EXECUTIVE SUMMARY

ES 1. INTRODUCTION

The New York City Department of Environmental Protection (DEP) supplies clean drinking water to more than eight and a half million New York City (City) residents and one million upstate customers in Westchester, Putnam, Orange, and Ulster Counties, New York. DEP supplies this water in sufficient quantities to meet consumers' present water demands while simultaneously maintaining and improving the City's water supply system to ensure it can meet all future water demands. The City must comply with all applicable New York State (State) and federal laws and regulations governing its water supply to protect public health and the environment. DEP achieves these mandates and objectives through its careful and coordinated management of the City's three upstate reservoir systems, which collectively comprise the New York City water supply system: the Catskill, Delaware, and Croton systems (**Figure ES-1**).

This Environmental Impact Statement (EIS) was prepared to evaluate modification of DEP's Catskill Aqueduct Influent Chamber State Pollutant Discharge Elimination System Permit (SPDES No. NY026-4652) (Catalum SPDES Permit). An Order on Consent (NYSDEC Case No. D007-001-11.01) was issued by the New York State Department of Environmental Conservation (NYSDEC) on October 4, 2013, and was amended in 2018 (2018 Modification) and in 2020 (2020 Modification) (collectively as modified, the Consent Order). Among other provisions, the Consent Order includes specific requirements and timeframes for carrying out this State Environmental Quality Review Act (SEQRA) review, including the preparation of an EIS for the Proposed Action – a modification of the Catalum SPDES Permit. Pursuant to the Consent Order, the Proposed Action would modify the Catalum SPDES Permit to incorporate the following:

1. Turbidity control measures, including operation of Ashokan Reservoir in accordance with the Interim Ashokan Release Protocol (IRP)[1]; and
2. Delay of dredging accumulated material (alum floc)[2] from Kensico Reservoir until the completion of certain infrastructure projects.

This EIS evaluates: potential benefits and environmental impacts of the Proposed Action on lower Esopus Creek, Ulster County, New York (from operation of Ashokan Reservoir in accordance with the IRP); and potential benefits and environmental impacts on Kensico Reservoir, Westchester County, New York (due to delay of dredging), as well as potential environmental considerations of dredging at Kensico Reservoir. It also evaluates infrastructure and operational alternatives to the IRP and structural alternatives to limit the extent of alum floc deposition in Kensico Reservoir.

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[1] Pursuant to the Consent Order, as part of the development of this EIS, potential benefits and impacts of operation of Ashokan Reservoir in accordance with the IRP were evaluated. The IRP is described in Section ES-4, "Overview of the Proposed Action." This EIS also evaluated whether revisions to the IRP are appropriate, see Section ES-8, "Proposed Revised Operating Protocol, Proposed Revised Monitoring Plan, and Additional Considerations."

[2] Aluminum sulfate (alum) attaches to particles suspended in the water column that cause turbidity and causes them to sink and settle on the floor of a water body. These coagulated/flocculated particles are referred to as "alum floc." The amount of alum floc that would be dredged is referred to in the Consent Order as the Total Dredging Mass.

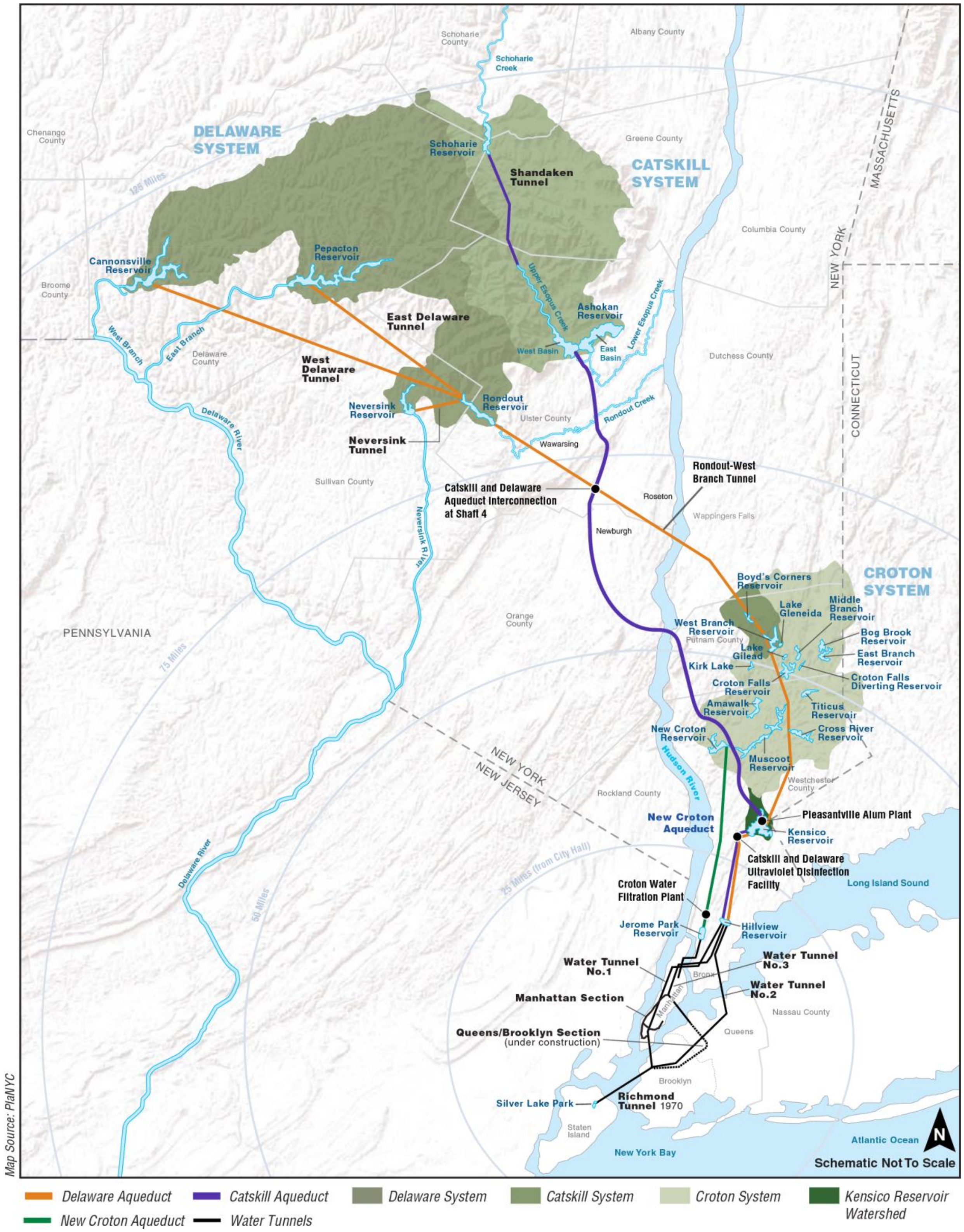

Figure ES-1
Water Supply System Overview

To form the basis of the EIS assessments, modeling was used to predict the potential differences between the future without and with the Proposed Action that would occur in flow regime and water quality along lower Esopus Creek, and in alum application to water in the Catskill Aqueduct upstream of Kensico Reservoir.[3] In the future without the Proposed Action, there would be no use of the Ashokan Release Channel (No IRP) and no dredging of accumulated alum floc from Kensico Reservoir (no dredging). The future with the Proposed Action would include use of the Ashokan Release Channel in accordance with the IRP (IRP) and delay of dredging accumulated alum floc from Kensico Reservoir (delay of dredging). Differences between the future without and with the Proposed Action were then used to: evaluate potential changes to water flow and water quality parameters in water diverted from Ashokan Reservoir through the Catskill Aqueduct (diversions) and flows to lower Esopus Creek; and, establish potential effects of delay of dredging in Kensico Reservoir. Differences between the future without and with the Proposed Action informed the technical area assessments conducted in this EIS in accordance with SEQRA - as set forth in 6 NYCRR 617 and authorized by Article 8 of the Environmental Conservation Law - and the City Environmental Quality Review (CEQR) process - as set forth in 62 RCNY Chapter 5 and Executive Order 91 of 1977 and its amendments. The following technical areas were assessed in this EIS for lower Esopus Creek and Kensico Reservoir:

- Water Resources and Water Quality
- Public Policy, Land Use, and Zoning
- Socioeconomic Conditions (lower Esopus Creek only)
- Open Space and Recreation
- Historic and Cultural Resources
- Aesthetic (Visual) Resources
- Aquatic Resources
- Wetlands
- Terrestrial and Wildlife Resources
- Hazardous Materials
- Infrastructure and Energy
- Transportation (Kensico Reservoir only)
- Air Quality (Kensico Reservoir only)
- Noise (Kensico Reservoir only)
- Public Health (project-wide)

The remainder of this Executive Summary is organized as follows:

- Section ES 2, “EIS Process,” presents key EIS milestones;
- Section ES 3, “Background of Modification of the Catalum SPDES Permit,” presents additional information on how DEP addresses turbidity in the Catskill System and historical context for this EIS;
- Section ES 4, “Overview of the Proposed Action,” discusses the Proposed Action in greater detail;
- Section ES 5, “Proposed Action in the Lower Esopus Creek Study Area,” describes the assessment of potential impacts and benefits within lower Esopus Creek due to operation of Ashokan Reservoir in accordance with the IRP;

[3] During alum application events, DEP adds alum and sodium hydroxide at the Pleasantville Alum Plant to water in the Catskill Aqueduct upstream of Kensico Reservoir (alum application) to reduce the turbidity of water diverted from Ashokan Reservoir.

- Section ES 6, "Proposed Action in the Kensico Reservoir Study Area," describes the assessment of potential impacts and benefits to the Kensico Reservoir study area due to a delay of dredging, and discusses the environmental considerations of dredging and presents results;
- Section ES 7, "Alternatives Analysis Summary," provides an overview of the analysis of infrastructure and operational alternatives; and
- Section ES 8, "Proposed Revised Operating Protocol, Proposed Revised Monitoring Plan, and Additional Considerations," provides an overview of these items, respectively.

ES 2. EIS PROCESS

NYSDEC issued a Draft Scope of Work for this EIS on April 9, 2014. Public meetings were held on the Draft Scope of Work on May 12, 2014 and May 14, 2014; and the public comment period closed on August 29, 2014. A Final Scope of Work was subsequently issued by NYSDEC on March 22, 2017, which included revisions to the Draft Scope of Work that were made in response to comments received during the Draft Scope of Work's public notice and comment period. The Ashokan Release Working Group (ARWG), comprised of representatives from Ulster County, local municipalities, DEP, State and federal regulatory agencies, landowners, environmental groups, and other stakeholders, provided input on the Draft Scope of Work.

ES 3. BACKGROUND OF MODIFICATION OF THE CATALUM SPDES PERMIT

While natural conditions and DEP's Watershed Protection Programs generally ensure the excellence of the City's water supply, episodic water quality events associated with turbidity, typically produced by storm events, do occur and require additional response by DEP (**Figure ES-2**). The Catalum SPDES Permit authorizes DEP to apply alum to reduce turbidity in the Catskill Aqueduct upon NYSDEC receipt of a copy of a notice from the New York State Department of Health (NYSDOH) that there is a potential imminent development of a public health hazard related to the discharge of turbid water from Kensico Reservoir. While application of alum is permitted in these limited circumstances, the Catalum SPDES Permit further provides effluent limits and contains a compliance schedule that requires DEP to meet specific milestones. DEP has conducted several studies to identify measures that minimize the need to apply alum to water in the Catskill Aqueduct upstream of Kensico Reservoir and, in accordance with the Catalum SPDES Permit, limit the areal extent of alum floc deposition within Kensico Reservoir.

One operational alternative identified through the studies included moving turbid water out of DEP's water supply system at Ashokan Reservoir, through the existing Ashokan Release Channel. This method of addressing turbidity in the Catskill System was first used following a series of major storm events in 2010. While largely unused for many years, the Ashokan Release Channel was designed to give DEP the option to release water in a controlled manner from Ashokan Reservoir (releases). The only other way water moves out of Ashokan Reservoir and into lower Esopus Creek is through uncontrolled spill at the Reservoir's spillway. Spill occurs when the Reservoir's storage capacity is exceeded. Over time, these spills have formed a natural channel downstream of the spillway that receives these flows of water, which is referred to as the spillway channel. Flows from the Reservoir released through the Ashokan Release Channel converge with the spillway channel at a point referred to as the spillway confluence, and from there, water flows to lower Esopus Creek and ultimately into the Hudson River (**Figure ES-3**).

In late summer 2011, DEP released water through the Ashokan Release Channel in response to Tropical Storms Irene and Lee, and other smaller storm events. On October 18, 2011, DEP began conducting more regular releases through the Ashokan Release Channel based on an initial version of the IRP, which included the community release, a Conditional Seasonal Storage Objective (CSSO), and rules for conducting releases for spill mitigation and in response to turbidity events.

Releases have continued to follow the IRP, which was updated on September 27, 2013 as part of the Consent Order. The Consent Order allows DEP to continue using the Ashokan Release Channel during the development of this EIS. A second important provision of the Consent Order provides for the delay of dredging of the accumulated alum floc in Kensico Reservoir until after the completion of certain infrastructure projects, including aqueduct repairs associated with DEP's Water for the Future (WFF) Program. Alum would be applied during these repairs in accordance with the WFF Alum Treatment Plan (ATP) pursuant to the 2018 Modification to the Catalum Administrative Order on Consent.[4]

[4] In addition, as discussed in Section 14, "Alternatives Analysis," the 2020 Modification to the Catalum Administrative Order on Consent requires DEP to analyze the potential impacts of delaying dredging further until after DEP constructs a filtration plant for the Catskill/Delaware water supply.

Turbidity in Upper Esopus Creek and Ashokan Reservoir

Geologic conditions in DEP's Catskill System watershed can cause episodic changes to water quality as a consequence of events, such as extreme storms, which can erode the naturally occurring silt and clay deposits present in the watershed's relatively steep slopes, stream banks, and channels. Such events result in elevated turbidity levels in the water of the Catskill System, and occasionally in diversions of water from Ashokan Reservoir to Kensico Reservoir.

