Comments by the New York City Watershed Inspector General on the Draft Environmental Impact Statement for the Proposed Modification of the Catalum SPDES Permit

June 14, 2021

The Office of the New York City Watershed Inspector General (WIG or WIG Office) is pleased to file these comments on the draft environmental impact statement (DEIS) evaluating the proposed modification to the NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit to the City of New York for the Catskill Influent Chamber (SPDES Permit No. 026-4652) (Catalum SPDES Permit).[1] The purpose of the DEIS is to evaluate potential significant adverse environmental impacts from proposed turbidity control measures to be incorporated into the Catalum SPDES Permit. Potential adverse impacts include discharges of alum into the Catskill Aqueduct, which causes deposition of that coagulant bound to sediment onto the bottom of the Kensico Reservoir, and discharges of turbid water down the release channel to the lower Esopus Creek, which impairs water quality in that stream. The DEIS also examines potential adverse impacts from the proposed postponement of dredging in the Kensico Reservoir until the completion of specific infrastructure projects.

The WIG filed comments on the scoping of the DEIS in August 2014. In those comments, the WIG recommended incorporation of climate change impacts into the analysis and consideration of alternatives that would reduce discharges of turbid water into the lower Esopus Creek. The WIG reiterates those comments concerning the DEIS. As discussed in further detail below, the DEIS, does not include the full historical precipitation data record, does not adequately document/incorporate climate change into its analysis, and does not adequately consider alternatives to the proposed action, such as a combined bypass tunnel to the lower Esopus Creek or the east basin of the Ashokan Reservoir. Accordingly, the WIG requests that these deficiencies be corrected in a supplemental DEIS.

I. Background

<u>Catskill Turbidity and the Catalum SPDES Permit</u>

The City's Catskill Watershed provides nearly half the drinking water consumed by 9 million New Yorkers each day. At times water quality in Catskill reservoirs is harmed by stormwater and other surface water flows polluted by "turbidity," or murkiness in the water caused by the presence of suspended solids. Turbid water conditions occur in the Catskill watershed because of high runoff events when heavy rains or snowmelt cause erosion of land, stream banks, and

[1] The DEIS was prepared in accordance with requirements of a DEC Order on Consent with the City dated October 4, 2013, that was amended in 2018 and 2020.

streambeds in waterbodies that feed the Schoharie and Ashokan Reservoirs. The erosion dislodges Catskill soils, composed of clay and silt. Because these soils are very small in particle size, they tend to stay suspended in water for long periods of time, giving the water a turbid, murky appearance. In light of excessive turbidity in the Catskill's Schoharie and Ashokan Reservoirs, these waterbodies are listed as impaired under Section 303(d) of the federal Clean Water Act, 33 U.S.C. § 1251 *et seq*. And because turbid water can carry various pathogens and threaten public health, New York's New York State Department of Health (DOH) and the United States Environmental Protection Agency (EPA) have concluded that problems of elevated turbidity within the Catskill system "likely represent the greatest risk to the City maintaining its filtration avoidance" status under the federal Safe Drinking Water Act.[2] If the City lost that status, it would be forced to construct a filtration plant at a cost of many billions of dollars.

The Ashokan Reservoir located west of the Hudson River impounds Esopus Creek. The Ashokan Reservoir is divided into two basins. Water flows from the upper Esopus Creek into Ashokan's west basin. Water flows into Ashokan's west basin from the upper Esopus Creek. This basin stores turbid water and allows suspended solids to settle out before the water is transferred over a weir into the east basin, which generally holds clearer, less turbid water. The east basin water (and, when it is relatively clear, west basin water) is then transported by the Catskill Aqueduct to the Kensico Reservoir before it is distributed to consumers.

Settling of suspended solids in the Ashokan Reservoir is insufficient to ensure that turbidity is always eliminated from the water supply system, especially in unusually large storms and during snowmelt. To reduce turbidity to ensure compliance with the federal Safe Drinking Water Act and analogous state requirements, the City's Catalum SPDES permit, issued by DEC under ECL Article 17 and the Clean Water Act, authorizes the City to introduce aluminum sulfate (alum) when needed into the Catskill Aqueduct prior to the water's entry into the Kensico Reservoir. For the City to maintain its filtration avoidance status and comply with regulations issued under the Safe Drinking Water Act, turbidity cannot exceed 5 nephelometric turbidity units at the intake to its water supply distribution system at the Kensico Reservoir. 40 C.F.R. §141.71(a)(2).

Alum is a coagulant. It attracts suspended particles and allows them to stick together in a clump. When alum-induced clumps, referred to as "alum floc," become heavier than the water, they sink to the bottom of the water column. Thus, removal of suspended particles from the water column using alum reduces the water's turbidity.

While alum improves the quality of drinking water, deposition of the alum

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[2] DOH and EPA, "Implementation of the New York City's Watershed Protection Program and Compliance with the 2007 Filtration Avoidance Determination: Status Review of the First Five-Year Period." (September 30, 2011), p. 25.

floc on the Reservoir's floor has deleterious effects on the Reservoir itself because it buries plant and animal life and can impair the Reservoir's best uses. *See* 6 NYCRR §§ 701.5: 935.6 (Table I) (Kensico Reservoir's best uses include primary and secondary contact recreation, fishing, fish and wildlife propagation and survival); *id.*, 6 NYCRR § 703.2 (turbidity in the Reservoir's water cannot exceed natural conditions, and suspended and other solids (which cause turbidity) cannot cause deposition or impair the water for its best usages). Because of the harm alum floc can cause to the Reservoir, the Catalum Permit seeks to limit alum application and requires that the City dredge the alum floc.

