



2023 CO-OP Drought Operations

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Introduction

The Washington, DC, metropolitan area experienced unusually dry conditions in the summer and fall of 2023, and flows in the Potomac River fell to levels requiring the Interstate Commission on the Potomac River Basin (ICPRB) Section for Cooperative Water Supply Operations on the Potomac (CO-OP)¹ to conduct drought response activities in support of the major regional water suppliers: Fairfax Water, Loudoun Water, WSSC Water, and the Washington Aqueduct, a Division of the U.S. Army Corps of Engineers. This report provides a brief summary of these activities and of related issues and discussions that arose. It also documents the take-aways of a Post-Drought Operations Review meeting that took place on November 3, 2023, and a subsequent meeting of the CO-OP Operations Committee on November 17.

Background

The Washington, DC, metropolitan area (WMA) water suppliers participate in a cooperative drought management system established in 1982 by the Water Supply Coordination Agreement (WSCA). The WSCA governs releases from shared upstream reservoirs and coordination of water supply withdrawals to optimize use of regional resources and provide protection from the impacts of severe drought. The WSCA was signed by the District of Columbia, CO-OP, and by the three major WMA water suppliers: Fairfax Water, WSSC Water, and the Washington Aqueduct, a Division of the U.S. Army Corps of Engineers. These suppliers, along with the District of Columbia, have also entered into cost-share agreements for three reservoirs located upstream of their Potomac River intakes: Jennings Randolph and Savage reservoirs on the Potomac River North Branch and Little Seneca Reservoir in Black Hill Regional Park in Montgomery County, Maryland. CO-OP can make water supply releases from these upstream reservoirs during low flow periods to augment Potomac River flow at WMA intakes. Fairfax Water and WSSC Water obtain a portion of their supplies from off-Potomac reservoirs: Fairfax Water's Occoquan Reservoir and WSSC Water's Patuxent reservoirs, respectively.

CO-OP provides technical, administrative, and managerial support for both drought operations and for drought planning, as required under the WSCA. CO-OP's drought response team consists of CO-OP's three full-time employees and one or two part-time drought "volunteers" recruited from other ICPRB sections. This small team has proved to be effective in past droughts, though all of these personnel have other ongoing responsibilities, so resources can become stretched when deteriorating conditions start requiring a near 24/7 level of activity. Because members of the drought team also serve on ICPRB's spill response team, response to a serious spill concurrent with a severe drought would further strain available staff resources. CO-OP staff operate and maintain software systems that track recent river flow, water withdrawals, and reservoir storage data on at least a daily basis and forecast Potomac River flows one to nine days into the future. During droughts, CO-OP staff use river flow forecast tools to support coordination of the suppliers' use of Potomac versus off-Potomac intakes and to determine release rates from upstream reservoirs to meet water demands, maintain Potomac River flow at Little Falls Dam above the 100 million gallons per day (MGD) environmental flow-by, and make efficient use of available system storage.

¹ ICPRB is an interstate compact commission authorized by Congress in 1940 to address serious pollution issues that required a cooperative regional response by the Potomac basin jurisdictions: Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia. The federal government is also a member of ICPRB. In 1970, ICPRB's compact was amended to empower it to address water resources and related land issues. In 1979, ICPRB created the CO-OP Section.

Two terms are used in this report that describe specific CO-OP staff drought response activities:

- **CO-OP Daily Monitoring** includes data collection and once-daily email reports to stakeholders.
- **CO-OP Drought Operations** include data collection, twice-daily email reports, and coordination of water withdrawals and reservoir releases to meet environmental flow-by and flow recommendations.

