for damaging high-volume releases to the maximum extent practicable. (Dulong)

Response 37

As stated in Chapter 9 of the FEIS, three shutdowns of the Catskill Aqueduct lasting up to 10 weeks each would be spaced over a period of three years from 2018 to 2020. These shutdowns would occur in the fall when the system is entering a period of lower demand. Therefore, diversions from the Catskill System at this time are historically lower. In addition, DEP would continue to operate Ashokan Reservoir in accordance with the IRP, or its successor, during any shutdown of the Catskill Aqueduct. The IRP, described in Response 9, includes a CSSO for Ashokan Reservoir. Therefore, should the water level in the reservoir rise to or above the CSSO during these short shutdowns of the Catskill Aqueduct, releases would be increased to maintain the CSSO. Additionally, during typical operations there is generally a void in Ashokan Reservoir storage at the end of the summer due to high demands and low reservoir inflow. Refer to the typical elevation curves in the FEIS figures below:

- **Figure 10.4-12:** Elevation Dataset Mean and Range for Typical Operations and WSSO – Ashokan Reservoir Study Area (West Basin)
- **Figure 10.4-13:** Elevation Dataset Mean and Range for Typical Operations and WSSO – Ashokan Reservoir Study Area (East Basin)

Further, under average conditions presented in the figures noted above, usable storage is typically less than 80 percent during the fall and it would take longer than 10 weeks to refill based on average inflows during that time of the year.

Comment 38

During the brief film that I had just seen, you stated that the Catskill is capable of doing 600 mgd. Even after the removal of biofilm, I believe it won't go much more than 650. The remainder of the supply would be made up by the Croton. Therein lays my question: Croton water is questionable at best. It can only deliver 290 million gallons at best. That's if the plant can handle it. What happens when the water quality determines that we can no longer use Croton water? The City can't supply itself; it can't survive on 650 million gallons of water a day. Therein lays my question. (Waterhouse)

Response 38

The Croton Water Filtration Plant is capable of treating 290 million gallons of water per day and is anticipated to be able to deliver 290 mgd to New York City during the RWBT temporary shutdown. In addition, the plant is designed to handle the full range of historical water quality conditions experienced by the system and will be able to treat water during any episodic water quality events that may occur while the Delaware System is temporarily offline as part of Water for the Future: Upstate Water Supply Resiliency project. In addition, there are two pump stations that would be operated during the RWBT temporary shutdown to transfer water from the Croton System to the Catskill/Delaware systems. The Croton Falls and Cross River pump stations are capable of delivering up to 240 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 for use by the City in meeting demand.

Repair and rehabilitation of the Catskill Aqueduct will provide additional water to the City and DEP's Demand Management program is anticipated to result in a reduction of water needs for the City and upstate customers at the time of the shutdown. In addition, planning the RWBT temporary shutdown between October and May further reduces the amount of water required as the system is in a period of lower demand. By starting on October 1 when the system is entering a period of lower demand and continuing through the winter months, and by allowing for initiation only under favorable hydrologic conditions, OST modeling was able to help the City optimize the amount of augmentation required to support bypass tunnel connection and repairs near Wawarsing. Finally, if, at any given time, system demand exceeded predicted available supply, demobilization from the RWBT bypass tunnel connection would be initiated. This would be a temporary demobilization until favorable conditions allow for a subsequent shutdown and project completion.

18.4 PROPOSED RONDOUT-WEST BRANCH TUNNEL INSPECTION AND REPAIR

Comment 39 Anadromous fishes such as alewife *(Alosa pseudoharengus)* and blueback herring *(Alosa aestivalis)* may use streams within the project area as migratory pathways and nursery and forage habitat. Juvenile river herring are a food source for several federally managed species. (NMFS)

Response 39 As noted in Section 11.9.5.14 of the FEIS, no alewives or blueback herring (adults or juveniles) were observed or collected during sampling events in the Roseton Study Area. Although baseline fish surveys completed in the Roseton Study Area did not identify EFH species or their prey (FEIS Section 11.9.5.14), following decommissioning the stream segments are expected to provide a hydrologic regime that would support EFH prey species, should they occur. As such, significant adverse impacts to fish are not anticipated within the Roseton Study Area.

Comment 40 According to the DEIS, there is a potential for significant adverse impacts to freshwater wetlands hydrologically connected to the Hudson River as a result of the cessation of leaks due to the decommissioning of the bypassed section of the RWBT. DEP has committed to developing a monitoring program that would be implemented prior to, during, and after the RWBT temporary shutdown to assess and confirm the extent of the impacts to these wetlands, and should permanent impacts be measured, DEP would perform compensatory mitigation. The monitoring program should be extended to five years and, as American eel is abundant in this location, should include the use of the area by the American eel. If the value of the area for American eel is diminished, the compensatory plan should include impacts to this species. (NFMS)

In accordance with the 2008 Federal Register, Part 332 Compensatory Mitigation for Losses to Aquatic Habitat, the project must specifically identify and fully account for all unavoidable impacts. Compensatory mitigation should match the type of habitat impacted; the quality impacted, and be located within the same watershed or system. In addition to compensation for permanent losses, the mitigation plan should also include any degradation of habitat. DEP should coordinate with us to develop a detailed compensatory mitigation plan that offsets all of the aquatic habitat loss and degradation that may result from this project and provide it to us for review prior to implementation. The plan should include success criteria and a long-term management plan. The site protection mechanism and long-term land steward should also be identified. (NMFS)