During unusually large storms and snowmelt large volumes of highly turbid water are discharged from the upper Esopus Creek into the Ashokan Reservoir. In response, DEP has sought to rely on the Ashokan Release Channel to release a portion of that water to the lower Esopus Creek instead of discharging it down the Catskill Aqueduct into the Kensico Reservoir. The reduction in flows to the Kensico Reservoir reduces the concomitant need to apply alum and reduces the deposition of alum floc onto the Reservoir's floor. Most recently beginning on Christmas day 2020, the rain and snow-melt from a storm resulted in more than 63 billion gallons of water flowing into the City's reservoirs during a 48-hour period. That made it one of the largest runoff events in the history of the City's water supply. Similarly, during and after large storm events in October and December of 2010, and Hurricane Irene and Tropical Storm Lee in August and September 2011, the City continuously released turbid water into the release channel from the west basin of the Ashokan Reservoir. Releases during these events were intended to protect water quality in the Kensico Reservoir and to attenuate risks of flooding, but also resulted in sustained turbid water conditions in the lower Esopus Creek for months at a time. Turbid conditions impaired the use of the lower Esopus Creek, causing great concern to lower Esopus Creek residents, communities, businesses, and elected officials, and led EPA on January 18, 2013 to place the lower Esopus Creek on its Clean Water Act Section 303(d) list of impaired waters. In doing so, EPA found that current regulatory requirements would not result in attainment of water quality standards for turbidity in the lower Esopus Creek within a reasonable period of time.

II. Proposed Modification of the Catalum SPDES Permit

The Proposed Action is modification of the Catalum SPDES Permit to incorporate turbidity control measures, including operation of Ashokan Reservoir in accordance with the Interim Ashokan Release Protocol (IRP); and delay of dredging accumulated alum floc from Kensico Reservoir until the completion of certain infrastructure projects. Operation of Ashokan Reservoir in accordance with the IRP includes three types of releases: a community release to provide recreational, environmental, and economic benefits to lower Esopus Creek; spill mitigation releases to enhance the flood attenuation provided by the Ashokan Reservoir; and operational releases to minimize transfer of more turbid west basin water into the

east basin of the Ashokan Reservoir to protect water quality and enhance the flood attenuation benefit provided by the Reservoir. The IRP sets a maximum release of no more than 600 million gallons per day (mgd), 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.

The DEIS reported minimal effects of the IRP on turbidity conditions in the lower Esopus Creek. It concluded that 70 percent of releases from Ashokan Reservoir will have low levels of turbidity and that turbidity levels under the IRP would be comparable to those without the IRP. However, the DEIS also acknowledged that the IRP would convert shorter duration spill events into lower flow releases of longer duration. Thus, the months-long periods of turbid flow in the lower Esopus Creek associated with extreme weather events, such as in Christmas 2020, would likely recur under the IRP.

The proposed modification also delays dredging alum floc from the Kensico Reservoir until after completion of the last of four infrastructure projects: repairs to the Rondout West Branch Tunnel, which is a portion of the Delaware Aqueduct. The other projects, which are already complete, are construction of the Croton Water Filtration Plant, the Catskill and Delaware Aqueduct Interconnection at Shaft 4, and improvements to Catskill Aqueduct Stop Shutters. Repairing the RWBT means that there will be shutdowns of this tunnel, rendering the City more dependent on water from the Catskill System. This increases the likelihood that the City would need to apply alum to water in the Catskill Aqueduct upstream of Kensico Reservoir during this period.

The DEIS considered various structural alternatives to the proposed action, including construction of the following: a west basin outlet structure, dividing weir crest gates, east basin diversion wall and channel improvements, upper gate chamber modifications, and east basin intake. The DEIS rejected these alternatives for a number of reasons, including relative ineffectiveness in managing turbidity, adverse construction impacts to land adjoining the Ashokan Reservoir, and potential increased flooding impacts.

The DEIS also included consideration of two distinct "bypass" alternatives: a bypass of the west basin for lower turbidity water from the upper Esopus Creek directly to Ashokan's east basin; and a bypass of the upper Esopus Creek directly to the lower Esopus Creek. The former alternative would isolate the west basin "following a turbidity event when turbidity in the west basin would be high. As a result, particles in the west basin would have more time to settle, while low turbidity water would be routed to the east basin." DEIS, p. 14-10. However, the DEIS rejected the former alternative because a bypass around the west basin "large enough to contain the range of flows that occur in upper Esopus Creek would be infeasible due to land disturbance and earthwork" and because it would impair the capacity of the west basin for flood attenuation. *Id.*