2023 drought overview

Hydrometeorological conditions

Potomac River flows had fallen to unseasonably low levels by early June 2023 due to low precipitation over the prior six months. Figure 1 shows a map of 180-day precipitation deficits in the Middle Atlantic as of September 9, 2023, computed by the Middle Atlantic River Forecast Center. Notably, the basin-wide average rainfall in the Potomac watershed upstream was only 16.2 inches, 26% lower than the historical average for that 180-day period. CO-OP conducted drought activities for a total of 106 days during 2023 beginning on June 12. CO-OP Daily Monitoring occurred five times, triggered by Potomac River flow falling below 2,000 cubic feet per second (cfs) at the U.S. Geological Survey (USGS) stream gage at Point of Rocks. CO-OP Drought Operations commenced on August 25 when Potomac River flow at the USGS's Little Falls gage approached the sum of combined WMA Potomac River withdrawals plus the 100 MGD environmental flow-by. CO-OP Drought Operations were suspended on September 11 after basin-wide rainfall improved Potomac flows.

CO-OP drought activities occurred on the following days in 2023:

- Daily Monitoring: June 12 – June 16, 2023 (5 days);
- Daily Monitoring: July 28 – August 8, 2023 (12 days);
- Daily Monitoring: August 18 – August 24, 2023 (7 days);
- Drought Operations: August 25 – September 11, 2023 (18 days);
- Daily Monitoring: September 12 – September 25, 2023 (14 days); and
- Daily Monitoring: October 4 - November 22, 2023 (50 days).

Potomac River flows and withdrawals during the summer of 2023 are shown in Figure 2. Figure 3 shows a close-up of flows and withdrawals during Drought Operations. The dotted orange lines indicate the 2,000 cfs daily monitoring threshold at Point of Rocks, and the dashed blue lines represent Potomac withdrawals plus 100 MGD, CO-OP's threshold for Drought Operations. Triangles denote the basin's average precipitation in inches. Note that the lowest daily average flow at Little Falls, 375 cfs (245 MGD), occurred on September 7, just before a precipitation event which raised river flow and ultimately ended CO-OP Drought Operations. A second rainfall event occurred over the weekend before September 25, which resulted in a suspension of Daily Monitoring the following Monday morning.

Drought response events

Key events during this year's drought are summarized below.

- On August 29, CO-OP staff met with water suppliers to discuss a potential "Alert Stage" declaration under the Low Flow Allocation Agreement.

- On August 30, the Washington Aqueduct voluntarily shifted water withdrawals from its Great Falls intake to its Little Falls intake to increase flows between Great Falls and Little Falls².
- On September 5, the Metropolitan Washington Council of Governments (MWCOG) Drought Coordination Technical Committee met to decide whether to recommend the declaration of a Drought Watch under the MWCOG *Metropolitan Washington Water Supply and Drought Awareness Response Plan*. The committee decided against recommending a Drought Watch. The rainfall forecast at the time suggested that there was no imminent need for water supply releases from Jennings Randolph Reservoir, according to CO-OP's flow forecasting tools.
- On September 8, CO-OP staff sent an email request for concurrence by the CO-OP General Managers for reservoir releases in the coming week "should our forecast models indicate a need to augment Potomac River flows." CO-OP model forecasts indicated that there was a small chance that a release from Little Seneca Reservoir would be required to ensure an environmental flow over Little Falls Dam of at least 100 MGD plus a margin of safety.
- On the mornings of September 9 and 11, CO-OP staff conducted virtual briefings for CO-OP General Managers on current conditions and CO-OP's decision-making process for determining the need for reservoir releases.

Special system conditions

Several special conditions had to be considered during the 2023 drought response activities. The most notable were projects affecting WSSC Water's operations, described below.

- Tridelphia dredging project: Prior to the onset of drought conditions, WSSC Water had made commitments for a project to remove sediment from Tridelphia Reservoir. The work was conducted from June 1 through mid-August of 2023. Before the commencement of dredging, the water level in Tridelphia was lowered, reducing combined storage in the two Patuxent reservoirs, Tridelphia and T. Howard Duckett, at the beginning of the summer to 8.15 BG.
- Potomac WTP projects: Several projects were ongoing at WSSC Water's Potomac Water Treatment Plant (WTP), and these projects reduced the plant's maximum production in 2023 to just 135 MGD from its usual maximum of 288 MGD. In addition, the maximum production at the Patuxent WTP was 65 MGD in the summer and fall of 2023, so WSSC Water's maximum total production was approximately 200 MGD.

