Appendix A

Proposed Revised Operating Protocol for the Ashokan Reservoir and Proposed Revised Monitoring Plan

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Proposed Revised Operating Protocol (ROP) for the Ashokan Reservoir and Proposed Revised Monitoring Plan

Introduction:
DEP can make releases from the Ashokan Reservoir via the Ashokan Reservoir Release Channel. Releases are intended to enhance benefits to the community, improve flood attenuation, and provide better drinking water quality. Reservoir releases from the Ashokan Reservoir shall be in accordance with the following Operating Protocol (items 1-7):

1. Community Release (subject to the Release Exceptions described in item 5 below)**:**

a. **Purpose:** to provide environmental, recreational and economic benefits to the lower Esopus Creek in a manner that will not adversely impact water supply.

b. **Minimum Flow:** DEP will make releases from the Ashokan Reservoir through the Ashokan Reservoir Release Channel at the rates prescribed in the following table.

Release Criteria [1]	Summer (May 1 – Oct 31)	Winter (Nov 1 – Apr 30)
Normal Hydrologic Condition	15 MGD	10 MGD
Turbidity >25 NTU	10 MGD	4 MGD
Turbidity >100 NTU	0 MGD	0 MGD
Drought Warning Condition	10 MGD	4 MGD
Turbidity >100 NTU	0 MGD	0 MGD
Drought Condition	0	0

Note 1: Hydrologic Condition is based on the combined storage in the Cannonsville, Pepacton and Neversink Reservoirs.

c. **Turbidity:** When substantial contrast in turbidity exists with varying depths in the west basin of the Ashokan Reservoir, DEP will make reasonable efforts to make releases from the elevation with the least turbidity.

d. **Action Stage Shutdown:** The community release shall be shutdown when the U.S. Geographical Survey (USGS) gage on the Esopus Creek at Mount Marion (Lower Esopus) is within 2 feet of the Action Stage (18') and is forecasted to reach the Action Stage, as predicted on the National Weather Service's (NWS's) Advanced Hydrologic Prediction Service web page.

2. Spill Mitigation Release (subject to the Release Exceptions described in item 5 below)**:**

a. **Purpose:** In order to enhance flood mitigation provided by the Ashokan Reservoir, DEP will utilize the established Conditional Seasonal Storage Objective (CSSO) rule curve depicted in Figure 1. Consistent with good practices for water supply reservoirs, and in order to ensure that sufficient resources are available during an extended dry period to support water supply needs, it is essential to ensure that the Ashokan Reservoir is filled on or around June 1st every year. To accomplish this, the CSSO must be limited and ramped. For the duration of the SPDES permit DEP shall endeavor, to the maximum extent possible without impacting water supply reliability, to maintain reservoir levels at the CSSO, thus creating a high probability of maintaining a fifteen (15) percent void space from November 1 through the following February 1 to help mitigate

flooding events. In determining the releases needed to maintain the CSSO, DEP will consider the following parameters in the evaluation: forecasted inflows over the next seven (7) days including inflow from snow water equivalent as forecast by the NWS Hydrological Ensemble Forecasting System (HEFS), anticipated diversions over the next seven (7) days, and the current usable reservoir storage. Based on any projected seven (7) day storage surplus, DEP will calculate total release volumes to progress toward the CSSO and allocate those volumes over the upcoming seven 7-day period. In making releases, DEP will consider reasonable requests from Ulster County for a release modification related to a downstream release concern, within the limitations of the release works for the Ashokan Reservoir Release Channel and subject to DEC concurrence. Spill Mitigation Releases are designed to help mitigate the effects of potential for flooding immediately below the Ashokan Reservoir to the lower Esopus Creek communities.

b. **Maximum Flow:** The maximum flow from the Release Channel shall not exceed 600 MGD. DEP will throttle releases as necessary so the combined flow for Ashokan spill and Ashokan Reservoir Release Channel discharge does not exceed 1,000 MGD. In addition, DEP will shut down the Release Channel when the USGS gage on the Esopus Creek at Mount Marion (Lower Esopus) is within 2 feet of the Action Stage (18') and is forecasted to reach Action Stage, as predicted on the NWS's Advanced Hydrologic Prediction Service web page. DEP shall endeavor to achieve the CSSO in a manner that minimizes the need for maximum flow, large volume releases.

c. **Turbidity:** When substantial contrast in turbidity exists with varying depths in the west basin of the Ashokan Reservoir, DEP will make reasonable efforts to make releases from the elevation with the least turbidity. The frequency of intake changes shall be limited to no more than once per week.

i. **Dates:** Year Round

Turbidity	Duration	Comments
0-25 NTU	Unlimited	
>26-50 NTU	12 Days	At the end of the 12-day discharge, **flushing for 36 hours when best available water from one of the two basins is <25 NTU***, prior to resuming additional Spill Mitigation Releases.
>50 NTU	5 Days	At the end of the 5-day discharge, **flushing for 36 hours when best available water from one of the two basins is <25 NTU***, prior to resuming additional Spill Mitigation Releases.