As to the second alternative bypass, the DEIS acknowledged that a bypass of the upper Esopus Creek directly to the lower Esopus Creek "could reduce the duration of spills and releases to lower Esopus Creek from Ashokan Reservoir with high levels of turbidity." DEIS, p. 14-11. Nevertheless, the DEIS rejected the alternative because it would "negate any flood attenuation provided by Ashokan Reservoir for lower Esopus Creek." *Id.* In addition, "turbidity levels entering lower Esopus Creek from upper Esopus Creek would be higher than the turbidity levels of spills and releases from the Reservoir in the future without and with the Proposed Action." *Id.*

Finally, Alternative 6, called the "Revised Operating Protocol" (ROP) was evaluated and selected as the best alternative to the Proposed Action. The ROP is a revision to the IRP, consisting of no change to community releases or the 600 mgd maximum rate of release to the release channel; adjustment of the Conditional Seasonal Storage Objective (CSSO) to the 85 percent Delaware System curve; modification of the turbidity release levels; and, among other changes, flushing with the best available water from the Ashokan Reservoir when such water is relatively clear (below 25 NTU) and a 36-hour period of no releases if Ashokan turbidity is greater than 25 NTUs. According to the DEIS, "[p]otential 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." DEIS, p. ES-45.

III. Recommendations

<u>The DEIS and All Related Turbidity Control Alternatives Need to be Revisited by Evaluating All Flow and Turbidity Data</u>

The DEIS was released for public comment on December 16, 2020. The ROP was selected by evaluating numerous metrics including discharge, turbidity, reservoir storage/level, and alum application of numerous alternatives to the IRP. Unfortunately, none of the alternative evaluations undertaken as part of the DEIS made use of the full historical record available for the aforementioned metrics, as the DEIS release date preceded the high discharge and high turbidity 2020 Christmas event, caused by heavy rainfall and melting snow. Including the 2020 Christmas event data and revisiting the comparison of all of the alternatives evaluated in a common statistical based analysis of the relevant metrics will ensure that the projected application of alum and/or the extended release of turbid water to the lower Esopus Creek is fully informed by the available historical data and is uniformly rigorous. In addition, all such statistically reliant evaluations comparing alternatives must also address the inherent uncertainty of such analysis stemming

from the assumption of stationarity.[3]

Climate Change

Climate change considerations are described in Chapter 5 (EIS Methodology) of the DEIS. According to the DEIS (p. 5-4), DEP climate, watershed, reservoir, and system operations models have been integrated to evaluate the potential impact of climate change on the City's water supply system. Their studies indicate "extreme levels of turbidities could increase by more than 50 percent and such high turbidity events could be more frequent in the future. In addition, climate change may result in a 23 percent increase in alum days per year in the future." An explanation of how these numbers were calculated needs to be included in a supplemental DEIS, along with an explanation of whether and how the DEIS included expectations of future flow increases in extreme events in its modeling.

The WIG Office investigated climate and extreme rainfall events in the NYC Watershed. In 2015, the Northeast Regional Climate Center (NRCC) at Cornell University partnered with the New York State Energy Research and Development Authority (NYSERDA) to develop extreme precipitation pattern projections for New Yok State. *See* Northeast Regional Climate Center and New York State Energy Research & Development Agency. (2015). *Intensity, Duration, and Frequency Curves for New York State: Future Projections for a Changing Climate*. Ithaca, NY: Northeast Regional Climate Center. Web. 1 June 2021. http://ny-idf-projections.nrcc.cornell.edu/index.html. Their final model depicts the intensity, duration, and frequency (IDF) of extreme precipitation events for the next century. This model is based on daily precipitation data from 157 weather stations across New York, adjacent states and Canada, and 49 unique sets of extreme precipitation projections based on three distinct modeling techniques.

These comments present the results of six scenarios of extreme precipitation derived from the NRCC/NYSERDA model, applying RCP 8.5, a conservative representative concentration pathway (RCP), which is characterized by greenhouse gas emissions increasing over time. This scenario predicts that even when greenhouse gas emissions begin to level off, high levels of greenhouse gas will remain in the atmosphere by 2100. The first three figures below depict the percent change in projected rainfall for storms classified as "100-year" storms comparing the periods 2010-2039 (Figure 1), 2040-2069 (Figure 2), and 2070 to 2100 (Figure 3) to 1970-1999 baseline levels. The next three figures (Figures 4, 5, and 6) depict maps that represent the same metrics and time periods, but for "50-year" storms. In both sets of maps, regions of the state encompassing reservoirs of the NYC Watershed

[3] Stationarity is the concept that natural systems fluctuate within an unchanging envelope of variability. It is a foundational concept that permeates training and practice in water-resource engineering. It implies that any variable (e.g., annual stream-flow or annual flood peak) has a time-invariant (or 1-year–periodic) probability density function (pdf), whose properties can be estimated from the instrument record.

are demarcated with red stars.

Results from this NRCC/NYSERDA model are presented in the table below:

Years	**100-year storm**	**50-year storm**
	Predicted Increase in Extreme Precipitation Event RCP 8.5	Predicted Increase in Extreme Precipitation Event RCP 8.5
2010 – 2039	5-15%	5-10%
2040 – 2069	10-20%	10-15%
2070 – 2100	15-25%	15-25%

Graphs depicting the model results are presented below.