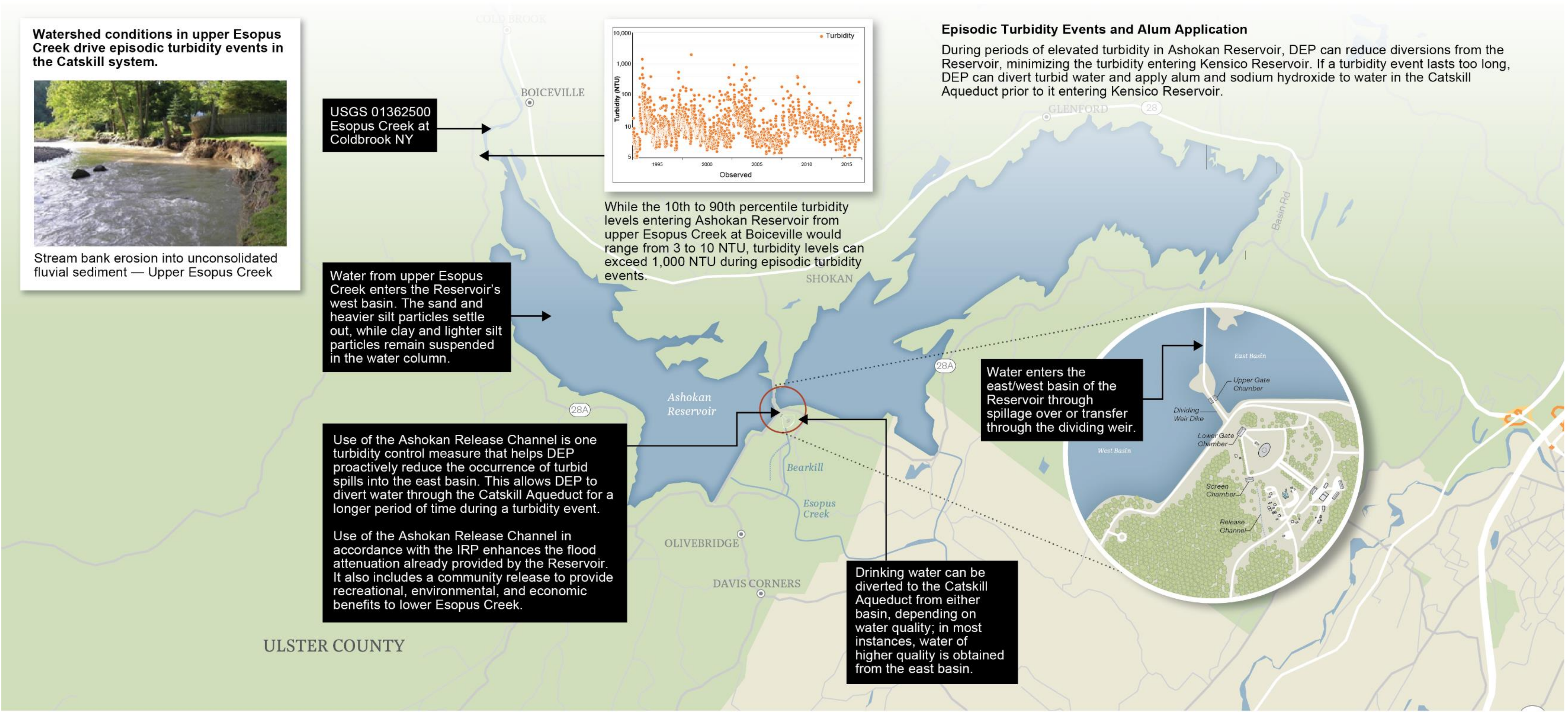

Figure ES-2
Water in Ashokan Reservoir

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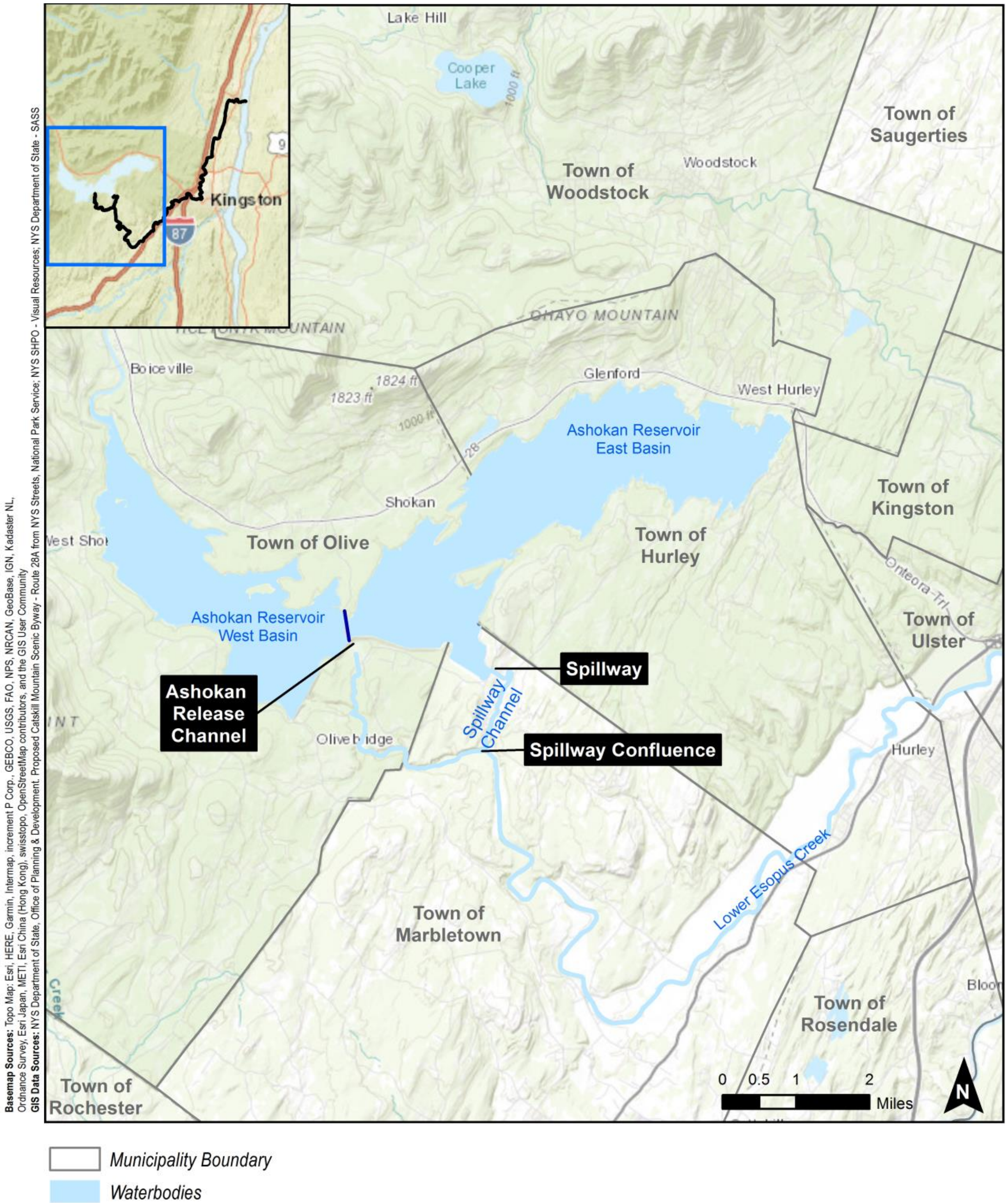

Figure ES-3
Ashokan Reservoir, Ashokan Release Channel, and Spillway

ES 4. OVERVIEW OF THE PROPOSED ACTION

OPERATION OF ASHOKAN RESERVOIR IN ACCORDANCE WITH THE INTERIM ASHOKAN RELEASE PROTOCOL

The Proposed Action includes operation of Ashokan Reservoir in accordance with the IRP to enhance benefits to the community, improve flood attenuation, and provide better water quality. The IRP establishes a set of operating rules for releases of water from Ashokan Reservoir to lower Esopus Creek through the Ashokan Release Channel. During or in anticipation of storm events, water can be released to create a void in Ashokan Reservoir's west basin to store turbid inflows. Releases flow from the Ashokan Release Channel to Little Beaverkill Creek and the upper portion of lower Esopus Creek before converging with the spillway channel at the spillway confluence, which is located about 3,500 feet downstream of the Olivebridge Dam. The combined flows ultimately discharge into the Hudson River at the Village of Saugerties. Operation of Ashokan Reservoir in accordance with the IRP would have the potential to alter the magnitude, duration, frequency, seasonality, and quality of flows of water in lower Esopus Creek and would release water to lower Esopus Creek year-round under most hydrologic conditions. No construction is proposed as part of the Proposed Action.

As summarized on **Figure ES-4** operation of Ashokan Reservoir in accordance with the IRP would include three different release types: a community release to provide recreational, environmental, and economic benefits to lower Esopus Creek; spill mitigation releases to enhance the flood attenuation provided by Ashokan Reservoir; and operational releases to minimize transfer of more turbid west basin water into the east basin of Ashokan Reservoir to protect water quality and enhance the flood attenuation benefit provided by the Reservoir. The IRP prescribes flow and duration criteria for each type of release based on seasonality and turbidity levels. It also sets maximum release magnitudes to no more than 600 million gallons per day (MGD), or 928 cubic feet per second (cfs), and requires DEP to throttle releases as necessary so that the combined flow from the spillway and Ashokan Release Channel does not exceed 1,000 MGD (1,547 cfs).

DELAY OF ALUM FLOC DREDGING AT KENSICO RESERVOIR

The Consent Order recognizes DEP's commitment to completing significant capital infrastructure projects during the next decade to ensure the reliability and sustainability of the City's water supply system. Pursuant to the Consent Order, dredging would not commence until certain DEP infrastructure projects are complete. Therefore, the Proposed Action includes and the EIS evaluated, the delay of dredging of accumulated alum floc at Kensico Reservoir until after completion of these infrastructure projects.

Three of these infrastructure projects are already complete – the Croton Water Filtration Plant, the Catskill and Delaware Aqueduct Interconnection at Shaft 4, and improvements to Catskill Aqueduct Stop Shutters. The remaining infrastructure project, which is underway, consists of repairs to the Rondout West Branch Tunnel (RWBT), a portion of the Delaware Aqueduct, as part of DEP's WFF Program. To facilitate completion of the repairs, the RWBT will be shut down (RWBT shutdown), and DEP will be more heavily reliant upon the water in the Catskill System to meet its customers' water demand. More reliance on the Catskill System during the RWBT shutdown increases the likelihood that the City would need to apply alum to water in the Catskill Aqueduct upstream of Kensico Reservoir during this period. DEP has commenced a project as part of its WFF Program to repair and rehabilitate the Catskill Aqueduct (CAT-RR project) to restore its historic capacity. DEP will apply alum to address turbidity in the water entering Kensico Reservoir during brief periods of aqueduct start-up after shutdowns associated with the

CAT-RR project. DEP evaluated the potential for alum application during the RWBT shutdown and the CAT-RR project in the Water for the Future: Upstate Water Supply Resiliency Final Environmental Impact Statement (FEIS) (CEQR No. 5DEP006U) issued on December 15, 2017.

As discussed, pursuant to the 2018 Modification to the Catalum Administrative Order on Consent, DEP is authorized to apply alum to support these WFF projects in accordance with the WFF ATP. The 2018 Modification also modifies the definition of the Total Dredging Mass that would be removed from Kensico Reservoir. It defines the Total Dredging Mass as the mass of alum floc deposited in Kensico Reservoir under two Emergency Orders in 2005, under authority of the Catalum SPDES Permit, and in accordance with the WFF ATP. The Consent Order also provides milestones for removing the Total Dredging Mass from Kensico Reservoir, including completing the dredging after the RWBT is repaired. Therefore, this EIS also evaluated the environmental considerations of removing the Total Dredging Mass from Kensico Reservoir.

Upon further advancement of the design, duration, and extent of proposed dredging and the development of a more detailed plan for dredging-related activities, additional assessment of potential environmental effects of dredging would be completed, as necessary.

Interim Ashokan Release Protocol (IRP)

NYSDEC and DEP have agreed to implement the IRP to enhance benefits to the community, improve flood attenuation, and provide better water quality as described in the Consent Order. The IRP prescribes flow and duration criteria for community, spill (discharge) mitigation, and operational releases based on seasonality and turbidity.

Community Release Protocol

Provides environmental, recreational, and economic benefits to lower Esopus Creek in a manner that will not adversely impact water supply. Community releases can range between 10 to 15 MGD (15 to 23 cfs) based on seasonality, hydrological conditions, and turbidity.

Spill (Discharge) Mitigation Release Protocol

Releases to reduce/minimize spills into the lower Esopus Creek, enhancing flood mitigation provided by the Ashokan Reservoir, subject to the Conditional Seasonal Storage Objective (CSSO) curve. Maximum flow allowable under discharge releases is 600 MGD (928 cfs), with a maximum of 1,000 MGD (1,547 cfs) in combination with spills.

Operational Release Protocol

Prevents or limits the spilling of more turbid west basin waters into the east basin of the Ashokan Reservoir to protect water quality and enhance flood mitigation benefit to lower Esopus Creek communities. Operational releases allow for release of up to a combined 1,000 MGD (1,547 cfs) of water from the Reservoir to the lower Esopus Creek via the Ashokan Release Channel and through uncontrolled spills over the east basin spillway.

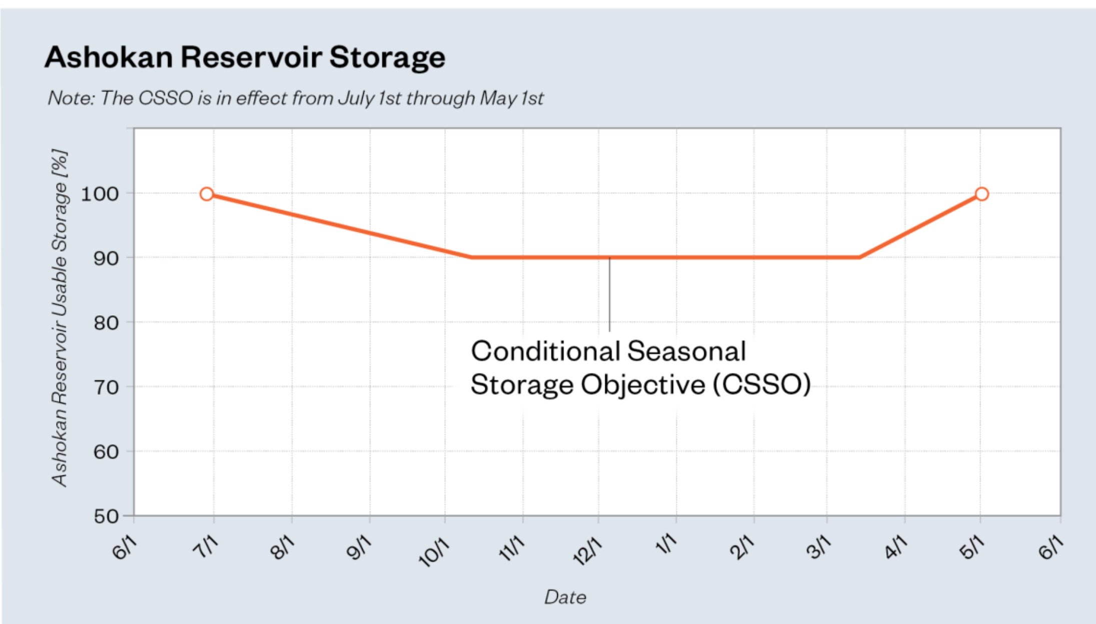

Figure ES-4
Overview of the Interim Ashokan Release Protocol (IRP)

ES 5. PROPOSED ACTION IN THE LOWER ESOPUS CREEK STUDY AREA

This section of the EIS evaluated how the Proposed Action would affect lower Esopus Creek by comparing the future without the Proposed Action (No IRP: no use of the Ashokan Release Channel) to the future with the Proposed Action (IRP: use of the Ashokan Release Channel in accordance with the Interim Ashokan Release Protocol).[5] The lower Esopus Creek study area was generally defined as the 0.25-mile area on either side of lower Esopus Creek along its approximately 33-mile length from Ashokan Reservoir to its confluence with the Hudson River (where lower Esopus Creek ends).