One of CO-OP's operational strategies during drought is to preserve reservoir storage by shifting a portion of withdrawals from off-Potomac reservoirs to the Potomac River on days when river flow is sufficient to support it. However, because of the reduced Potomac WTP production capacity, WSSC Water's ability to do this was limited. A second CO-OP operational strategy is to shift a portion of WSSC Water's Potomac River withdrawals to the Patuxent on days in which Potomac River flows are forecasted to drop to 140 MGD or below at the Little Falls gage. However, this was not an option because of the limited production capacity at the Patuxent plant.

In the face of these difficulties, WSSC Water operational staff demonstrated considerable resourcefulness. The Potomac plant production was kept at an approximately constant rate of 135 MGD, with additional demand met by the Patuxent plant, and system demands were met every day of the drought. A means was found to reduce the Patuxent plant minimum production rate from 40 MGD to 30 MGD, which helped

² The *Potomac River Environmental Flow-By Study* (Maryland Department of Natural Resources, 1981) recommends that to support the integrity of a highly productive and popular fishery between Great Falls and Little Falls: "At a calculated flow of 500 mgd just above the Great Falls intake, begin shifting Aqueduct withdrawals to the Little Falls dam intake to maintain at least 100 mgd plus the Washington Aqueduct's allocation up to 200 mgd between Great Falls and Little Falls dam."

preserve Patuxent storage on low-demand days. Finally, the constant Potomac WTP production of 135 MGD, corresponding to a withdrawal of 150 MGD, served to keep WSSC Water's Potomac withdrawals steady, another goal of CO-OP drought operations.