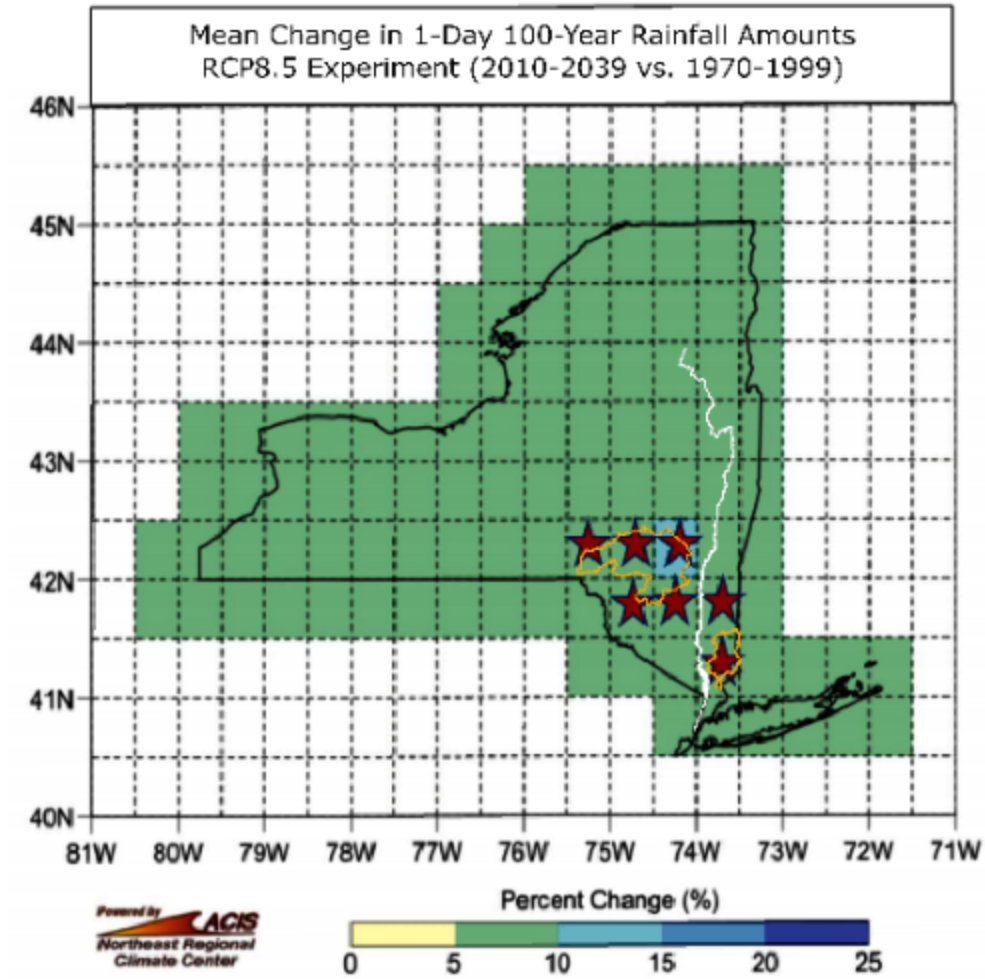

Figure 1. The results above depict the percent change in projected rainfall for 100-year storms in the period 2010-2039 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the green and blue colors on the map- these signify that rainfall from 100-year storms is projected to increase by 5-15% relative to 1970-1999 levels across the NYC Watershed for the period 2010-2039.