The EIS analysis framework in the lower Esopus Creek study area relied upon a tiered assessment approach for identifying potential benefits and impacts of the Proposed Action along lower Esopus Creek. Potential benefits and impacts would arise from changes to various parameters within lower Esopus Creek such as water depth, water velocity, erosion, sediment deposition, inundation, turbidity, total suspended solids (TSS), and temperature due to potential differences in flow regime and water quality between the future without and with the Proposed Action (**Figure ES-5**). First, potential differences in flow regime (the magnitude, frequency, duration, and seasonality of streamflow within lower Esopus Creek), and water quality were evaluated between the future without and with the Proposed Action. Next, the effect of potential differences in these parameters on the natural and built environment between the future without and with the Proposed Action were assessed for various environmental resources within the EIS (referred to as technical area assessments).

The Esopus Creek valley was formed by centuries of repeated glaciation, stream erosion, and deposition. Some bedrock outcrops exist where surficial deposits never formed or were exposed by erosion. As a result of its geological formations, lower Esopus Creek includes three distinct segments (valley segments), transitioning from a steeply sloped, confined, and fast flowing channel at its upstream-most segment, to a wider, flatter, and slower stream, and finally to a long narrow valley (lacking the wider floodplain present in the upstream segments) confined by bedrock ridges. Lower Esopus Creek streamflow is largely unimpeded along its full length, except for Cantine Dam, a former mill dam which is located approximately one mile upstream of lower Esopus Creek's confluence with the Hudson River. Within these valley segments are areas of similar habitat characteristics for supporting aquatic species, or reaches, defined by NYSDEC. Therefore, lower Esopus Creek was divided into this series of Valley Segment Reaches (valley reaches) for the EIS, as summarized in **Table ES-1** and shown on **Figure ES-6.**

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[5] As described, the Proposed Action would modify the Catalum SPDES Permit to incorporate: (1) Turbidity control measures, including operation of Ashokan Reservoir in accordance with the IRP; and (2) Delay of dredging accumulated material (alum floc) from Kensico Reservoir until the completion of certain infrastructure projects. The Lower Esopus Creek Study Area assessment focuses on operation of Ashokan Reservoir in accordance with the IRP.

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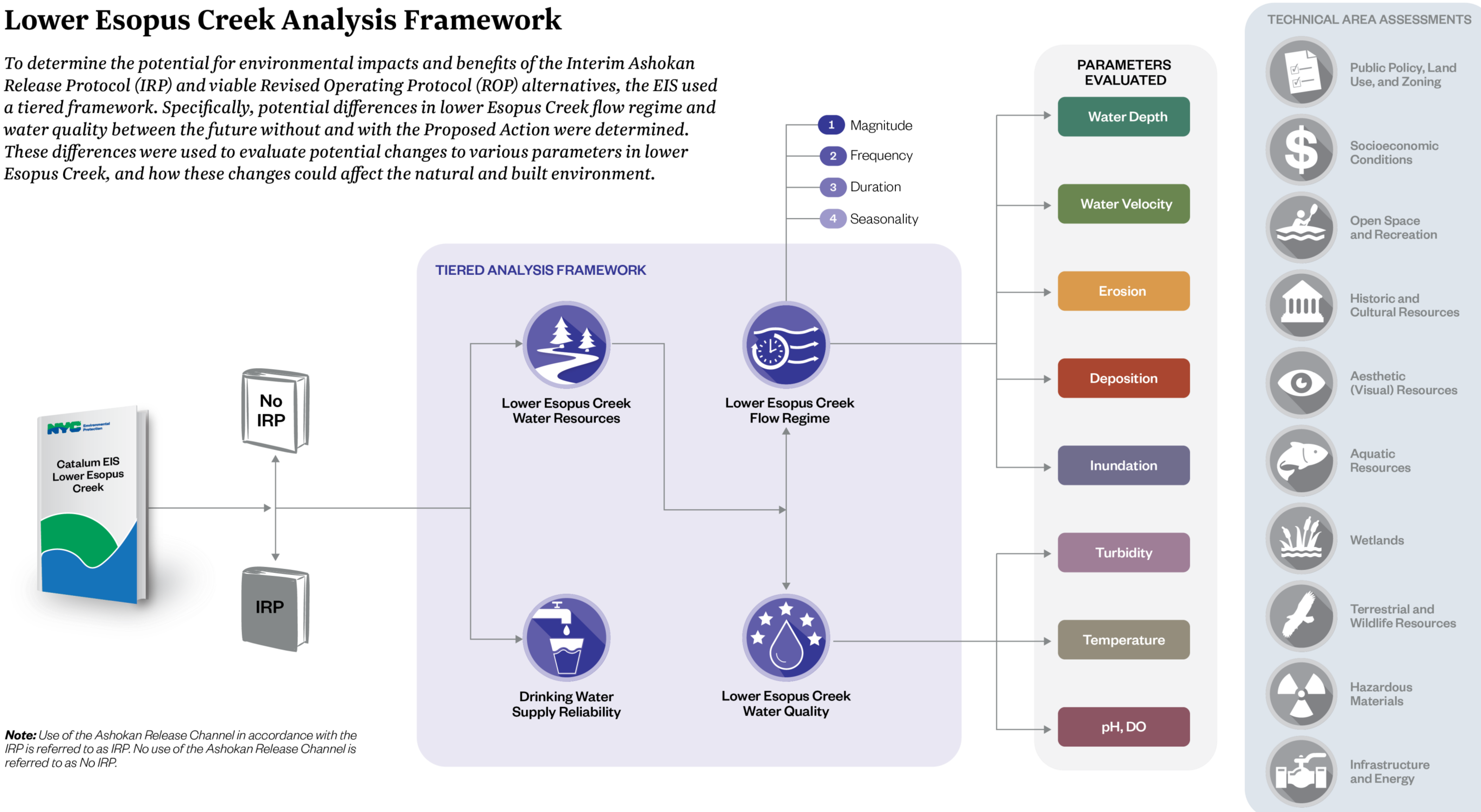
Lower Esopus Creek Analysis Framework

To determine the potential for environmental impacts and benefits of the Interim Ashokan Release Protocol (IRP) and viable Revised Operating Protocol (ROP) alternatives, the EIS used a tiered framework. Specifically, potential differences in lower Esopus Creek flow regime and water quality between the future without and with the Proposed Action were determined. These differences were used to evaluate potential changes to various parameters in lower Esopus Creek, and how these changes could affect the natural and built environment.



Note: *Use of the Ashokan Release Channel in accordance with the IRP is referred to as IRP. No use of the Ashokan Release Channel is referred to as No IRP.*

Figure ES-5
EIS Analysis Framework: Lower Esopus Creek

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Table ES-1. Valley Segments and Reaches of Lower Esopus Creek

Valley Segment	Reach	Valley Reach	Start (Upstream) Location	End (Downstream) Location	Reach Length (Miles)	Valley Segment Length (Miles)	Reach Slope (%)
1	A	1A	Ashokan Dam	Spillway Confluence	3[1]	8.5	0.7
	B	1B	Spillway Confluence	Hurley Mountain Road	5.5		0.5
2	C	2C	Hurley Mountain Road	Leggs Mill Road	16	16	0.1
3	D	3D	Leggs Mill Road	Glenerie Falls	2	8	0.05
	E	3E	Glenerie Falls	Cantine Dam	5		0.2
	F	3F	Cantine Dam	Hudson River	1		unknown

Note:

[1] Reach A includes the reach between the Ashokan Release Channel and the spillway confluence. Reach A does not include the spillway channel (from the east basin to the spillway confluence) or the portion of lower Esopus Creek above the spillway confluence between Olivebridge Dam and the confluence with the upper portion of lower Esopus Creek, which are approximately one additional mile.

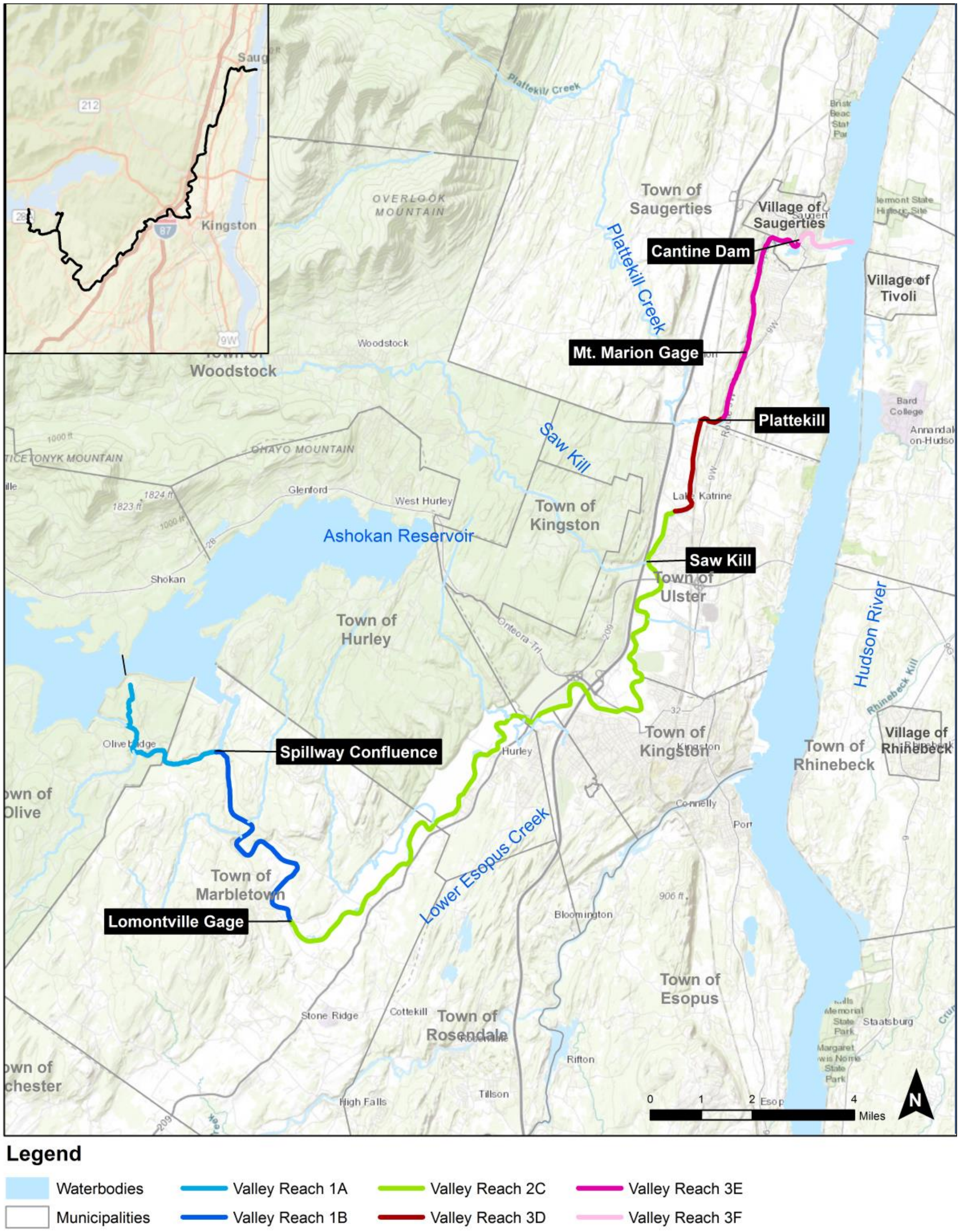

Figure ES-6
Lower Esopus Creek General Study Area

There are several sources of flow to lower Esopus Creek, including runoff from the lower Esopus Creek watershed, spills and releases from Ashokan Reservoir, the Saw Kill tributary (Valley Reach 2C), and the Plattekill tributary (Valley Reach 3D). Together, the Valley Reach 2C watershed (which includes the Saw Kill sub-watershed) and Valley Reach 3D watershed (Plattekill sub-watershed) constitute 80 percent of the lower Esopus Creek watershed. **Table ES-2** and **Figure ES-7** show the percent contribution of each of the sub-watersheds to lower Esopus Creek by valley reach.

Table ES-2. Lower Esopus Creek Watershed by Valley Reach Sub-watershed

Valley Reach	Individual Percent Contribution to the Lower Esopus Creek Watershed Area	Cumulative Percent Contribution to the Lower Esopus Creek Watershed Area
1A	8%	8%
1B	7%	15%
2C	52%	67%
3D	28%	95%
3E	4%	99%
3F	1%	100%

SURFACE WATER INPUTS TO LOWER ESOPUS CREEK

Ashokan Reservoir is one of several sources of flow to lower Esopus Creek. In accordance with the IRP, releases from Ashokan Reservoir to lower Esopus Creek would range from 10 to 15 MGD (23 cfs) (seasonally-based community release) to 600 MGD (928 cfs) (maximum spill mitigation and operational release magnitude). Observed and modeled data were used to assess potential differences in streamflow and water quality conditions in lower Esopus Creek between the future without and with the Proposed Action. To capture the influence of the Proposed Action across various types of inflow conditions, hydrologic condition years were developed to separate out the wettest 25th percentile of years (wet years) and the driest 25th percentile of years (dry years) from a given data set. Normal years were defined as the middle 50th percentile of years. The wet years served as a proxy for evaluating conditions in the future with the Proposed Action that take climate change into consideration. The analysis also evaluated the entire hydrologic record available in DEP's Operation Support Tool model (i.e., 69 years of hydrological records), which includes historical peak storm events and droughts.[6] Observed streamflow within lower Esopus Creek was primarily measured by the U.S. Geological Survey (USGS) gage located at Mount Marion (USGS Gage No. 01364500). This gage is the main source of streamflow data within lower Esopus Creek, beginning in 1970. This gage also started recording turbidity data for lower Esopus Creek in 2013. The Mount Marion gage measures combined streamflow within lower Esopus Creek.