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

d. **Ramping Rates:** All changes in water release rates will be conducted in accordance with the following schedule:

i. Flow Increases:

1. For flows greater than 0 and up to 80 MGD: 20 MGD/hour
2. For flows greater than 80 MGD and up to 200 MGD: 40 MGD/hour
3. For flows greater than 200 MGD: 40 MGD/half-hour

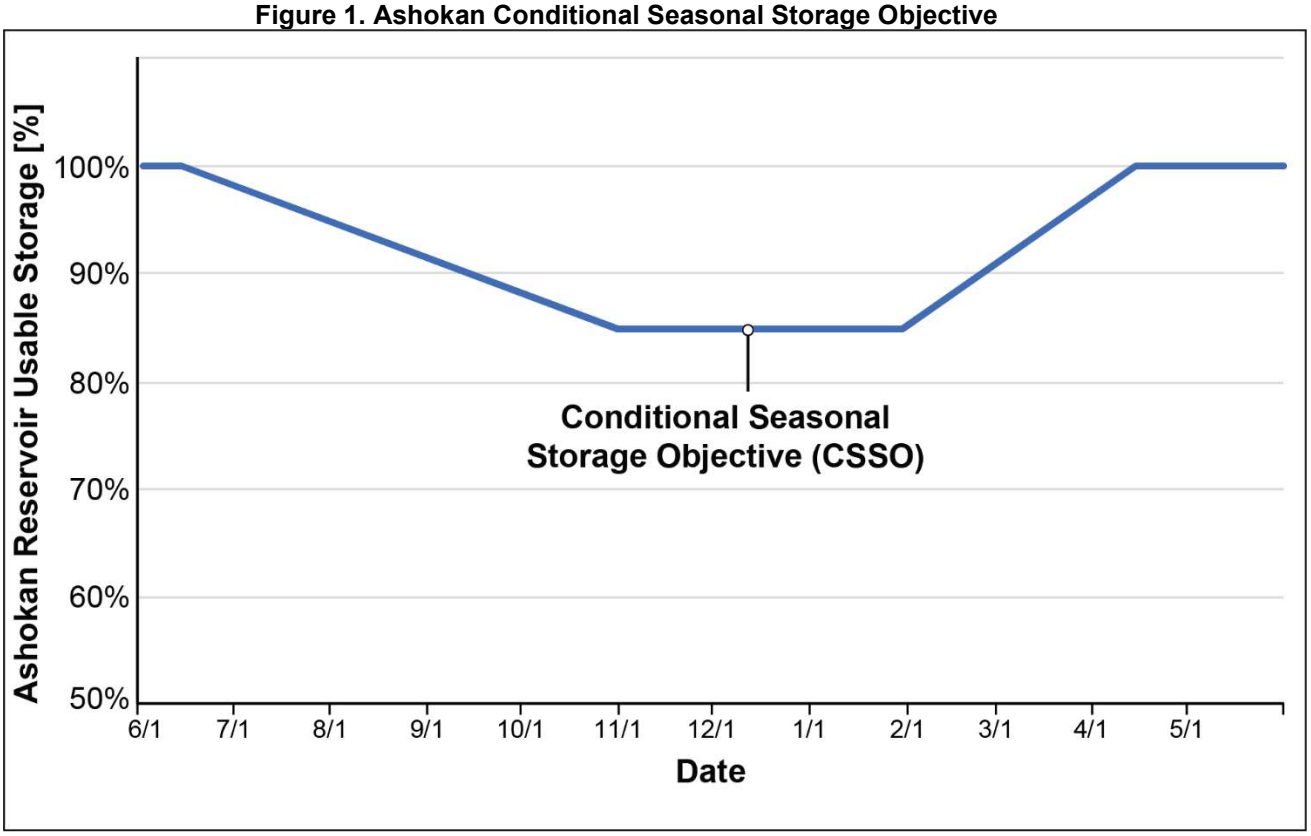
ii. Flow Decreases:

1. For flows greater than 200 MGD: 40 MGD/half-hour

2. For flows from 200 to 80 MGD: 40 MGD/hour
3. For flows from 80 to 0 MGD: 20 MGD/hour

e. **Void Target:** Conditional Seasonal Storage Objective (CSSO) as per Figure 1.