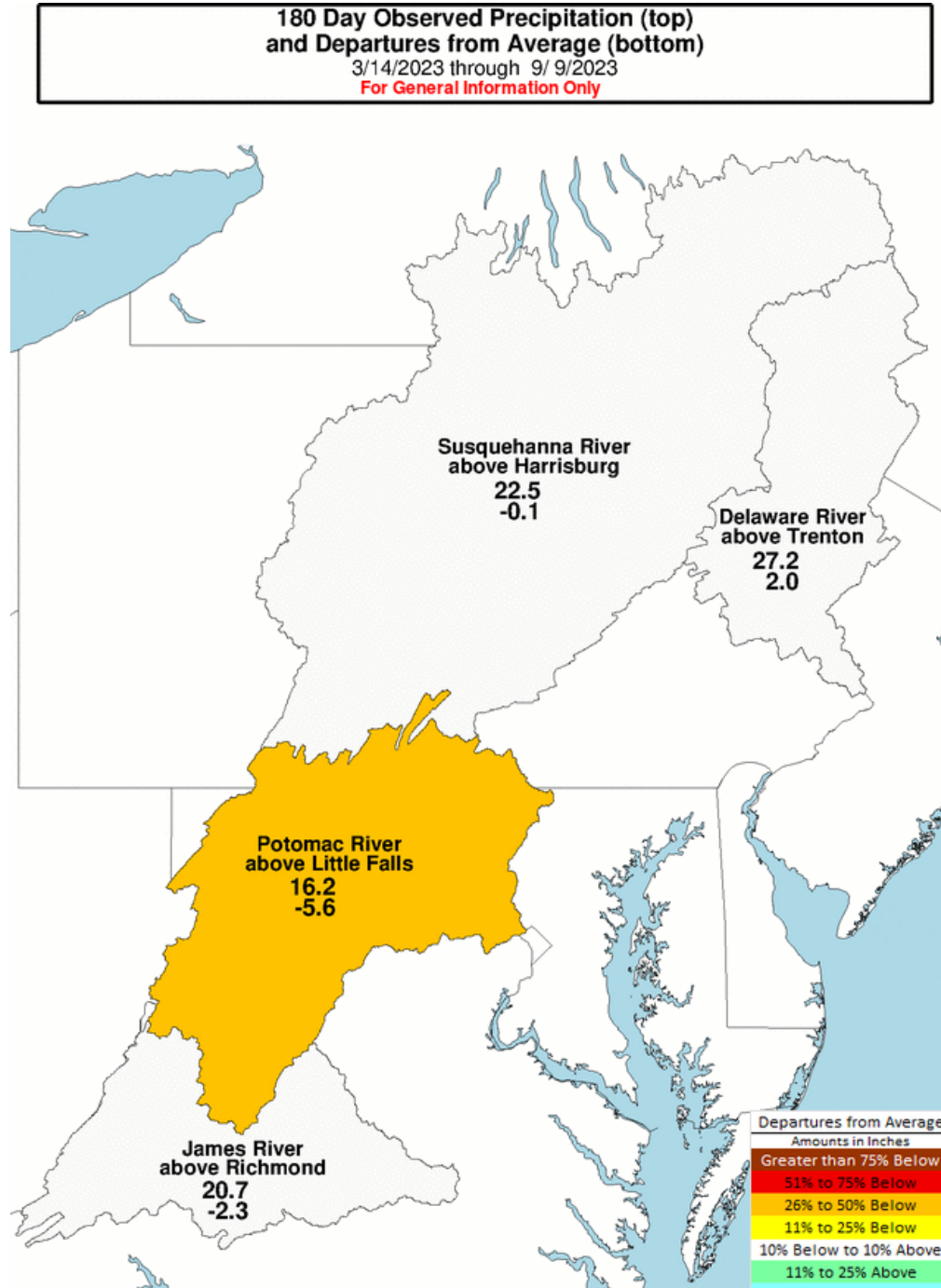


Figure 1: 180-day cumulative precipitation deficits from the Middle Atlantic River Forecast Center.

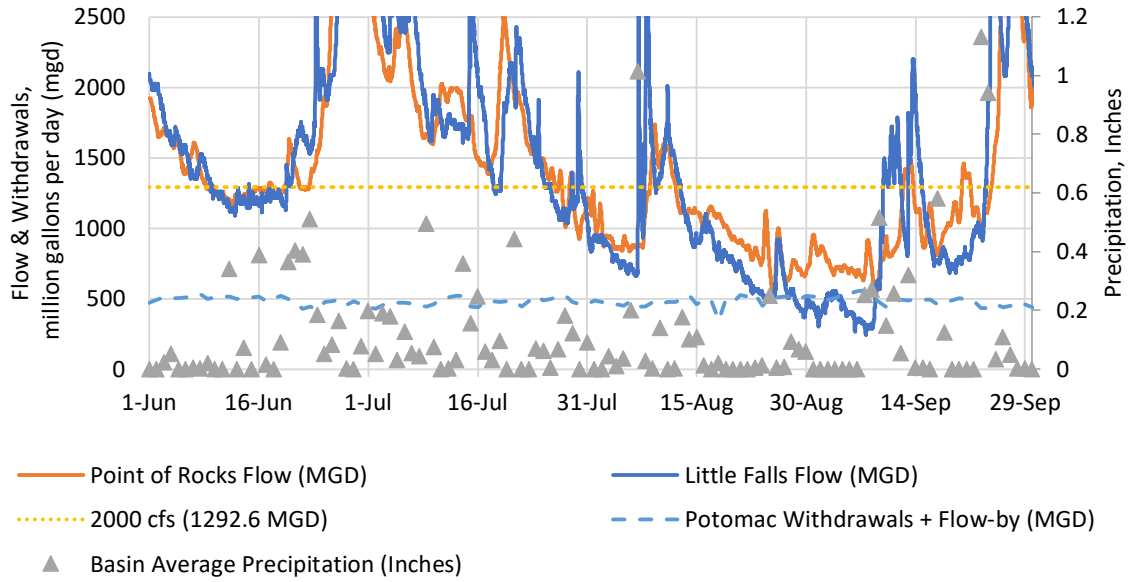


Figure 2: Summer 2023 flows, withdrawals, and precipitation.