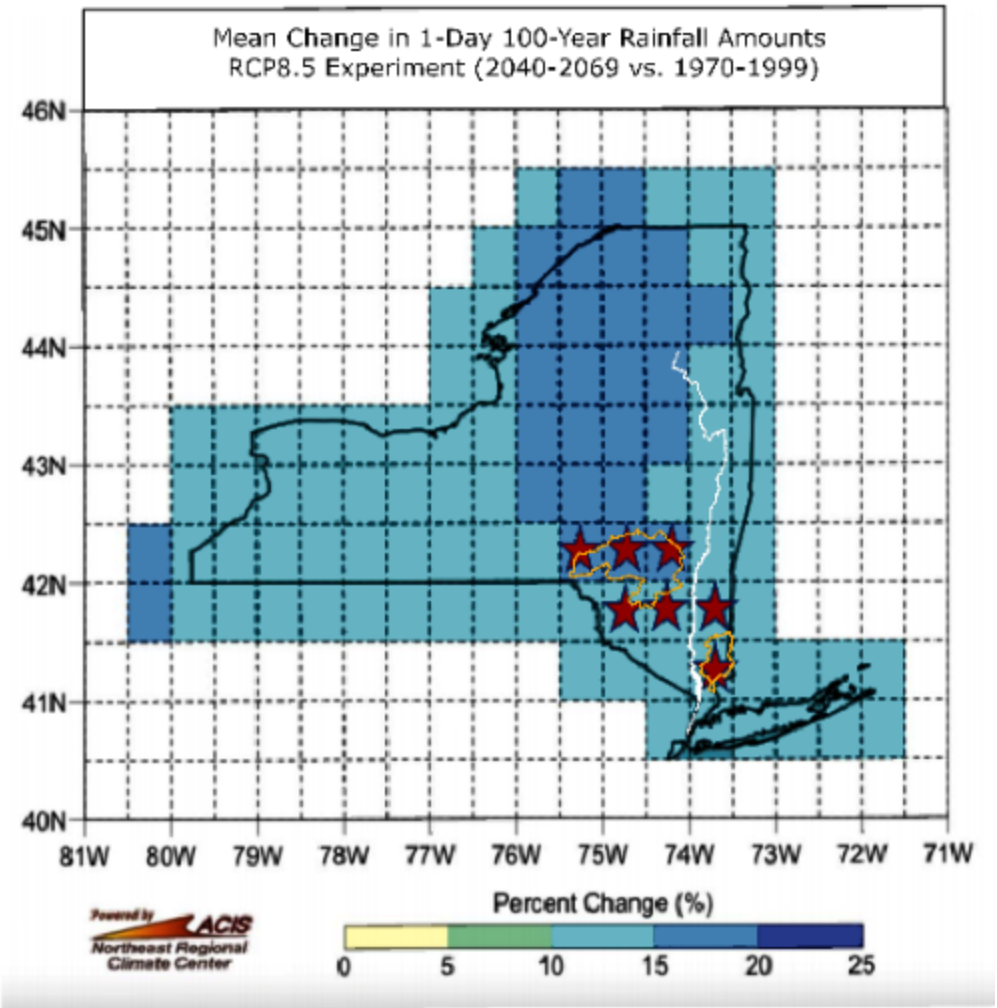

Figure 2. The results above depict the percent change in projected rainfall for 100-year storms in the period 2040-2069 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the light and dark blues on the map- these signify that rainfall from 100-year storms is projected to increase by 10-20% relative to 1970-1999 levels across the NYC Watershed for the period 2040-2069.

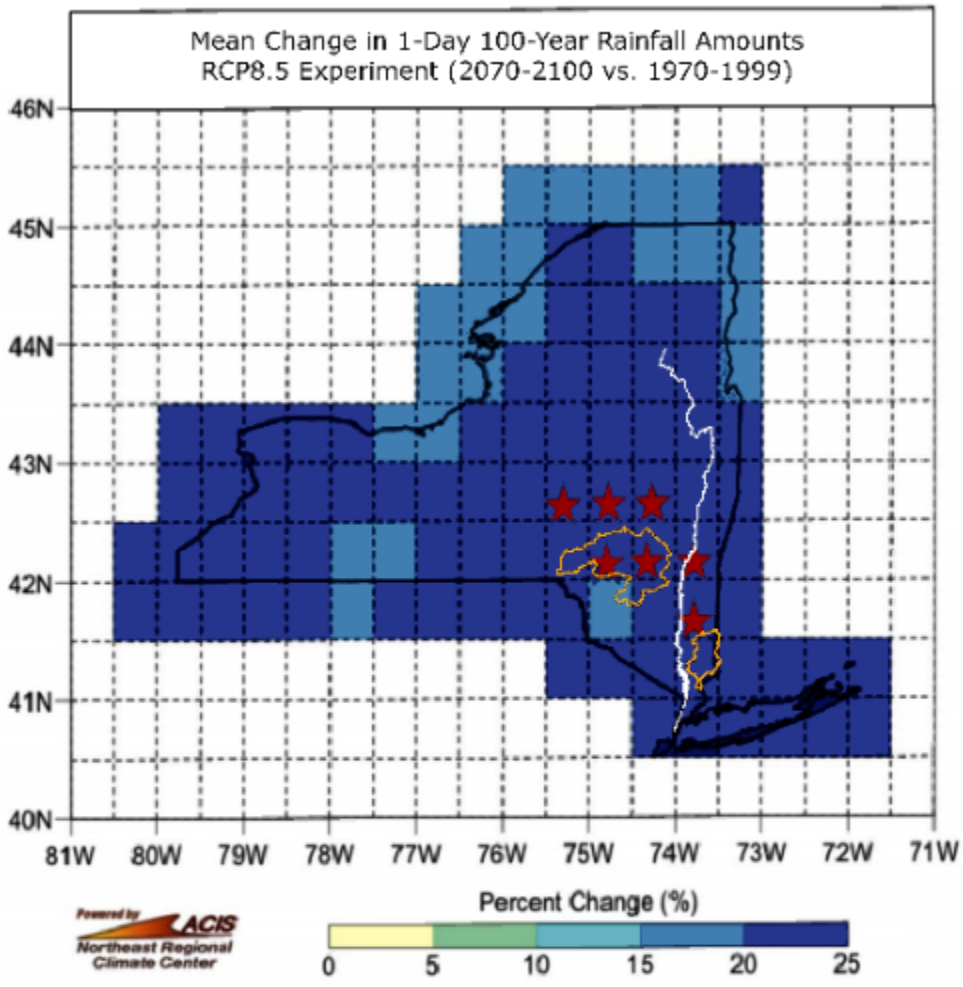

Figure 3. The results above depict the percent change in projected rainfall for 100-year storms in the period 2070-2100 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the light and dark blues on the map- these signify that rainfall from 100-year storms is projected to increase by 15-25% relative to 1970-1999 levels across the NYC Watershed for the period 2070-2100.