Figure 1. Ashokan Conditional Seasonal Storage Objective



Note: The CSSO is in effect year-round.

3. Operational Release (subject to the Release Exceptions described in item 5 below)**:**

a. **Purpose:** To prevent or mitigate the spilling of more turbid west basin waters into the east basin of the Ashokan Reservoir in order to protect water quality and enhance the flood mitigation benefit that the reservoir already provides to the lower Esopus Creek communities.

b. **Maximum Flow:** The maximum flow from the Release Channel shall not exceed 600 MGD. The release will be throttled as necessary so the combined flow for Ashokan spill and Ashokan Reservoir Release Channel discharge does not exceed 1,000 MGD. In addition, shutdown when the USGS gage on the Esopus Creek at Mount Marion (Lower Esopus) is within 2 feet of the Action Stage (18') and is forecasted to reach Action Stage, as predicted on the NWS's Advanced Hydrologic Prediction Service web page. Because the Lower Esopus Creek is used for various recreational and agricultural purposes, it may be necessary, at times, to limit the flow rate to be protective of those uses. Therefore, for the period from June 1 through October 1, the maximum flow rate through the release channel for operational releases shall be limited to no more than 300 MGD unless a larger release rate is necessary to prevent overspill of poor quality water from the west basin into the east basin of the Ashokan Reservoir.

c. **Void Target:** To be determined based on current and predicted hydrologic conditions to protect water quality and ensure reservoir refill.

d. **Ramping Rates:** All changes in water release rates will be conducted in accordance with the following schedule:

i. Flow Increases:

1. For flows greater than 0 and up to 80 MGD: 20 MGD/hour
2. For flows greater than 80 MGD and up to 200 MGD: 40 MGD/hour
3. For flow greater than 200 MGD: 40 MGD/half-hour

ii. Flow Decreases:

1. For flows greater than 200 MGD: 40 MGD/half-hour
2. For flows from 200 to 80 MGD: 40 MGD/hour
3. For flows from 80 to 0 MGD: 20 MGD/hour

e. **Turbidity:** When substantial contrast in turbidity exists with varying depths in the west basin of the Ashokan Reservoir, DEP will make reasonable efforts to make releases from the elevation with the least turbidity. The frequency of intake changes shall be limited to no more than once per week.

i. November 1 through April 30:

Turbidity	Duration	Comments
0-25 NTU	Unlimited	
>26-50 NTU	12 Days	At the end of the 12-day discharge, **flushing for 36 hours when best available water from one of the two basins is <25 NTU***, prior to resuming additional Spill Mitigation Releases.
>51-100 NTU	5 Days	At the end of the 5-day discharge, **flushing for 36 hours when best available water from one of the two basins is <25 NTU***, prior to resuming additional Operational Releases.
>100 NTU	(see Note 1)	

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

Note 1: The discharge of water with turbidity >100 NTU shall be allowed only on those days where the Esopus Creek, flowing in to the Ashokan Reservoir, has turbidity >100 NTU. If releases are being made and the turbidity of the Esopus Creek flowing into the Ashokan Reservoir drops below 100 NTU, DEP shall commence ramping down the releases rate on the next day and shall cease the release as soon as practicable (considering ramping rate requirements contained herein) after the turbidity in the creek fell below such threshold. DEP shall conduct daily turbidity monitoring for the period during which such releases are being made.

ii. May 1 through October 31:

Turbidity	Duration
0-25 NTU	Unlimited
>25 NTU	The discharge of water with turbidity >25 NTU shall be allowed only on those days where the Esopus Creek, flowing in to the Ashokan Reservoir, has turbidity >25 NTU. If releases are being made and the turbidity of the Esopus Creek flowing into the Ashokan Reservoir drops below 25 NTU, DEP shall commence ramping down the releases rate on the next day and shall cease the release as soon as practicable (considering ramping rate requirements contained herein) after the turbidity in the creek fell below such threshold. DEP shall conduct daily turbidity monitoring for the period during which such releases are being made.

4. Notification:

a. Report all operational changes of the release channel to the Ulster County Emergency Management office, Ulster County Department of the Environment, and DEC.

b. Continue to send operational data to Ulster County and Town officials on a daily basis and provide turbidity data to Ulster County upon written request.

c. Report all water quality data to DEC promptly after receipt.