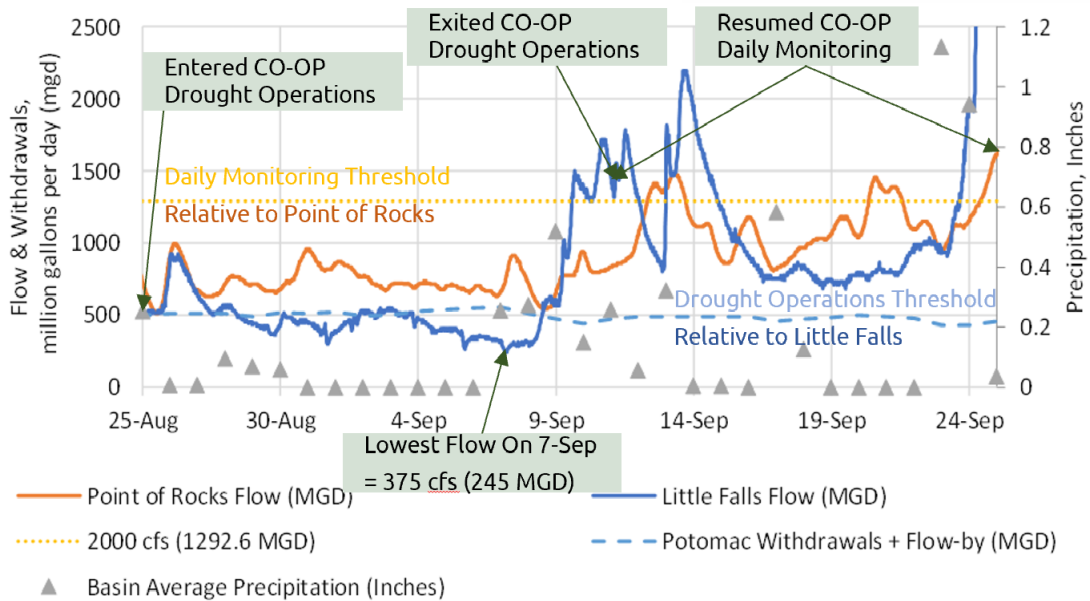


Figure 3: Close-up of flow conditions during 2023 Drought Operations.

Drought Operations Governance and Communications

Regional agreements

Several regional agreements influence how water is managed in the WMA during droughts: the *Low Flow Allocation Agreement*, the *Water Supply Coordination Agreement*, and the *Metropolitan Washington Water Supply and Drought Awareness Response Plan*. Each of these agreements defines certain numerical thresholds that may trigger actions or requirements, and these thresholds were of interest and the subject of discussion during 2023 drought activities.

LFAA

The *Low Flow Allocation Agreement* (LFAA) governs allocations of available water during water supply emergencies. It was signed in 1978 by the United States, Maryland, Virginia, and the District of Columbia (the “governing parties”), and the Washington Suburban Sanitary Commission (WSSC Water), and Fairfax County Water Authority (Fairfax Water) (the “member parties”). Under the LFAA, as amended by Modification No. 2, the Washington Aqueduct may, in consultation with the member parties, declare an Alert Stage, Restriction Stage, or Emergency Stage when Potomac River flow falls below specified thresholds. During a Restriction or Emergency Stage, Washington Aqueduct is responsible for calculating each user's allocated fair share of water available from the Potomac River, considering the amount needed for environmental flow-by below Little Falls Dam. The allocation for each supplier is based on its average winter (December, January, February) water use over the past five years as a fraction of the total winter water use of all users. A Memorandum of Intent (MOI) issued by the Acting Director of Civil Works of the U.S. Army Corps of Engineers to the Under Secretary of the Interior set forth the Corps’ guidance for the determination of stages of low flow and the amount needed for flow in the Potomac River downstream of the Little Falls Dam to maintain environmental conditions (“environmental flow-by”). Pursuant to the MOI, Washington Aqueduct adopted the recommendation of a joint study led by Maryland, the *Potomac River Environmental Flow-by Study* (Maryland DNR, 1981) to establish the amount needed for environmental flow-by below Little Falls Dam as 100 MGD.