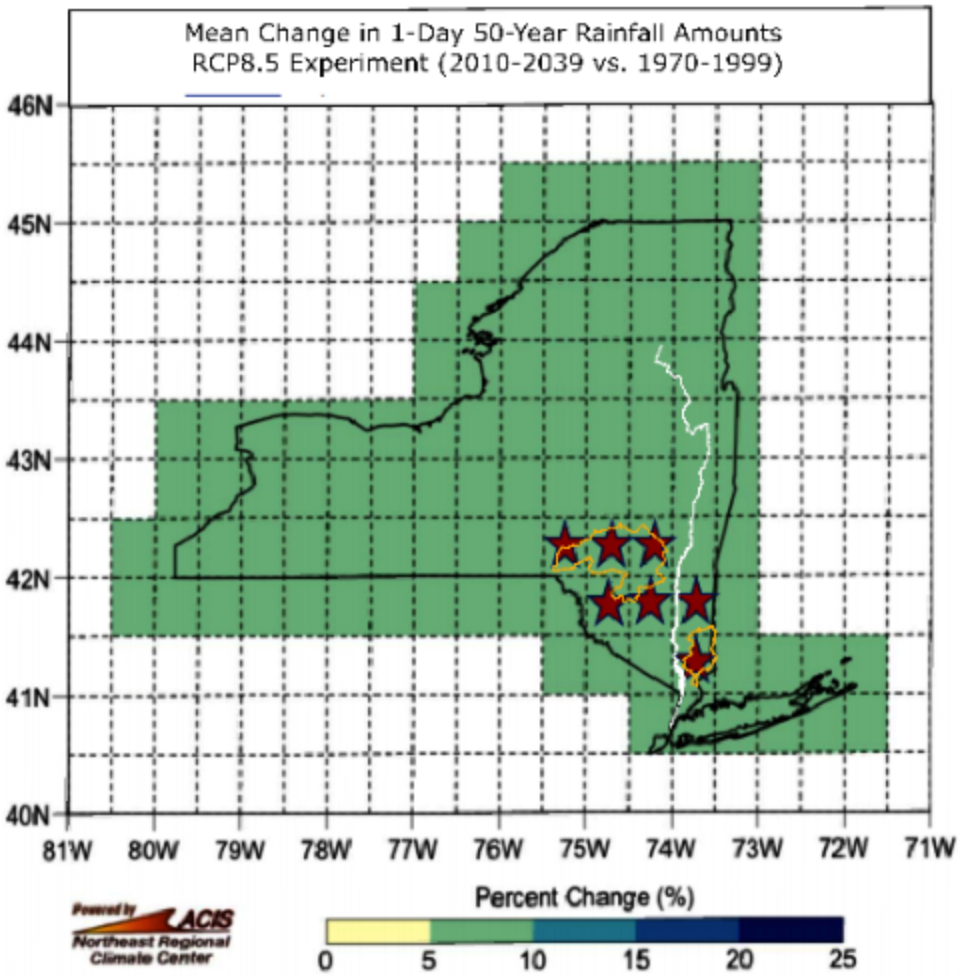

Figure 4. The results above depict the percent change in projected rainfall for 50-year storms in the period 2010-2039 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the green color on the map- this signifies that rainfall from 50-year storms is projected to increase by 5-10% relative to 1970-1999 levels across the NYC Watershed for the period 2010-2039.