Response 40

As noted in Section 11.11.1 of the FEIS, a total of 1.2 acres of non-regulated wetlands within the Roseton Study Area are estimated to be lost as result of the cessation of leaks from decommissioning. DEP has committed to a monitoring program that would consist of hydrologic monitoring for up to 5 years following decommissioning, and biennial wetland monitoring for 5 years to determine if significant adverse impacts to wetlands have occurred as a result of decommissioning. Should significant adverse impacts to the non-regulated wetlands be measured, then DEP would perform compensatory mitigation for the impacted wetlands. Assuming that USACE does not claim jurisdiction over the wetlands and watercourses, the 2008 mitigation rule will not apply; however, DEP has committed to compensatory wetland mitigation at a minimum one to one mitigation ratio should it be necessary. Upon proceeding with wetland mitigation, DEP would prepare a mitigation plan that includes metrics for documenting project performance relative to objectives, and a monitoring plan for a minimum of 3 years to confirm that the mitigation meets the project objectives.

As noted in FEIS Section 11.9.5.14, American eel were found in multiple stream segments in the Roseton Study Area, including stream segments not influenced by the RWBT leak (Stream Segment 2). As described in FEIS Section 11.9.5.30, significant adverse impacts to American eel are not anticipated as they were documented in Stream Segment 2, which is not influenced by the RWBT leak, and reflects the anticipated hydrologic regime for the remaining stream segments following decommissioning. DEP would also utilize data collected during monitoring of Roseton stream segments to qualitatively document potential changes to aquatic habitat in these stream segments.

Comment 41

As listed species and critical habitat for Atlantic sturgeon may occur within the vicinity of the proposed project, any proposed in-water work has the potential to impact these species. As project details become finalized, a consultation, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, may be necessary. (NMFS)

Response 41

As noted in FEIS Chapter 11, there is no physical construction or in-water work associated with the Proposed Project in the Roseton area which is the only element of the proposed action that would be in close proximity to potential Atlantic sturgeon habitat. No impacts to Atlantic sturgeon would therefore occur. Should this change, DEP would consult with all appropriate agencies.

Comment 42

Comments were made regarding the commenter's attempt to gather information on Town of Newburgh and Wawarsing houses and DEP's agreements with the homeowners in Wawarsing. The commenter went on to say it is noted that there is contamination under Channel Master [Imperial Schrade] and wondered if there are any more leaks in the New York City Aqueduct that DEP has not told us about yet. The commenter noted there would be meetings, hopefully in another week or two, called the Rondout Creek Disease Registry Meetings, in regard to the Rondout Creek floodplain, on both sides, which is owned by New York City, where New York City took all the riparian rights, means all the water that flows into a creek on either side, and that land and the groundwater underneath it when they took title to a lot of New York Upstate homes. (Wendel).

Response 42

Groundwater at the Channel Master (property currently owned by the Imperial Schrade Corporation) facility on Route 209 in Ellenville, New York was impacted by past disposal practices by others associated with Channel Master, such as the manufacture of television antennas and related accessory items including mounting hardware, transmission cables, and installation kits. According to public records provided by the EPA,[8] groundwater contamination is limited to a 10,000 square foot area of the water table aquifer beneath an area of a former manufacturing building where solvents were used. Groundwater impacts have not been detected in the bedrock aquifer.

According to these records, a groundwater pump-and-treat remediation system was installed and is operated to remediate the groundwater beneath the main building. Groundwater is extracted from the aquifers, treated, and discharged to Sandburg Creek pursuant to a New York State Pollutant Discharge Elimination System (SPDES) Permit.

The potential effects of Water for the Future: Upstate Water Supply Resiliency could have on groundwater in the unconsolidated and bedrock aquifers were documented in Section 11 of the FEIS, noting that groundwater in the unconsolidated aquifer will not be affected in this area of Ellenville. Therefore, Water for the Future: Upstate Water Supply Resiliency will not affect the groundwater contamination or groundwater remediation at the Channel Master site.

Regarding the potential legacy contamination at the Channel

[8] https://archive.epa.gov/epawaste/hazard/web/pdf/ny7788.pdf

Master/Imperial Schrade property, the property does not abut Rondout Creek, but is located along Sandburg Creek, approximately 1 mile upstream of its confluence with Rondout Creek. Variations in flows in Rondout Creek will have no impact on Sandburg Creek or its potential to cause erosion along the Channel Master/Imperial Schrade property.

18.5 PROPOSED NEW PALTZ TEMPORARY TRANSMISSION PIPELINE

Comment 43 It is only going to take 30 days to construct this temporary line? That gives a lot of leeway to the town to try to find an alternative water supply (T. Cryer)

Response 43 The construction of the temporary pipeline is anticipated to be completed in a total of 30 days. DEP would construct the temporary pipeline prior to the 10-week shutdown of the Catskill Aqueduct when the existing New Paltz Connection Chamber would not have access to water from the aqueduct. As discussed in Section 9.18, "New Paltz Temporary Transmission Water Main," for the purpose of the SEIS analyses, it was conservatively assumed that construction of the temporary pipeline would be completed in 2018 prior to the first planned shutdown for the repair and rehabilitation project, and the temporary pipeline would remain in place until after the final shutdown, anticipated in 2020.

Comment 44 The Wallkill Downtake Chamber is in New Paltz, and not Gardiner? (T. Cryer)

Response 44 The Wallkill Downtake Chamber is located within the Town of New Paltz.

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