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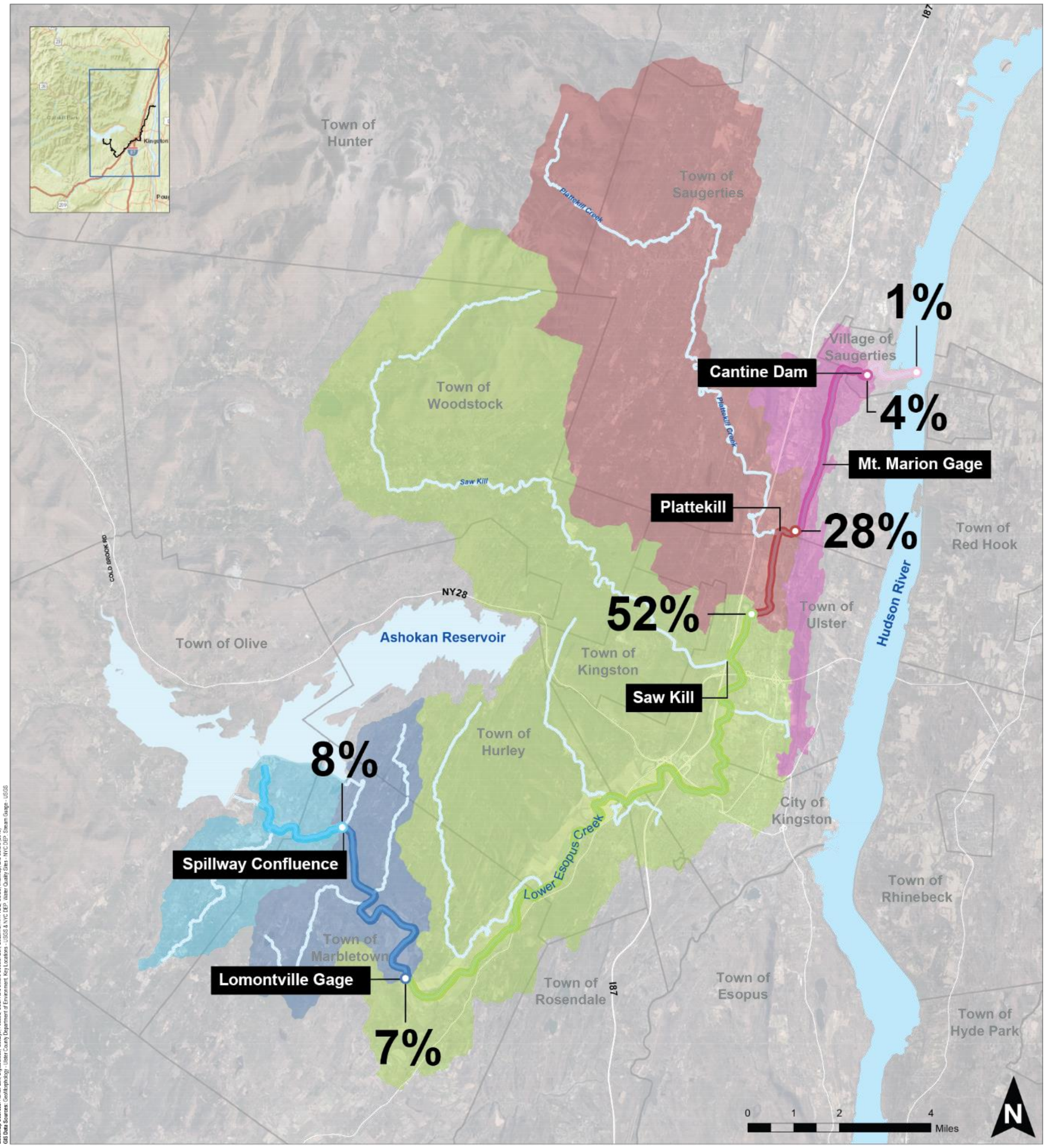
[6] The City's OST is a computer-based model that provides computational and predictive support for water supply operations and planning to facilitate DEP's management of the system, response to changing hydrologic conditions, and understanding of the potential system response to planned and unplanned events, such as infrastructure improvements or storms and droughts, respectively. The hydrologic record within the OST was extended to include available data through 2017 in response to comments received during the National Academy of Science's preparation of *Review of the New York City Department of Environmental Protection Operations Support Tool for Water Supply (2018).*



Percentages shown are the individual contribution of the sub-watershed areas to the lower Esopus Creek watershed area. Sub-watershed boundaries are shaded for each Valley Reach.

Valley Reach 1A
Valley Reach 1B
Valley Reach 2C
Valley Reach 3D
Valley Reach 3E
Valley Reach 3F

Figure ES-7
Sub-watersheds by Valley Reach of Lower Esopus Creek

This combined streamflow is comprised of any flows from Ashokan Reservoir and streamflow within lower Esopus Creek upstream of the gage.[7] Pursuant to the Consent Order, another lower Esopus Creek stream gage was installed at Lomontville (USGS Gage No. 01363556). Flow data for this location were only available beginning in November 2013, with turbidity data available in 2016.

Based on modeling conducted using DEP's Operation Support Tool (OST) across the model's simulation period, the community release would occur 71 percent of the time and flows (inclusive of releases and spill) from Ashokan Reservoir between the community release and maximum release of 600 MGD (928 cfs) would occur 22 percent of the time. Flows from the Reservoir between 600 MGD (928 cfs) and 1,000 MGD (1,547 cfs) would occur four percent of the time, only when the Reservoir is spilling. For the remaining three percent of the time, Reservoir spill would be greater than 1,000 MGD (1,547 cfs) (two percent) or the system would be in a drought (one percent). During periods of spill greater than 1,000 MGD or drought, there would be no releases from Ashokan Reservoir. To further characterize flows from Ashokan Reservoir to lower Esopus Creek, the percent of time that each type of release is anticipated to occur, and the average magnitude of these releases, are presented on **Figure ES-8**. This is shown for wet, normal, and dry years over the model simulation period.[8]

Releases from Ashokan Reservoir would combine with background streamflow in lower Esopus Creek. The percent contribution of flow from Ashokan Reservoir to lower Esopus Creek streamflow is greatest in the upper portions of lower Esopus Creek where the sub-watersheds of the upstream valley reaches represent a smaller portion of the lower Esopus Creek watershed. **Table ES-3** presents the median (50^{th} percentile) contribution of various release flows from Ashokan Reservoir at the end of each valley reach. The percent contribution was not calculated for Valley Reach 3F as this portion of lower Esopus Creek is tidally influenced by the Hudson River. As shown in the table, releases would make up more than half of the streamflow within lower Esopus Creek for all magnitudes of releases through Valley Reach 1B. Downstream of Valley Reach 1B, releases from the Reservoir would become a smaller proportion of the total streamflow within lower Esopus Creek. This is where the area of the sub-basins increases and lower Esopus Creek receives flow from its two major tributaries, the Saw Kill (downstream end of Valley Reach 2C) and Plattekill (downstream end of Valley Reach 3D). The potential effect of each release type, considering other inputs of flow into lower Esopus Creek, is described further below.

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[7] The Mount Marion USGS gage has a total drainage area of 419 square miles, but because of the hydraulic disconnect from the construction of Ashokan Reservoir, the natural drainage area is effectively 164 square miles plus the spills and releases from Ashokan Reservoir.

[8] Note that flushing is also a component of the IRP and its purpose is to limit prolonged periods when release turbidity is elevated above 30 NTU. Flushing would rarely occur over the model simulation period and is not shown on the figure.

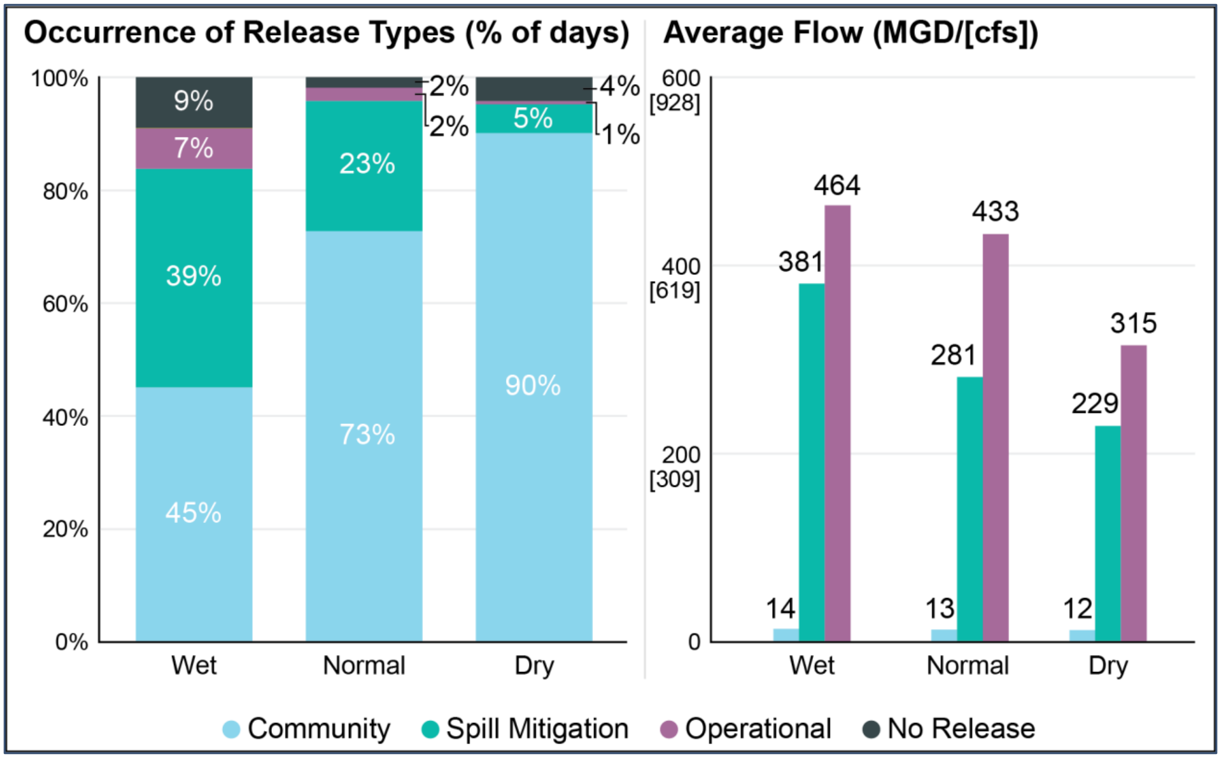

Figure ES-8. Modeled Occurrence and Average Annual Flow of Releases in the Future With the Proposed Action

Table ES-3. Median Contribution of Flows from Ashokan Reservoir to Lower Esopus Creek Background Streamflow in the Future With the Proposed Action

Percent Occurrence of Release and Spill Flow Magnitude[1]	71%	22%	4%[3]
Valley Reach	**Community Release Flow Less than or Equal to 15 MGD (23 cfs) (Percent Contribution)[2]**	**Flow from Ashokan Greater than 15 and Less than or Equal to 600 MGD (928 cfs) (Percent Contribution)**	**Flow from Ashokan Greater than 600 and Less than or Equal to 1,000 MGD (1547 cfs) (Percent Contribution)**
1A	65%	90%	96%
1B	53%	84%	94%
2C	26%	61%	78%
3D	21%	55%	73%
3E	20%	54%	72%
3F	NA	NA	NA

Notes:

[1] The percent occurrence of flow magnitude is the percent of time each flow rate from Ashokan Reservoir would occur in the future with the Proposed Action over the 69-year OST simulation period.

[2] To calculate the percent contribution of Ashokan Reservoir releases to lower Esopus Creek streamflow, modeled daily flows from the OST from 1971 through 2017 were added to the observed background streamflow at Mount Marion over the same time period scaled by valley reach (see Section 5.2, "Lower Esopus Creek Modeling Methodology").

[3] For the remaining three percent of the time, the Reservoir is spilling at a flow magnitude greater than 1,000 MGD (two percent) or the system is in a drought (one percent). During periods of spill greater than 1,000 MGD or drought, there would be no releases from Ashokan Reservoir.

NA – Not applicable

COMMUNITY RELEASE

Unlike the future without the Proposed Action, the future with the Proposed Action would provide sustained flow to lower Esopus Creek year-round (via the community release). Upstream of the spillway confluence, in Valley Reach 1A, the median contribution of the community release to streamflow in lower Esopus Creek would be 65 percent. In the future without the Proposed Action, there would be no flows to Valley Reach 1A from Ashokan Reservoir. Therefore, potential differences between the future without and with the Proposed Action would have the greatest potential to affect this portion of lower Esopus Creek. The community release would continue to comprise a greater percentage of the streamflow through the end of Valley Reach 1B. Downstream of Valley Reach 1B, the community release would provide sustained flow, but at a smaller percentage of overall streamflow in lower Esopus Creek. This less pronounced effect of sustained flows downstream would be due to natural flows from additional sub-basins of lower Esopus Creek through Valley Reach 3D. Even further downstream, Valley Reach 3F (located downstream of Cantine Dam), is tidally influenced from the Hudson River. These tidal flows are the key driver of the flow regime in Valley Reach 3F and any flow effects from the community release are not anticipated to affect Valley Reach 3F. While the community release is of smaller magnitude than maximum spill mitigation and operational releases, it would help to maintain the CSSO and enhance flood attenuation already provided by Ashokan Reservoir.

In the future with the Proposed Action, in the summer, the community release would have the potential to cool water temperature in Valley Reaches 1A and 1B. It is not anticipated that the community release would affect temperature within lower Esopus Creek downstream of Valley Reach 1B since the percent contribution of flow diminishes past this point. Given the percent contribution of flow of the community release in Valley Reach 1A, and the small number of tributaries along this reach, turbidity within Valley Reach 1A is anticipated to be equal to that of releases from Ashokan Reservoir. Turbidity of the community release is anticipated to be low, with a median modeled turbidity of 1.8 NTU.

SPILL MITIGATION RELEASES

Spill mitigation releases in the future with the Proposed Action would be conducted to maintain the CSSO in Ashokan Reservoir established by the IRP and would not occur in the future without the Proposed Action. The IRP provides for spill mitigation releases up to 600 MGD (928 cfs) and requires DEP to throttle releases as necessary so that the combined flow from the spillway and Ashokan Release Channel does not exceed 1,000 MGD (1,547 cfs). In addition, the IRP requires DEP to cease all releases from Ashokan Reservoir in instances when the Mount Marion gage is within one foot of the flood "Action Stage" stage and forecasted to reach the flood Action Stage. These requirements are designed to reduce the potential for downstream flooding associated with operation of Ashokan Reservoir in accordance with the IRP. Spill mitigation releases would also follow prescribed ramping rates to limit how quickly total streamflow within lower Esopus Creek increases and decreases as a result of releases through the Ashokan Release Channel.

Therefore, compared to the future without the Proposed Action, spill mitigation releases in the future with the Proposed Action would provide a flood attenuation benefit beyond that provided by Ashokan Reservoir and the community release for all portions of lower Esopus Creek downstream of the spillway confluence in two ways: (1) by reducing the number of spill events from proactive management of the Reservoir water level to maintain the CSSO; and (2) by converting shorter duration, higher flow spill events into longer duration, lower flow release events with more gradual ramping rates.[9]

Modeling indicated that spill mitigation releases would only occur 22 percent of the time, mostly in the winter and spring. In Valley Reach 1A, the median percent contribution of releases up to 600 MGD (928 cfs) would be 90 percent. In the future without the Proposed Action, there would be no flows to Valley Reach 1A, which is upstream of the spillway confluence, from Ashokan Reservoir. Therefore, differences between the future without and with the Proposed Action for releases up to 600 MGD (928 cfs) would have the greatest potential to affect this portion of lower Esopus Creek.