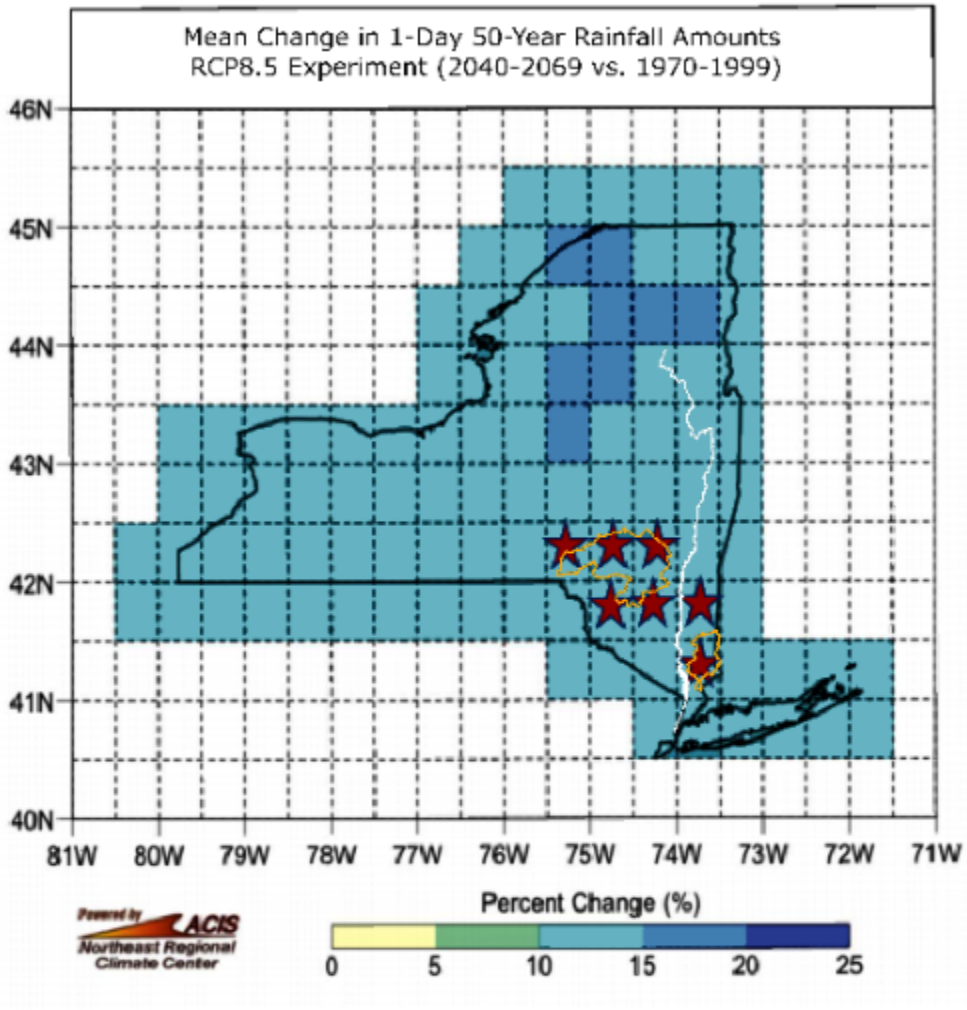

Figure 5. The results above depict the percent change in projected rainfall for 50-year storms in the period 2040-2069 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the light and dark blues on the map- these signify that the rainfall from 50-year storms is projected to increase by 10-15% relative to 1970-1999 levels across the NYC watershed for the period 2040-2069.

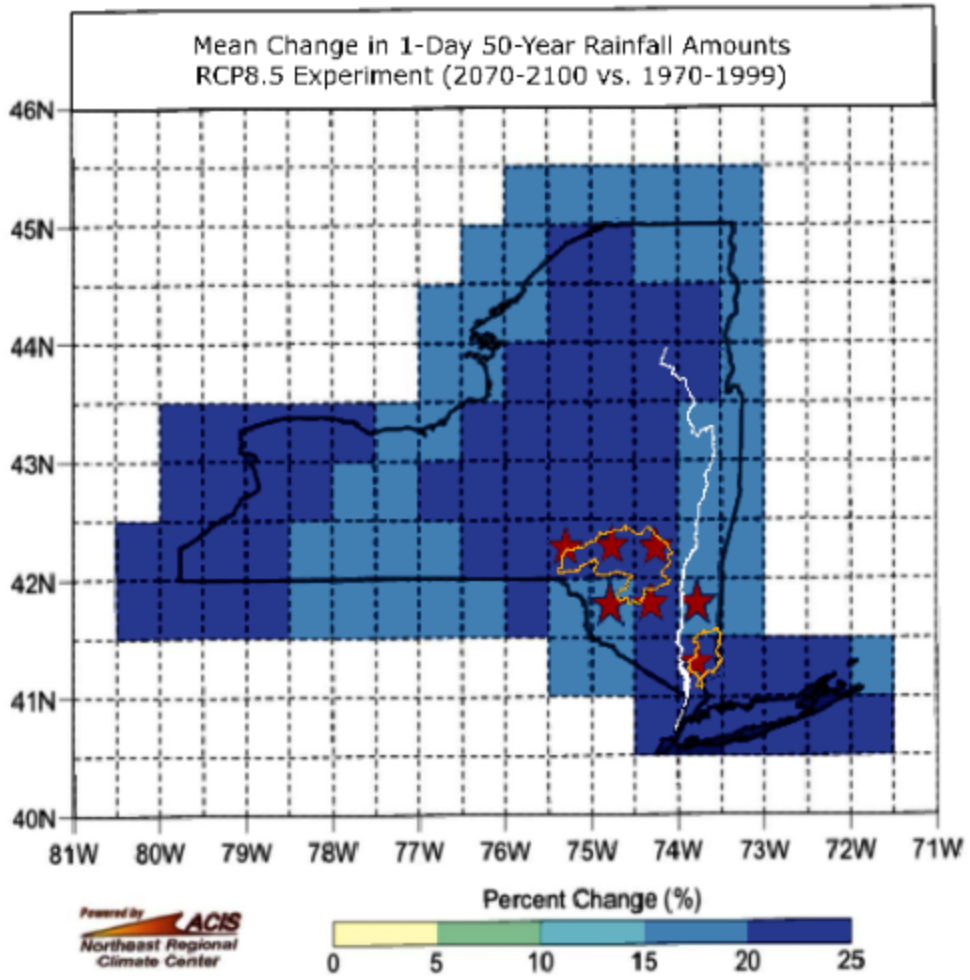

Figure 6. The results above depict the percent change in projected rainfall for 50-year storms in the period 2070-2100 relative to 1970-1999. Red stars indicate where reservoirs are located in the NYC Watershed. Orange outline is the NYC watershed. Vertical white line is the Hudson River.

Note the light and dark blues on the map- these signify that rainfall from 100-year storms is projected to increase by 15-25% relative to 1970-1999 levels across the NYC Watershed for the period 2070-2100.