5. Release Exceptions:

As noted in items 1,2 and 3 of this Operating Protocol, DEP may also make changes to the releases if any of the following conditions are met:

a. DEP, with concurrence by DEC, determines that additional resources are reasonably necessary for reservoir balancing, for refill of the Ashokan Reservoir, for proper water supply management, or in the case of drought watch, warnings or emergencies.

b. DEC in accordance with DEC's existing legal authority directs an emergency action or DEP takes an emergency action.

c. DEC, or DEP with concurrence by DEC, determines that releases must be changed or interrupted as necessary for inspection, maintenance, testing and repairs (including Delaware Aqueduct repairs).

d. DEP, with concurrence by DEC, responds to a spill mitigation request (release or request not to release) from Ulster County provided that requested release or cessation of release will not adversely impact water supply.

e. DEP responds to a spill mitigation request (release or request not to release) from DEC provided the requested release or cessation of release will not adversely impact water supply.

6. Utilization of the Shandaken Tunnel:

During Spill Mitigation Releases and after reservoir storage has been reduced to meet the CSSO objectives, the use of the Shandaken Tunnel to provide water to the Ashokan Reservoir will be minimized in keeping with the existing Shandaken SPDES Permit and consistent with proper water supply management. In particular from May 1st through February 1st, for determinations in accordance with footnote 2.J. in the Shandaken Tunnel SPDES permit, the unfilled storage capacity within the Ashokan Reservoir will be calculated from the CSSO curve rather than the spillway elevation for the period.

7. Monitoring Plan:

a. Water Flow:

i. Monitor continuously by the DEP Water Supply Control Center via the Supervisory Control and Data Acquisition System with telemetry from release channel gages.

ii. During periods of inoperable continuous monitoring – perform visual gage readings at least once daily and as flow is changed.

b. Water Quality:

i. Monitoring Objective

i. To monitor water quality in the Upper Esopus Creek and turbidity contributions from Ashokan Reservoir to the Lower Esopus Creek.

ii. Monitoring Sites

i. Condition: Release Channel Not Operating (Routine monitoring conducted at these sites, regardless of reservoir spill status)

1. Upper Esopus Stream Site

a. Esopus Creek (E16i) – last sampling point prior to entry into Ashokan Reservoir

2. Limnology Sites

a. Ashokan Reservoir Limnology Stations (1EA-4EA) – multiple depths in water column, both basins (reservoir conditions permitting, March- December)

3. Keypoint Sites

a. Ashokan Upper Gatehouse – water at the east and west basin intake levels as follows:

i. ES – East Surface
ii. EM – East Middle
iii. EB – East Bottom
iv. WS – West Surface
v. WM – West Middle
vi. WB – West Bottom

b. Ashokan Effluent Sampling Station (EARCM) – final effluent leaving Ashokan via Catskill Aqueduct

ii. Condition: Release Channel Operating - In addition to sites listed above, add these sites:

1. Ashokan Release Channel (M-1) – water released through the release channel to the lower Esopus Creek

2. Lower Esopus Stream Sites

a. Lomontville Gage
b. Mt. Marion Gage

iii. Condition: Release Channel Operating & Ashokan Spilling (In addition to sites listed above, add this site):

1. Lower Esopus Stream Sites

a. Ashokan Spill (ASP) – Ashokan Reservoir spill channel below spillway

iii. Monitoring Frequency and Analytes

i. Condition: Release Channel Not Operating (Routine monitoring at these sites)

Site Type	Sites	Analytes	Frequency
Upper Esopus Creek	E16i	Turbidity, Temperature	Weekly
		Total Suspended Solids	Monthly
Limnology	1EA-4EA	Turbidity, Temperature	2x/Month*
		Total Suspended Solids	Monthly*
Keypoints	EARCM	Turbidity, Temperature	5 Days/Week
		Total Suspended Solids	Monthly
Keypoints	ES, EM, EB, WS, WM, WB	Turbidity, Temperature	Weekly

* Reservoir conditions permitting (March – December)

ii. Condition: Release Channel Operating (In addition to sites listed above, add these sites)

Site Type	Sites	Analytes	Frequency
Keypoints	M-1	Turbidity, Temperature, Total Suspended Solids, Flow	Weekly
Lower Esopus Creek	Lomontville and Mt. Marion Gages	Turbidity, Flow	Continuous (15- minute USGS Gage Data)

iii. Condition: Release Channel Operating & Ashokan Spilling (In addition to sites listed above, add this site)

Site Type	Sites	Analytes	Frequency
Key Points	ASP	Turbidity, Flow	Weekly

Proposed Monitoring Sites