Spill mitigation releases up to 600 MGD (928 cfs) in the future with the Proposed Action are anticipated to have a potential to affect lower Esopus Creek through the downstream end of Valley Reach 2C. At the downstream end of Valley Reach 2C, the median percent contribution of flow from Ashokan Reservoir would reduce to 61 percent due to the increasing size of the sub-watersheds contributing flow to lower Esopus Creek. The Saw Kill joins lower Esopus Creek at the end of Valley Reach 2C, with the Plattekill joining just downstream at the terminus of Valley Reach 3D, where releases up to 600 MGD (928 cfs) would comprise approximately 54 percent of streamflow within lower Esopus Creek. The percent contribution of flows from Ashokan Reservoir up to 600 MGD (928 cfs) to streamflow in Valley Reach 3E at its terminus at Cantine Dam would be 51 percent. As stated above, Valley Reach 3F is tidally influenced from the Hudson River and any flow effects from spill mitigation releases are not anticipated to affect Valley Reach 3F.

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[9] The flood attenuation benefit would not be realized upstream of the spillway confluence in Valley Reach 1A since spills do not flow through this portion of lower Esopus Creek.

OST modeling estimated that the median turbidity level of spill mitigation releases would be 6.6 NTU in the future with the Proposed Action. Turbidity levels would be similar between the future without and with the Proposed Action and would be within the range and variability of turbidity levels in lower Esopus Creek. In the future with the Proposed Action, spill mitigation releases would follow requirements established by the IRP to limit duration of releases based on turbidity levels.

Only 13 percent of the spill mitigation releases that would occur over the OST simulation period are anticipated to occur in the summer. These releases would have the potential to cool water temperature along lower Esopus Creek, with a diminishing effect downstream of Valley Reach 2C.[10] Valley Reach 3F is tidally influenced and any temperature effects from spill mitigation releases are not anticipated to affect this valley reach. Given the size of turbidity particles transferred through flows from Ashokan Reservoir, it is not anticipated that turbidity within spill mitigation releases that has not settled in the Reservoir under quiescent conditions would settle in the faster moving water of lower Esopus Creek.

OPERATIONAL RELEASES

The third type of release in the future with the Proposed Action would be operational releases. Operational releases would be used to prevent spill of turbid water from the west basin to the east basin to protect the quality of water diverted to Kensico Reservoir. As with spill mitigation releases, operational releases conducted in accordance with the IRP would be limited in duration based on the level of turbidity in water released from Ashokan Reservoir. Releases of water with turbidity levels greater than 100 NTU are not permitted except when the turbidity level of inflow to Ashokan Reservoir from upper Esopus Creek is greater than 100 NTU. Operational releases must also follow prescribed ramping rates to limit how quickly total streamflow within lower Esopus Creek increases or decreases as a result of releases through the Ashokan Release Channel. The percent contribution of flow and associated potential for effects along lower Esopus Creek described for spill mitigation releases up to 600 MGD (928 cfs) would be the same for operational releases up to 600 MGD (928 cfs). However, operational releases are anticipated to occur less than five percent of the time, mostly as a result of episodic turbidity events. When operational releases are anticipated to occur, they would tend to occur in the late winter to early spring (from contributions of rainfall events and spring snowmelt) and late summer (from tropical storms). The median duration of operational release events is anticipated to be 3 days over the OST model simulation period with a median turbidity level of 15 NTU.

SUMMARY OF POTENTIAL IMPACTS AND BENEFITS OF THE PROPOSED ACTION ON LOWER ESOPUS CREEK

As discussed, the assessment of potential benefits and impacts of the Proposed Action on lower Esopus Creek was conducted using a tiered approach. First, a water resources and water quality assessment was conducted to determine the potential effects of the Proposed Action to streamflow and water quality conditions within the lower Esopus Creek study area. Specifically, an assessment was conducted to evaluate potential differences between the future without and with the Proposed Action on the magnitude, duration, frequency, and seasonality of streamflow (flow regime) and turbidity levels, temperature, dissolved oxygen, and pH (water quality). Various parameters associated with potential differences in the flow regime and water quality of lower Esopus Creek between the future without and with the Proposed Action were identified and evaluated, as applicable, for each technical area assessment. **Figure ES-9** summarizes the differences in flow regime and water quality, and potential differences for each parameter, between the future without and with the Proposed Action.

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[10] The percent of time spill mitigation releases would occur in the summer was established using a seasonal analysis over the OST simulation period.

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Potential Differences Between the Future Without and With the Proposed Action for Lower Esopus Creek

Differences in flow regime and water quality between the future without and with the Proposed Action are drivers for potential impacts and benefits within the lower Esopus Creek Study Area. These differences, and their effect on the parameters evaluated as part of the lower Esopus Creek analysis framework, were used as the basis for conducting the technical area assessments.

FLOW REGIME

1 Magnitude

- Ashokan Reservoir is **one of several sources of flow** to lower Esopus Creek.
- The influence of flows from Ashokan Reservoir diminishes moving downstream.
- In the future with the Proposed Action, **Valley Reach 1A would receive flows from both Ashokan Reservoir and the contributing sub-watershed.** In the future without the Proposed Action, this valley reach would only receive flows from the contributing sub-watershed.
- **The magnitude of storm recurrence intervals would be reduced** in the future with the Proposed Action.

2 Frequency

- The future with the Proposed Action **would further enhance flood attenuation provided by Ashokan Reservoir.**
- **The community release would occur 71% of the time.** Flows (both releases and spills) from Ashokan Reservoir between the community release and 600 MGD (928 cfs) would occur 22% of the time and flows between 600 and 1,000 MGD (928 to 1,547 cfs) would occur 4% of the time.

3 Duration

- In the future with the Proposed Action, the IRP **would convert shorter duration, higher flow spill events into lower flow releases of longer duration,** reducing variability of streamflow in lower Esopus Creek.

4 Seasonality

- The **community release would provide a sustained flow to lower Esopus Creek year-round** and enhance the flood attenuation already provided by Ashokan Reservoir.
- Seasonality of **spills and releases in the future with the Proposed Action would be the same as spills in the future without the Proposed Action, occurring more frequently in the winter and spring.**

Water Depth and Velocity

- Differences in the velocity and depth of streamflow between the future without and with the Proposed Action would be **greatest in Valley Reach 1A** and diminish moving downstream.
- **Median velocities in the future with the Proposed Action would be comparable** to those in the future without the Proposed Action.
- **Differences in median depth** along lower Esopus Creek **would be a ½-foot or less.**

Erosion and Deposition

- There are no **anticipated differences of aggradation or degradation of the streambed** between the future without and with the Proposed Action.
- **Streambank erosion would be comparable** between the future without and with the Proposed Action.
- **Valley Reach 2C is most susceptible to streambank erosion** and is influenced by localized factors affecting bank retreat in both the future without and with the Proposed Action.
- Differences in streamflow between the future without and with the Proposed Action would **not result in impacts to overall channel stability of lower Esopus Creek.**

Inundation

- Streamflow up to approximately 4,000 MGD (6,189 cfs) remain within the channel of lower Esopus Creek and therefore, **flows in the range of maximum releases in the future with the Proposed Action are not anticipated to flood infrastructure or roadways.**
- **Streamflow up to 1,000 MGD (1,547 cfs) is below the channel forming discharge** and would inundate, but not substantially reshape an in-channel feature referred to as the Inner Berm.

WATER QUALITY

Turbidity/TSS

- **Based on OST modeling, releases (all types) from Ashokan Reservoir are anticipated to have low levels of turbidity (5 NTU or less), 70% of the time.** Turbidity of the community release would be 5 NTU or below approximately 90% of the time.
- **Since implementation of the IRP in 2013, 68% of the releases from Ashokan Reservoir have had turbidity levels of 5 NTU or less.**
- Turbidity that has not settled in the **quiescent conditions of Ashokan Reservoir is not anticipated to settle** in the faster moving water of lower Esopus Creek.
- **Observed turbidity levels in streamflow are primarily influenced by the localized conditions of the lower Esopus Creek watershed,** as opposed to flows from Ashokan Reservoir.
- **Turbidity levels of flow from Ashokan Reservoir in the future with the Proposed Action would be comparable to those in the future without the Proposed Action and within the range and variability of turbidity levels that occur in lower Esopus Creek streamflow.**

Temperature

- Releases in the future with the Proposed Action are anticipated to cool **lower Esopus Creek temperatures in summer.**
- The extent of temperature effects would **depend on flow magnitude** and diminish moving downstream.

pH, DO

- **There is no anticipated difference in pH and DO** within lower Esopus Creek between the future without and with the Proposed Action.

Figure ES-9
Potential Differences Between the Future Without and With the Proposed Action on Lower Esopus Creek

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Each parameter was evaluated along the length of lower Esopus Creek. For the reasons summarized below, no significant adverse impacts are anticipated as a result of the Proposed Action, and implementation of the IRP would provide a benefit via enhanced flood attenuation and sustained flows from the community release.

PUBLIC POLICY, LAND USE, AND ZONING

Public policies within the study area have been established to protect communities from flooding, maintain the character and recreational opportunities along lower Esopus Creek, maintain the integrity of historic resources, and limit erosion and disturbance of natural resources. The Proposed Action would provide a flood protection benefit by reducing the number, magnitude, and duration of spill events from Ashokan Reservoir. Furthermore, the IRP would require DEP to throttle releases as necessary so that the combined flow from Ashokan Reservoir (spill and release) does not exceed 1,000 MGD (1,547 cfs), and to cease releases in instances when the Mount Marion gage is within one foot of the flood Action Stage and forecasted to reach the flood Action Stage. Flows in the range of releases in the future with the Proposed Action would not result in inundation of structures (flooding). Erosion between the future without and with the Proposed Action would be comparable.

From a natural resources and recreational perspective, the Proposed Action would provide a benefit of sustained flow to lower Esopus Creek year-round. No significant adverse impacts related to cultural and historic resources are anticipated as a result of the Proposed Action. Therefore, the Proposed Action is consistent with public policies within the study area. The Proposed Action would not involve construction, nor would it cause changes to land use or zoning. Therefore, there are no anticipated significant adverse impacts to the lower Esopus Creek study area public policy, land use, and zoning as a result of the Proposed Action.

SOCIOECONOMIC CONDITIONS

Many businesses located within the study area have a portion of their revenue that can be influenced by recreational use and/or the aesthetic qualities of lower Esopus Creek, either seasonally or year-round (e.g., lodging, campgrounds, restaurants). Furthermore, lower Esopus Creek is the predominant recreational resource in the study area, providing a number of recreational opportunities such as fishing, swimming, and boating to residents and visitors. As a result, changes in lower Esopus Creek streamflow and water quality conditions may affect resident spending (relative to lower Esopus Creek recreational activities) or business revenues, which could in turn influence the socioeconomic conditions of the study area.

Conditions within lower Esopus Creek did not have an observable effect on prices of single-family homes located along the lower Esopus Creek waterfront during the period of analysis (between 2007 and 2017).

Based on responses to a questionnaire obtained via a survey conducted to support the socioeconomic assessment, the community release would have the potential to increase the number of days survey respondents would participate in recreational activities along lower Esopus Creek by providing sustained flow to lower Esopus Creek. Some survey respondents indicated that the *high flow, very cloudy water* condition, could have the potential to reduce the number of days they would participate in recreational activities along lower Esopus Creek (and potentially result in reduced spending). Likewise, some business survey results indicated that *high flow, very cloudy water* conditions may decrease revenue due to decreased sales and/or higher operating costs. However, the occurrence of these conditions would be infrequent, and similar between the future without and with the Proposed Action. Any potential reduction in the number of days respondents participate in recreational activities along lower Esopus Creek associated with infrequent, short-duration, high flow, high turbidity conditions would be minor overall, and would result in minimal changes in spending and effects to socioeconomic conditions, if any.

Therefore, the Proposed Action is not anticipated to cause a significant adverse impact on socioeconomic conditions within the lower Esopus Creek study area.

OPEN SPACE AND RECREATION

The Proposed Action has the potential to improve swimming, fishing, and boating recreational opportunities by providing sustained flow to lower Esopus Creek year-round through the community release, though the benefit of this sustained flow would diminish moving downstream. Since a majority of the recreational activities occur in the downstream portions of lower Esopus Creek (i.e., Valley Reaches 3D and 3E) the potential benefit would be small. Potential differences in streamflow between the future without and with the Proposed Action are not anticipated to impact recreational opportunities associated with swimming, fishing, and boating. The number of days with turbidity levels in lower Esopus Creek streamflow greater than 25 NTU in the future without and with the Proposed Action would be similar. Turbidity levels of lower Esopus Creek streamflow in the future with the Proposed Action would be within the range and variability of turbidity levels that occur in the future without the Proposed Action. Therefore, no significant adverse impacts to open space and recreation are anticipated as a result of the Proposed Action.

HISTORIC AND CULTURAL RESOURCES

Fifty-six of the sixty historic architectural resources identified in the study area are located more than 200 feet away from lower Esopus Creek. The Ashokan-Turnwood Covered Bridge, located within the channel in Valley Reach 1A, falls within the inundation boundary associated with releases up to 600 MGD as defined by the HEC-RAS modeling for the future with the Proposed Action. Three historic structures, Warehouses 1 and 2 of the Saugerties Steamboat Co. and the Saugerties Lighthouse – are located downstream of Cantine Dam in Valley Reach 3F, which is tidally influenced and would not be affected by potential differences in streamflow between the future without and with the Proposed Action. While the Covered Bridge is located within the inundation boundary associated with releases up to 600 MGD (928 cfs), it has regularly experienced water levels associated with 600 MGD releases. A field visit conducted in fall 2018 showed that water levels associated with this release level do not reach the bridge deck. Furthermore, the New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP) was consulted and their determination indicated that the Proposed Action would have no impact on archaeological and/or historic resources within the study area, including the Covered Bridge, the Ashokan Field Campus Historic District, the Kingston Stockade District, and the Hurley Historic District. Therefore, there are no anticipated significant adverse impacts to historic or cultural resources as a result of the Proposed Action.

AESTHETIC (VISUAL) RESOURCES

In the future with the Proposed Action, releases would increase the streamflow velocity and depth in Valley Reach 1A of lower Esopus Creek as compared to the future without the Proposed Action. The extent of inundation would increase, most noticeably, in narrow portions of lower Esopus Creek, but would remain within the channel. Turbidity levels of the releases would be below 5 NTU over 70 percent of the time. In valley reaches downstream of the spillway confluence, streamflow velocity would be comparable to those in the future without the Proposed Action. While water depth and the extent of inundation would increase, streamflow would remain within the channel. Turbidity levels would be similar between the future without and with the Proposed Action and would be within the range and variability of turbidity levels in lower Esopus Creek streamflow. Potential differences in water depth, velocity, and inundation between the future without and with the Proposed Action are not anticipated to impact views of lower Esopus Creek from aesthetic resources, as viewers would continue to enjoy a similar visual experience of lower Esopus Creek and its surroundings. Therefore, no significant adverse impacts to aesthetic (visual) resources are anticipated as a result of the Proposed Action.