A more recent study on the Projected IDF Curve Data Tool for the Chesapeake Bay Watershed and Virginia was published in 2021 by researchers from Carnegie Mellon University, the NRCC (again), and the Rand Corporation.[4] The Chesapeake Bay tool was designed to encompass the Chesapeake Bay watershed and counties directly adjacent to it, including 20 counties in the western portion of New York. Two of the 20 counties in New York, Delaware and Schoharie,

[4] Carnegie Mellon University, Cornell University and the Rand Corporation. *Projected Intensity-Duration-Frequency (IDF) Curve Data Tool for the Chesapeake Bay Watershed and Virginia.* midatlantic-idf.rcc-acis.org/. Accessed May 27, 2021.

are also located in the New York City watershed. In comparison to the 2015 NRCC/NYSERDA model, which employs a 1970-1999 baseline, the Chesapeake Bay tool employs a 1950-1999 baseline. Additionally, the two models employ different return periods (Chesapeake Bay: 2020-2070 and 2050-2100; New York: 2010-2039, 2040-2069, and 2070-2100)). Comparing the results from the 2015 New York and 2021 Chesapeake Bay extreme precipitation projection models:

Return Period	*New York IDF Mapping Tool: Range (% Increase) RCP8.5*	*Chesapeake Bay IDF Mapping Tool: Range (% Increase) RCP8.5*
	New York City Watershed	*Delaware & Schoharie Counties*
100-Year	2010-2039: 5-15% 2040-2069: 10-20% 2070-2100: 15-25%	2020-2070: 16% & 12% 2050-2100: 26% & 21%
50-Year	2010-2039: 5-10% 2040-2069: 10-15% 2070-2100: 15-25%	2020-2070: 11% & 13% 2050-2100: 18% & 21%

Based on the two models, extreme precipitation events are predicted to increase in the future. Increased extreme precipitation events in the Catskill portion of the New York City Watershed can result in increased extreme levels of turbidity, increased application of alum, and extended time the release channel is in use. A supplemental DEIS should address whether the New York or Chesapeake Bay models, or some other model, was incorporated into the modeling underlying the DEIS to account for the effects of Climate Change. Because of the significant effects of Climate Change, expected increases in extreme weather events need to be included in the modeling. The statement in the DEIS concerning how extreme levels of turbidity could increase by more than 50% in the future and potentially result in a 23% increase in alum application days per year needs to be explained and addressed in a supplemental DEIS as well.

Bypass Tunnel Alternative

The DEIS presents two distinctly different alternatives that bypass the Ashokan's west basin. These alternatives connect the upper Esopus Creek to either the lower Esopus Creek (Alternative 8) or to the east basin (Alternative 7). Alternative 8 is an enormous bypass tunnel designed to accommodate peak or flood flow (*i.e.* 50,000 mgd or 69,625 cfs) and all flow with unacceptably high turbidity. As such, it is cost prohibitive. In Alternative 8, the tunnel delivers water from the upper Esopus Creek to the lower Esopus Creek (bypassing the west basin of the Ashokan Reservoir). No turbidity control alternative evaluated in the DEIS other than Alternative 8 prevents high turbidity levels in the west basin of the Ashokan Reservoir, without increasing the duration or magnitude of turbidity exceedances in

the lower Esopus Creek. However, besides being cost prohibitive, Alternative 8 does not provide flood control to lower Esopus Creek residents.

The WIG Office believes another alternative that combines most of the benefits of Alternatives 7 and 8 while providing for existing levels of flood control should be considered in a supplemental DEIS. This bypass tunnel would be designed to transport low turbidity Esopus Creek base-flow water (streamflow not effected by significant individual precipitation events) from the upper Esopus Creek, bypassing the west basin of the Ashokan Reservoir during times when the west basin is exhibiting unacceptable levels of turbidity, and discharging the flow to either the lower Esopus Creek or the east basin of the Ashokan Reservoir or both as needed. Such a tunnel would allow water in flood events to flow to, and through the west basin or lower Esopus Creek (with the flow to the Esopus limited to 600 mgd) as they have previously. This bypass tunnel would also facilitate the transport of low turbidity, post flood, base-flows from the upper Esopus Creek directly to two destinations – to either the east basin of the Ashokan Reservoir or to the Release Channel, or to both. This is in contrast to current activities, where post flood, non-turbid upper Esopus Creek water flows into the west basin, where it mixes with turbid water, and becomes unacceptably turbid. By bypassing the west basin, which would act as a post flood settling basin, and sending non-turbid water to the east basin, the need for alum application would be reduced. In addition, this alternative could provide non-turbid water to the Release Channel, significantly shortening the duration of turbidity in the lower Esopus Creek. This alternative would give the City additional turbidity control and flexibility during post-flood conditions. Such a tunnel should be the subject of a cost benefit evaluation in a supplemental DEIS, including consideration of construction impacts and effects on flood attenuation.

IV. Conclusion

The WIG Office appreciates this opportunity to provide comments on the Catalum SPDES Permit and looks forward to working with DEC, DEP, and other Watershed regulators and stakeholders as environmental review of the modification of the Catalum SPDES Permit proceeds.

Respectfully submitted,

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