AQUATIC RESOURCES

The Proposed Action would provide sustained flow to lower Esopus Creek from Ashokan Reservoir which would have the potential to benefit fish, particularly during low streamflow conditions and within Valley Reach 1A. Flow from Ashokan Reservoir to Valley Reach 1A during the summer would be a potential benefit to the cold-water fishery in this reach (e.g., trout) that prefer cooler temperatures, while warm-water species (e.g., bass, sunfish) would not be affected by alterations in temperature as a result of flow from the Reservoir in the future with the Proposed Action.

As discussed, turbidity levels in streamflow would be similar between the future without and with the Proposed Action. Turbidity levels of flow from Ashokan Reservoir in the future with the Proposed Action would be within the range and variability of turbidity levels that occur in lower Esopus Creek in the future without the Proposed Action. Overall, lower Esopus Creek supports a diverse and stable benthic community including taxa considered relatively intolerant of poor water quality conditions. Based on observed differences between benthic sampling stations during field assessments conducted to support the EIS, it is likely that localized factors affect benthic communities. The type of localized factors that may affect these communities include surface water runoff and water quality conditions that would occur in the future both without and with the Proposed Action.

Literature searches and field analyses indicated that the turbidity levels and duration in the IRP are appropriate for protection of most fish species found within lower Esopus Creek downstream of the spillway confluence under all life stages. Therefore, there are no anticipated significant adverse impacts to aquatic resources as a result of the Proposed Action.

However, as discussed in Section ES.8, “Proposed Revised Operating Protocol, Proposed Revised Monitoring Plan, and Additional Considerations,” the Proposed Revised Operating Protocol proposes to modify the release turbidity levels that trigger flushing to 25 and 50 NTU to reduce the potential for stress to aquatic species upstream of the spillway confluence.

WETLANDS AND FLOODPLAIN FORESTS

The Proposed Action would provide sustained flow to lower Esopus Creek year-round from the community release. Streamflow velocity and inundation associated with the Proposed Action would be similar to magnitudes and water levels anticipated to occur in the future without the Proposed Action and the same as baseline conditions. Observed changes to wetlands and floodplain forest communities along lower Esopus Creek during monitoring conducted to support the EIS were related to tree mortality associated with insect infestation and disease. Wetland and floodplain forest communities in the study area have experienced the full range of streamflow anticipated to occur in the future with the Proposed Action with no discernible changes to wetland boundaries or flow-related vegetative composition. Therefore, no significant adverse impacts to wetlands and floodplain forests are anticipated as a result of the Proposed Action.

WILDLIFE AND VEGETATION

In the future with the Proposed Action, streamflow in the range of release magnitudes would be contained within the stream channel. Therefore, streamflow in the range of the releases in the future with the Proposed Action would only inundate in-channel features such as the inner berm and mid-channel bars, features that would be frequently wetted in both the future without and with the Proposed Action. Wetland studies indicated that downed trees in the study area would continue to be driven by natural processes such as beaver predation, invasive species (i.e., Emerald Ash Borer), and disease. Because habitat is not anticipated to be affected as a result of the Proposed Action, conditions for amphibians, insects, and wading birds are anticipated to continue to remain suitable for these wildlife and terrestrial resources. Additionally, species that do utilize in-channel features are well adapted to the dynamic hydrological conditions that occur within stream channels. Furthermore, the Proposed Action is anticipated to have no effect on any threatened or endangered species or their habitat that have the potential to occur within the study area. Therefore, the Proposed Action is not anticipated to result in significant adverse impacts to terrestrial and wildlife habitat, wildlife corridors, or wildlife species that occur within the lower Esopus Creek study area.

HAZARDOUS MATERIALS

All hazardous material sites identified within the study area are located in Valley Reach 3F. This valley reach is downstream of Cantine Dam and tidally influenced by the Hudson River, and therefore, would not be affected by potential differences between the future without and with the Proposed Action. Therefore, there are no anticipated significant adverse impacts to hazardous materials as a result of the Proposed Action.

INFRASTRUCTURE AND ENERGY

The existing water and wastewater infrastructure located within the study area is not located within the stream channel and therefore would not be at risk of flooding nor would it benefit from additional flood attenuation in the future with the Proposed Action. Valley Reach 2C is most susceptible to erosion in both the future without and with the Proposed Action. There is a sewer interceptor operated by the Town of Ulster Wastewater Treatment Plant located in Valley Reach 2C. This sewer interceptor and several manholes associated with the Town of Ulster Wastewater Treatment Plant are located near areas of observed erosion, or on the outside of meander bends which are more susceptible to erosive forces. However, the rate of erosion is expected to be comparable between the future without and with the Proposed Action. Inundation and erosion are not anticipated to affect other municipal water supply and wastewater facilities and distribution infrastructure. Similarly, properly constructed and maintained private wells and septic systems with appropriate separation distances from the ordinary high-water mark for lower Esopus Creek would be unaffected by differences in streamflow between the future without and with the Proposed Action. A review of water quality reports for the Town of Ulster, which draws its water from three wells located in the floodplain of lower Esopus Creek, did not reveal any changes in turbidity or other water quality data over the period in which the reports are available (which includes the occurrence of Tropical Storms Irene and Lee in 2011). Furthermore, the Proposed Action does not have the potential to affect water consumption, sewage generation rates, or electrical demand. Therefore, significant adverse impacts to existing infrastructure within the study area are not anticipated as a result of the Proposed Action.

ES 6. PROPOSED ACTION IN THE KENSICO RESERVOIR STUDY AREA

Modification of the Catalum SPDES Permit in the future with the Proposed Action requires an analysis of the potential effects of the delay of dredging of alum floc at Kensico Reservoir associated with the application of alum to the Catskill Aqueduct (since 2005 and in accordance with the WFF ATP) upstream of Kensico Reservoir, as well as an assessment of environmental considerations associated with this dredging. The assessment compared the future without the Proposed Action (no dredging) to the future with the Proposed Action (delay of dredging).[11] As shown on **Figure ES-10,** the study area for environmental considerations of dredging at Kensico Reservoir includes a staging and support area near the Catskill Aqueduct Influent Chamber (CATIC) site, a potential location for a facility near Westlake Drive to support dewatering of dredged material (dewatering site), an area for two temporary pipelines between the CATIC and dewatering sites. It also includes the proposed dredging area that is anticipated to occur within the limits of the approximate area of floc deposition in the vicinity of CATIC Cove where water from the Catskill Aqueduct discharges to Kensico Reservoir. Environmental considerations of dredging are evaluated for the entire study area.

DELAY OF DREDGING

In the future with the Proposed Action (delay of dredging), existing alum floc would continue to remain in place and the deposition of new alum floc in Kensico Reservoir would increase as a result of alum application in accordance with the WFF ATP. In the future with the Proposed Action, general compliance with water quality standards would remain unchanged. NYSDEC-designated best uses for Kensico Reservoir, including use as a drinking water supply, would continue to be achieved as has been the case for many years.

New deposition is anticipated to occur only within the same lateral extent of the Kensico Reservoir CATIC Cove associated with alum floc deposition since 2005. The diversity and presence of existing benthic communities within previously deposited alum floc are anticipated to continue to persist as documented from a comparison of 2007 and 2014 benthic sampling events that were completed after several previous alum applications. Likewise, impacts to other aquatic species, specifically fish, are not anticipated from the existing or newly deposited alum floc. No impacts to water quality or wetlands are expected to occur as these would remain comparable to current conditions. Similarly, adverse impacts from existing floc have not been observed – water quality standards and designated uses for Kensico Reservoir have been and continue to be met. Potential impacts associated with aluminum present within alum floc are not anticipated since the long-term water quality characteristics of Kensico Reservoir (i.e., neutral pH levels) do not support the conditions necessary for bioavailability of aluminum that would potentially result in adverse impacts to benthos or fish. The delay of dredging would also not result in potential impacts to the community. No active site preparation or construction activities would occur during the period of delay and therefore potential impacts to transportation, air quality, or noise are not anticipated with a delay of dredging. Likewise, potential impacts to historic resources, open space and recreation, aesthetics, or upland habitat anticipated with dredging or site preparation, such as clearing and site access road construction, are not expected to occur with the delay of dredging. Therefore, the delay of dredging is not anticipated to result in a significant adverse environmental impacts within the Kensico Reservoir study area.

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[11] As described, the Proposed Action would modify the Catalum SPDES Permit to incorporate: (1) Turbidity control measures, including operation of Ashokan Reservoir in accordance with the IRP; and (2) Delay of dredging accumulated material (alum floc) from Kensico Reservoir until the completion of certain infrastructure projects. The Kensico Reservoir Study Area assessment focuses on delay of dredging.

ENVIRONMENTAL CONSIDERATIONS OF DREDGING

Figure ES-11 shows the modeled range of average settled thickness of the alum floc in Kensico Reservoir. Any dredging in the future would be focused on the dredging of alum floc deposited in Kensico Reservoir under two Emergency Orders in 2005, under authority of the Catalum SPDES Permit, and in accordance with the WFF ATP.[12] Implementation of dredging in the future would require careful consideration of its potential effects, including cumulative effects from potential overlap with another planned DEP project in the vicinity of the study area – the Kensico Eastview Connection (KEC) Project. While engineering controls would be used during dredging of alum floc within Kensico Reservoir in the future, this work would introduce equipment and result in disturbance that would increase turbidity to the Reservoir. Therefore, the work would pose some risk to DEP's ability to meet the stringent site-specific filtration avoidance criteria of their Filtration Avoidance Determination that allows the City to comply with U.S. Environmental Protection Agency's (EPA) Surface Water Treatment Rule. A more detailed assessment would need to consider the potential design, duration, and extent of proposed dredging that would be further refined in the future; however, the EIS includes identification of resource areas that would warrant environmental consideration and are summarized in **Table ES-4**.

[12] This is the 'Total Dredging Mass' as defined by the 2018 Modification to the Catalum Administrative Order on Consent.

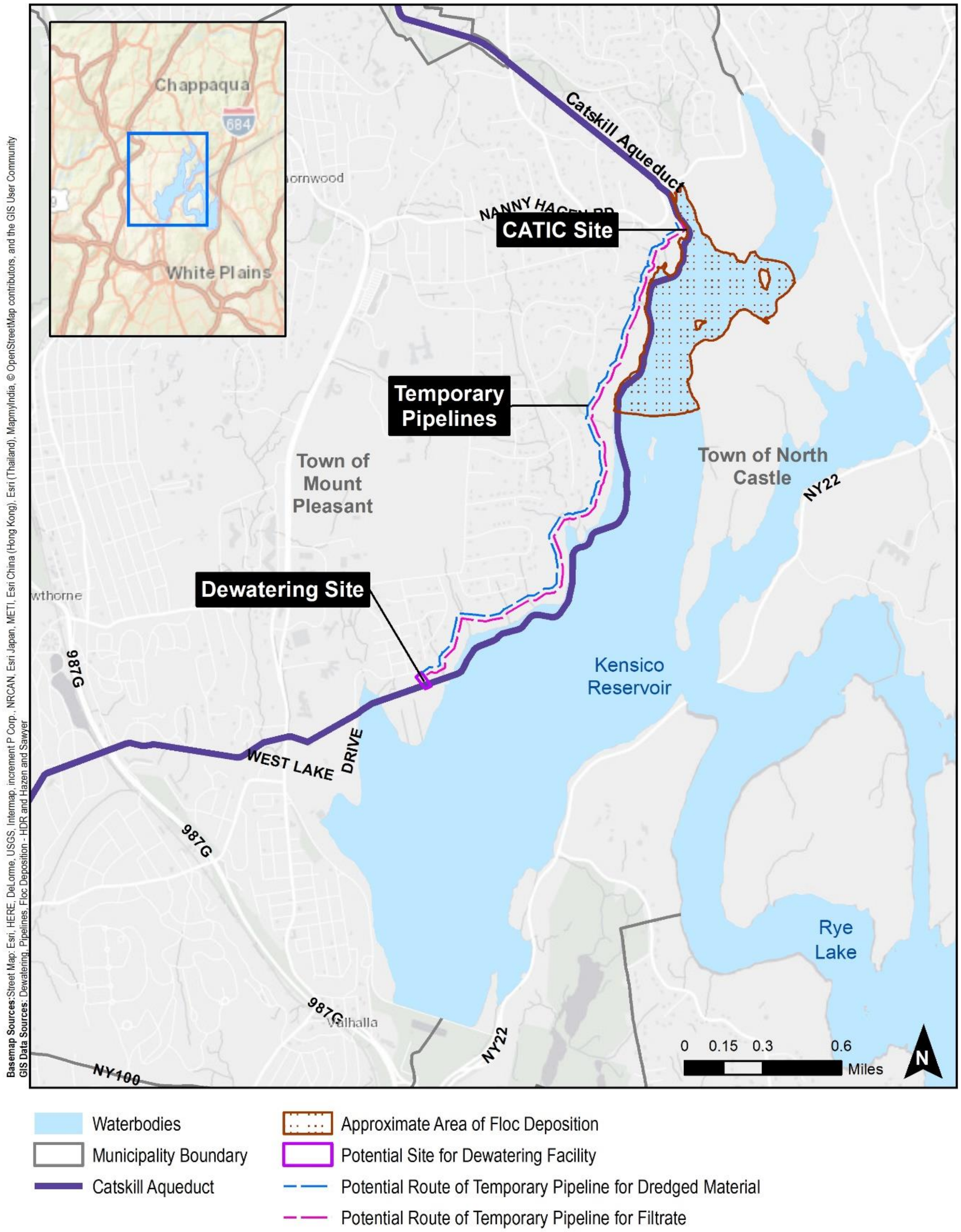
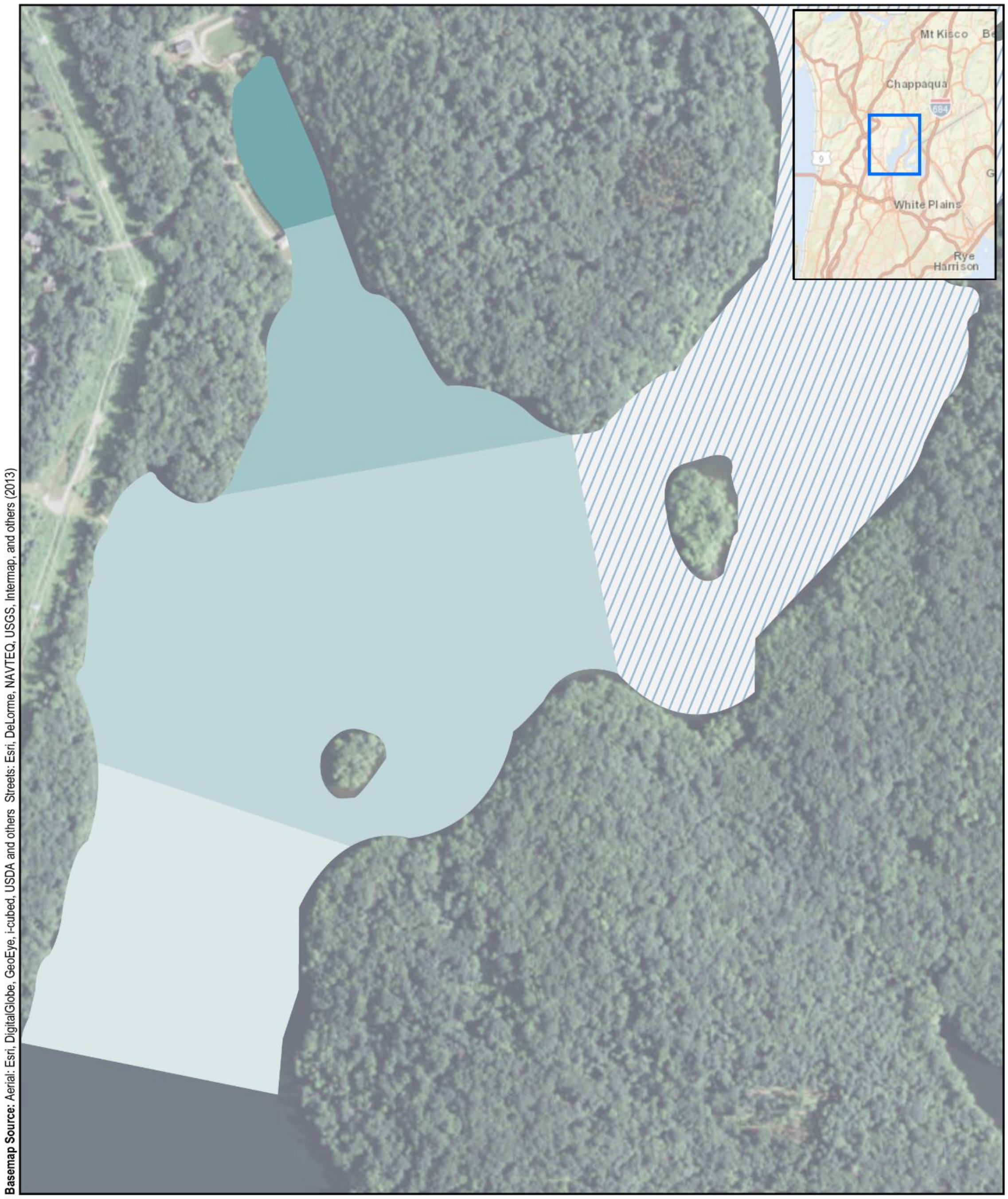


Figure ES-10
Kensico Reservoir Study Area



Note: 1) Negligible settling of alum floc is anticipated to occur in this area.
2) Estimates are from alum floc sub-model sensitivity testing of alum trigger between 2.0-3.0 NTU.

0 650 Feet

Modeled Additional Deposition Thickness During WFF Program (ft)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.9
- 0.9 - 1.1
- See note 1

Figure ES-11
Modeled Range of Average Settled Thickness of Alum Floc During WFF Program

Table ES-4. Potential Environmental Considerations by Resource Area for Activities Associated with Dredging

Resource Area	Activity	Environmental Considerations
Water Resources and Water Quality	Site Preparation; Dredging and Dewatering	• Sediment resuspension in the water column during dredging • Potential sedimentation and erosion • Stormwater runoff • Potential pipeline discharges

Aquatic Resources	Dredging	• Physical removal of existing benthic community and habitat in CATIC Cove with full benthic recolonization anticipated to take several years
		• Physical alteration of existing habitat (e.g., deeper, altered substrate)
		  o Disturbance of fish foraging and nursery habitat
		  o Altered fish habitat value
		• Effects on early fish life stages and impaired feeding ability within active dredging areas

Wetlands	Site Preparation; Dredging and Dewatering	• Potential sedimentation and erosion • Stormwater runoff • Temporary stream crossings • Potential pipeline discharges
Terrestrial and Wildlife Resources	Site Preparation; Dredging and Dewatering	• Clearing of trees and vegetation • Potential noise effects to wildlife during dredging and dewatering • Temporary stream crossings
Open Space and Recreation	Dredging	• Dredging activities would occur for up to three years • Placement of turbidity curtains across the dredge area from shore to shore during dredging would limit recreational access to these areas
Critical Environmental Areas	Construction, Dredging, and Dewatering	• Mobile (vehicular) noise from activities for site preparation and dewatering operations • New stationary noise from dewatering, dredging, and temporary generators
Historic and Cultural Resources	Site Preparation	• Soil disturbance for staging, dewatering, pipeline placement, and access roads could affect historic resources

Table ES-4. Potential Environmental Considerations by Resource Area for Activities Associated with Dredging (Continued)

Resource Area	Activity	Environmental Considerations
Aesthetic (Visual) Resources	Dredging and Dewatering	• Proposed dredging activities would be visible from existing public view corridors for the duration of construction
Transportation	Construction, Dredging, and Dewatering	• Increased traffic associated with construction, chemical delivery for dewatering, and dredged material transport
Air Quality	Construction, Dredging, and Dewatering	• Mobile (vehicular) air emissions from activities for site preparation and dewatering operations • New stationary air emissions from dewatering, dredging, and temporary generators
Noise	Construction, Dredging, and Dewatering	• Mobile (vehicular) noise from activities for site preparation and dewatering operations • New stationary noise from dewatering, dredging, and temporary generators

Note:
Potential overlap with the KEC Project may result in cumulative impacts for selected technical resource areas as discussed in Section 8.3, “Potential Impacts and Benefits of the Proposed Action on Kensico Reservoir Study Area.”

ES 7. ALTERNATIVES ANALYSIS SUMMARY

As discussed, this EIS also evaluated infrastructure and operational alternatives to the IRP, as well as structural elements to limit the extent of alum floc deposition in Kensico Reservoir. The alternatives analysis was conducted to: determine whether alternatives reduce, mitigate, or eliminate impacts while substantively meeting goals and objectives of the Proposed Action; demonstrate a reasonable range of options to the Proposed Action; and compare potential impacts and benefits under alternative approaches. The alternatives evaluated in this EIS include:

- Reasonable structural and operational alternatives at Ashokan Reservoir that could reduce turbidity levels entering Kensico Reservoir;
- A range of alternatives related to operation of the Catskill Aqueduct involving discharge of water from the aqueduct prior to arrival at Kensico Reservoir; and
- Reasonable structural alternatives at Kensico Reservoir that minimize the area of floc deposition resulting from the application of alum.

The alternatives analysis for this EIS also considered the No Action Alternative, which has been determined to be the continued operation of the Ashokan Release Channel in accordance with the IRP and assumes delay of dredging of alum floc at Kensico Reservoir until repairs to the RWBT are complete. Pursuant to the 2020 Modification to the Catalum Administrative Order on Consent, this EIS also evaluates the further delay of Kensico Reservoir dredging until after DEP constructs a filtration plant for the Catskill/Delaware water supply.

While each of the structural alternatives described would have the potential to cause multiple construction-related or operational impacts, they also would not enhance benefits or reduce, eliminate, or mitigate potential impacts of the Proposed Action. The Ashokan Reservoir structural alternatives would have the potential to cause environmental, flooding, and construction impacts without substantial turbidity reduction benefits in water diverted to Kensico Reservoir or in releases and spills from Ashokan Reservoir to lower Esopus Creek. The Catskill Aqueduct Alternatives would have the potential to negatively affect the water supply of the City and the Outside Community Connections and flows from Ashokan Reservoir would be anticipated to be the same as those in the future with the Proposed Action.[13] The Kensico Reservoir structural alternatives would have the potential to cause construction-related impacts without changing alum floc deposition or migration within Kensico Reservoir. A summary of the alternatives analysis is provided in **Table ES-5.**

[13] DEP supplies water to several communities located along the full length of the upper Catskill Aqueduct from Ashokan to Kensico Reservoirs (outside community connections) serving a total population of approximately 150,000.

Table ES-5. Summary of Alternatives Analyses

Alternative	Conclusions
Ashokan Reservoir Alternatives	
Alternative 1 – West Basin Outlet Structure	Demonstrated low to moderate benefits for DEP in addressing turbidity events in Ashokan Reservoir. Temporary construction impacts, disturbance to adjacent land and potential for increased flood impacts to lower Esopus Creek from increasing releases to 2,000 MGD (3,094 cfs) or higher.
Alternative 2 – Dividing Weir Crest Gates	Limited effectiveness in increasing west basin storage to capture flow from large storm events, so limited DEP water supply benefit. Potential impacts to west basin shoreline wetlands and vegetation with a higher pool level when crest gates are raised. In combination with operation of Ashokan Reservoir in accordance with the IRP, releases to lower Esopus Creek would still be required from the west basin to prevent turbid spill to the east basin and meet the CSSO, and turbidity levels of these releases would be similar to those that occur in the future with the Proposed Action.
Alternative 3 – East Basin Diversion Wall and Channel Improvements	Limited effectiveness in reducing the number of days of elevated turbidity in Catskill Aqueduct diversions or alum application to water in the Catskill Aqueduct upstream of Kensico Reservoir. Environmental and construction impacts associated with disturbance to land within the Reservoir. In combination with operation of Ashokan Reservoir in accordance with the IRP, flows to lower Esopus Creek would be similar to the future with the Proposed Action, because releases to lower Esopus Creek would still be required from the west basin to prevent turbid spill over the Dividing Weir.
Alternative 4 – Upper Gate Chamber Modifications	Limited effectiveness in reducing turbidity loads in the Catskill Aqueduct or alum application rates to water in the Catskill Aqueduct upstream of Kensico Reservoir. It is anticipated there would be limited construction impacts from this alternative. This alternative would provide limited additional reduction in turbidity levels of spills and releases to lower Esopus Creek compared to current operational capabilities.
Alternative 5 – East Basin Intake Structure	Would enhance DEP's operational flexibility, potentially provide a small to moderate benefit for reducing alum application to water in the Catskill Aqueduct upstream of Kensico Reservoir. Construction would be a major undertaking and would entail several construction-related impacts (and have the potential to cause impacts to land above and below water). Limited effectiveness in reducing turbidity levels in releases to lower Esopus Creek, as the new intake could not be connected to the existing Ashokan Release Channel. In combination with operation of Ashokan Reservoir in accordance with the IRP, the magnitude and turbidity of releases would be similar to the future with the Proposed Action.
Alternative 6 – Changed Ashokan Release Channel Operations	See Section 14.3, "Ashokan Reservoir Alternative 6 – Revised Operating Protocol."

<table>
<tr><th colspan="2">Table ES-5. Summary of Alternative Analyses (Continued)</th></tr>
<tr><th>Alternative</th><th>Conclusions</th></tr>
<tr><td>Alternative 7 – Bypass of Low Turbidity Upper Esopus Creek Water to Ashokan East Basin</td><td>Limited effectiveness for addressing turbidity in Ashokan Reservoir and potential for significant construction-related environmental impacts due to required size of the bypass (15-45,000 MGD, 23 to 69,625 cfs). The volume of water entering Ashokan Reservoir would be the same as in the future without and with the Proposed Action. By sending flows directly to the east basin, the flood attenuation benefit provided by storing water in the west basin would be lost, potentially increasing the magnitude or frequency of spill events.</td></tr>
<tr><td>Alternative 8 – Bypass of Upper Esopus directly to Lower Esopus Creek</td><td>This alternative would increase DEP's operational flexibility and potentially reduce turbidity load in water transferred through the Catskill Aqueduct. The project would be a major undertaking and there is a potential for significant environmental impacts from a construction project of this magnitude. Potential for increased flood impacts and higher levels of turbidity in flows to lower Esopus Creek from loss of flood and turbidity attenuation benefits within Ashokan Reservoir.</td></tr>
<tr><td colspan="2">Catskill Aqueduct Alternatives</td></tr>
<tr><td>Alternative 1 – Hudson River Drainage Chamber</td><td rowspan="4">The Catskill Aqueduct Alternatives would be used during episodic turbidity events. During these events, Ashokan Reservoir would still spill and turbidity levels of flows to lower Esopus Creek would be comparable between the future without and with the Proposed Action (see Section 7.1.1, "Flow Regime and Water Quality in Lower Esopus Creek"). Each of these alternatives would also limit the ability of DEP to use the Catskill Aqueduct for drinking water purposes and would limit operational flexibility of the system.</td></tr>
<tr><td>Alternative 2 – Croton Lake Siphon</td></tr>
<tr><td>Alternative 3 – Rondout Pressure Tunnel</td></tr>
<tr><td>Alternative 4 – Wallkill Pressure Tunnel Siphon Drain or the Wallkill Blow-off Chamber</td></tr>
</table>

Table ES-5. Summary of Alternative Analyses (Continued)

Alternative	Conclusions
Kensico Reservoir Alternatives	
Alternative 1 – Perforated Target Baffle	Ineffective at reducing the area of alum floc deposition and increased migration of small-sized floc to deeper parts of Kensico Reservoir, and potential impact of construction on water quality.
Alternative 2 – Sedimentation Basin	
Alternative 3 – Perforated Baffle Wall	
Alternative 4 – Submerged Weir	
Alternative 5 – Boom and Silt Curtains	
Alternative 6 – Large Settling Basin	
Alternative 7 – Further Delay of Kensico Reservoir Dredging	Dredging of alum floc would occur as a single event after DEP constructs a filtration plant for the Catskill/Delaware water supply. Therefore, any water quality impacts associated with dredging would be managed by a future filtration facility downstream of Kensico Reservoir, reducing the potential for impacts to public health. Since alum floc within Reservoir sediments has not resulted in adverse effects to public health or the environment as demonstrated through DEP's extensive, long-term water quality monitoring, further postponement of dredging would not be anticipated to result in significant adverse health or environmental impacts. See Section 14.2.3, "Kensico Reservoir Alternatives."

ES 8. PROPOSED REVISED OPERATING PROTOCOL, PROPOSED REVISED MONITORING PLAN, AND ADDITIONAL CONSIDERATIONS

PROPOSED REVISED OPERATING PROTOCOL

Since there are no anticipated adverse impacts associated with operation of Ashokan Reservoir in accordance with the IRP in the future with the Proposed Action, Ashokan Alternative 6 was developed to enhance benefits to lower Esopus Creek while maintaining DEP's ability to reliably provide water of sufficient quality to meet customer water demands under various hydrologic conditions, without compromising water supply reliability. To identify options for this alternative, modeling was used to assess the effects of changes to components of the IRP, both individually and in combination, including: the magnitude of the community release, the CSSO curve for spill mitigation releases, the maximum release through the Ashokan Release Channel, turbidity levels for releases, and the Mount Marion flows that would restrict releases.

After consideration of the model results, it was determined that the selected Ashokan Alternative 6, referred to as the preferred Revised Operating Protocol (ROP) and provided in Appendix A, would consist of:

- No change to the community release;
- No change to maximum release rate of 600 MGD (928 cfs) with 1,000 MGD (1,547 cfs) maximum of spill and releases combined for Spill Mitigation and Operational Releases;
- Adjustment of the CSSO to the 85 percent Delaware System curve (see **Figure ES-12**); [14]
- Modification of the release turbidity levels from 30 NTU and 60 NTU to 25 NTU and 50 NTU, respectively (see **Table ES-6**);
- Increasing the forecast horizon for the Mount Marion trigger to two feet below "Action Stage" with the potential to move the flow trigger to Lomontville;[15] and
- Flushing when best available water from one of the two basins is below 25 NTU. When turbidity in both basins is greater than 25 NTU, flushing would be replaced by a period of 36 hours with no releases.

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[14] The CSSO curve in the IRP was modeled after the CSSO curve for the Delaware System. The proposed ROP for Ashokan Reservoir reflects recent updates to the CSSO curves on the Delaware System.

[15] While the IRP does not include a flow trigger at the Lomontville gage, one could be established once there is sufficient peri od of record at this location (i.e., 10 total years of measurements).

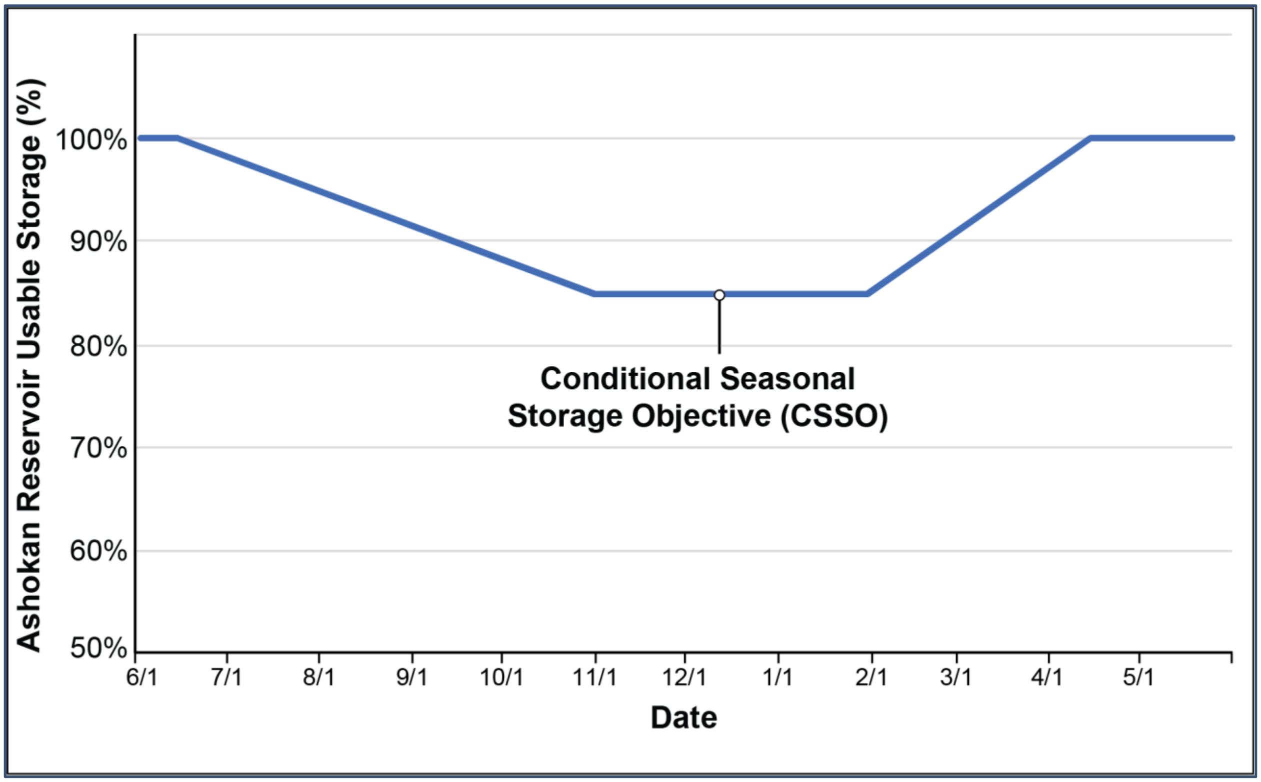

Figure ES-12. Proposed Revised Operating Protocol CSSO Curve Shape

Table ES-6. Proposed Revised Release Protocol

<table>
<tr><th>Type of Release</th><th>0-25 NTU</th><th>> 26 - 50 NTU</th><th>>51-100 NTU</th><th>> 100 NTU</th></tr>
<tr><td>Community</td><td>15/10 MGD[1] (23/15 cfs)</td><td colspan="2">10/4 MGD (15/6 cfs)</td><td>0 MGD (0 cfs)</td></tr>
<tr><td>Spill Mitigation (up to 600 MGD, 928 cfs)</td><td>Unlimited</td><td>12 days followed by flushing for 36 hours when best available water from one of the two basins is <25 NTU[2]</td><td colspan="2">5 days followed by flushing for 36 hours when best available water from one of the two basins is <25 NTU[2]</td></tr>
<tr><td>Operational (up to 600 MGD, 928 cfs)</td><td>Unlimited</td><td>12 days followed by flushing for 36 hours when best available water from one of the two basins is <25 NTU[2]</td><td>5 days followed by flushing for 36 hours when best available water from one of the two basins is <25 NTU[2]</td><td>Only when turbidity of upper Esopus Creek is >100 NTU</td></tr>
</table>

Notes:

[1] The community release follows a seasonal pattern. (15 MGD (23 cfs) from May 1st through October 31st and 10 MGD (15 cfs) from November 1st through April 30th).

[2] When turbidity in both basins is >25 NTU, flushing would be replaced by a period of 36 hours with no releases.

Overall, the effects of the ROP would not differ substantially from those anticipated in the future with the Proposed Action (IRP: use of the Ashokan Release Channel in accordance with the Interim Ashokan Release Protocol). Since the magnitude, frequency, duration and seasonality of releases would not change as a result of the ROP as compared to the future with the Proposed Action, there are no anticipated changes to the parameters evaluated to identify potential differences between the future without and with the Proposed Action associated with the ROP (water depth, water velocity, inundation, erosion, and deposition). By reducing turbidity levels that trigger flushing to 25 and 50 NTU, and replacing flushing with a period of no releases when the turbidity levels in both basins of Ashokan Reservoir are greater than 25 NTU, there are no anticipated impacts to the quality of releases as compared to the future with the Proposed Action. Potential benefits of the ROP as compared to the future with the Proposed Action include improved protection of trout upstream of the spillway confluence due to lowered release turbidity levels, a reduction of stress to aquatic species due to the suspension of releases when turbidity in both basins of Ashokan Reservoir is above 25 NTU, and additional response time for reduction of releases as needed based on forecast of flood flow stages at the Mount Marion gage.

PROPOSED REVISED MONITORING PLAN

As part of this EIS, DEP evaluated the Water Quality Monitoring Plan incorporated into the Interim Ashokan Release Protocol. In connection with the requirement to develop a Revised Operating Protocol, the Consent Order specifically required DEP to consider the potential need to monitor “temperature, turbidity, total suspended solids, biomonitoring, physical geomorphic factors, and flow data” and to identify at what locations this monitoring (if required) should occur along lower Esopus Creek. As part of development of this EIS, and as described in Section 7.1, “Water Resources and Water Quality,” DEP has several years of physical geomorphic and biomonitoring data and flow and water quality data along lower Esopus Creek. Based on the results of the assessments conducted to support the EIS, additional collection of physical geomorphic data and biomonitoring data is not warranted. The current monitoring of flows and water quality in water leaving Ashokan Reservoir and streamflow at Lomontville and Mount Marion provides sufficient information on lower Esopus Creek streamflow and water quality conditions. Collection of water quality data at the five existing sampling sites along lower Esopus Creek (three required in the Water Quality Monitoring Plan incorporated into the IRP and two voluntarily added by DEP to support the EIS) would not need to continue (**Figure ES-13**). Therefore, DEP is proposing the following Proposed Revised Monitoring Plan to be implemented with the proposed ROP (see **Table ES-7** and **Appendix A**).

Table ES-7. Proposed Revised Monitoring Plan

Site/Type	Sites	Analytes	Collection Frequency
Upper Esopus Creek	E16i (confluence)	turbidity, temperature total suspended solids	Weekly Monthly
Limnology	1EA-4EA (in Reservoir)	turbidity, temperature total suspended solids	2x/Month[1] Monthly[1]
Reservoir Effluent	EARCM	turbidity, temperature total suspended solids	5 Days/Week Monthly
Ashokan Upper Gatehouse	ES, EM, EB, WS, WM, WB	turbidity, temperature	Weekly
Ashokan Release Channel	M-1	turbidity, temperature total suspended solids, flow	Weekly when releases are occurring
Ashokan Spillway Channel	ASP	turbidity, flow	Weekly when Reservoir is spilling
Lower Esopus Creek	Lomontville and Mount Marion gages	turbidity, flow	USGS gage data collected every 15 minutes

Notes:
[1] Reservoir conditions permitting, March through December.

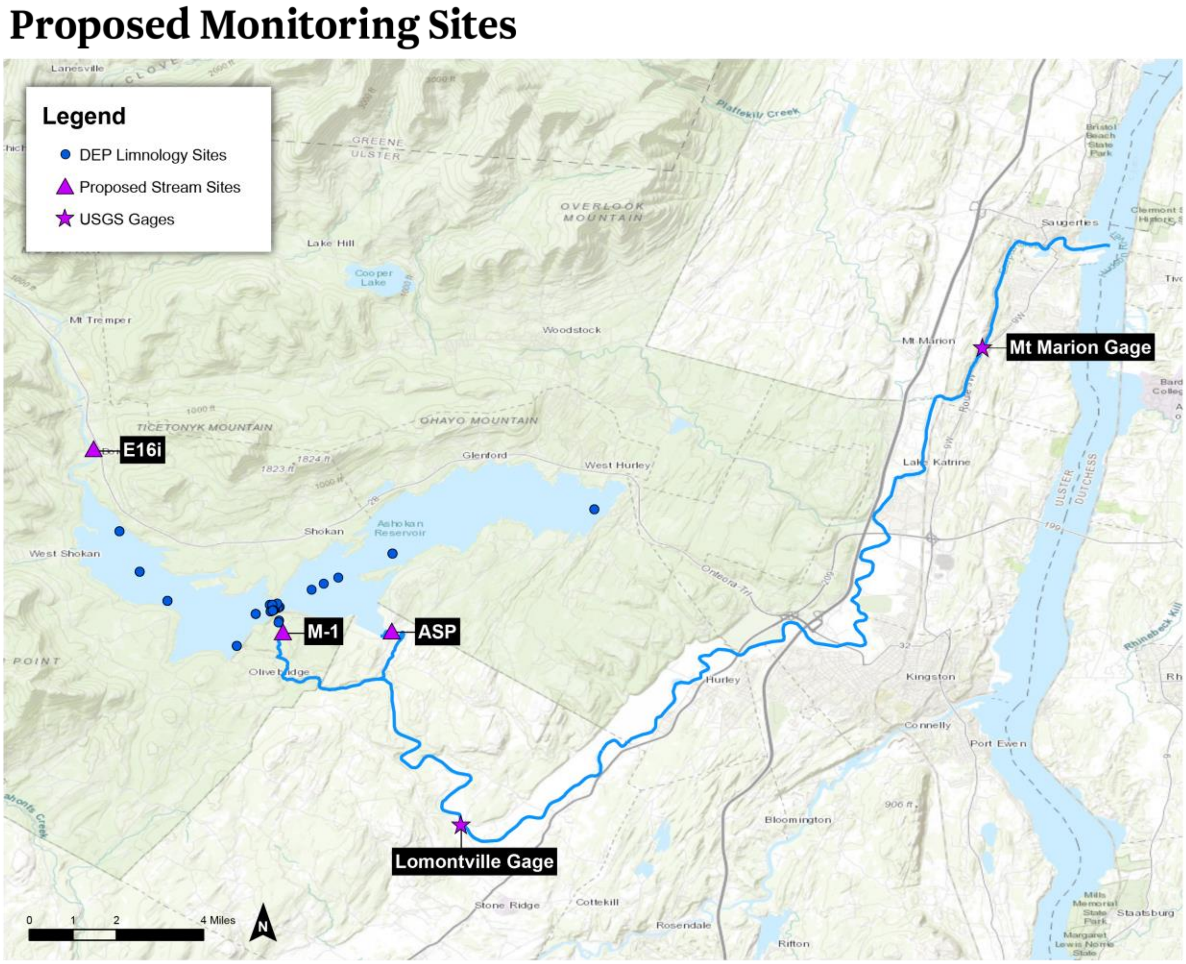

Figure ES-13. Proposed Monitoring Sites Along Lower Esopus Creek Included in the Proposed Revised Monitoring Plan

ADDITIONAL CONSIDERATIONS

Pursuant to the Consent Order, DEP funded Environmental Benefit Projects in lower Esopus Creek. A portion of the funds were used to add water quality monitoring at Mount Marion and install a USGS gage at Lomontville. While the IRP does not include a flow trigger at the Lomontville gage, one could be established with input from the National Weather Service and Ulster County Office of Emergency Management and NYSDEC once there is sufficient period of record at this location (i.e., 10 total years of measurements). Other funds are being used to secure a technical review consultant for the ARWG, stock fish in lower Esopus Creek, and support development and implementation of a lower Esopus Creek Stream Management Plan. No significant adverse impacts are anticipated from the Proposed Action along lower Esopus Creek or at Kensico Reservoir. However, assessments conducted as part of this EIS provide information that could be used to support Stream Management Plan development.

In particular, future stream management plan activities along lower Esopus Creek could focus on identifying and addressing areas in Valley Reach 2C that are susceptible to erosion based on localized geomorphic conditions or where structures located in the floodplain may be adversely affected by bank retreat in the future without and with the Proposed Action. These locations may include areas where an adequate riparian buffer is not present, where composite banks are present, or where structures are located immediately adjacent to the channel. Additional considerations for future stream management activities could include addressing in-channel obstructions such as removal of extensive erosion-inducing debris jams, modification of past efforts to stabilize the channel, and modification of augmentations to streamflow (e.g., concentrated areas where stormwater runoff enters lower Esopus Creek). Detailed observations of areas along lower Esopus Creek where some of these conditions were observed are provided in the Stream Management Plan Considerations subsection within Section 7.1, “Water Resources and Water Quality.”