The LFAA also institutes the role of an impartial Moderator, appointed by the governing parties, to mediate disputes and enforce the agreement. A Standby Moderator is appointed annually on a rotating basis. To ensure ongoing collaboration and adherence to the agreement’s terms, an annual meeting is convened every April to review it.

WSCA

The *Water Supply Coordination Agreement* (WSCA) established the WMA's system of cooperative water resources management during periods of drought. It was signed in 1982 by the United States acting through the Baltimore District Office of the US Army Corps of Engineers (USACE) functioning through the Washington Aqueduct Division (Washington Aqueduct), the District of Columbia, WSSC Water, Fairfax Water, and the CO-OP. The WSCA requires the suppliers to coordinate their operations during drought "so as to provide the optimal utilization of all available water supply facilities for the benefit of the inhabitants of the Washington Metropolitan Area," with both upstream and off-Potomac reservoirs to be operated in accordance with the agreement's *Drought-Related Operations Manual for the Washington*

*Metropolitan Area Water Suppliers*³ ("Operations Manual"). Under the WSCA, CO-OP is responsible for administrative, technical, supervisory, and management services. The WSCA establishes an Operations Committee, composed of a representative from each utility, to oversee implementation of the agreement.

MWCOG Water Supply Plan

The *Metropolitan Washington Water Supply and Drought Awareness Response Plan (2001)* was developed by the Metropolitan Washington Council of Governments (MWCOG) and regional stakeholders, including the regional water suppliers and CO-OP after the drought of 1999. This plan consists of two interrelated components: (1) a year-round emphasis of wise water use and conservation and (2) a water supply and drought awareness and response plan to be implemented during drought conditions for a coordinated regional response. The plan provides four stages for water use restrictions for the Potomac River: Normal, Watch, Warning, and Emergency.

Roles and responsibilities

CO-OP

Under the WSCA, ICPRB's CO-OP Section is given the responsibility of establishing "joint and coordinated operating procedures for use by the suppliers to monitor supply (including rainfall forecasts) and demand during emergencies and droughts" and establishing and maintaining "a system for monitoring supply and demand and performing drought management analyses." CO-OP's system currently includes

- Data Portal - a password-protected website that automatically ingests twice-daily data reports from suppliers and serves as a data exchange platform for other system components;
- Low Flow Forecast System (LFFS) - a watershed runoff model that uses National Weather Service and other data to provide real-time forecasts of Potomac River flow out 15 days into the future; and
- DroughtOps_DSS - an online dashboard, developed in the R/Shiny software platform, for real-time support of CO-OP drought operations, providing information for situational awareness and informing decisions on reservoir release rates.

Whenever Potomac River flow at Point of Rocks falls below 2,000 cubic feet per second (cfs), the WSCA's Operations Manual requires CO-OP to estimate daily flow in the Potomac River at Little Falls Dam, modified by excluding the impacts of WMA withdrawals. The process is part of the CO-OP Daily Monitoring stage of drought response activities. We refer to these modified daily flow values as Potomac River "adjusted flow" at Little Falls. These daily flow values are available via the USGS's National Water Information System as Station No. 01646502, Potomac River, adjusted, near Washington, DC.⁴ The Operations Manual also provides numerical triggers for the stage of drought response that we now refer to as CO-OP Drought Operations. During Drought Operations, CO-OP is to determine appropriate release rates from Jennings Randolph Reservoir water supply storage and from Little Seneca Reservoir, respectively, to meet total system demands and the Little Falls flow-by and to convey requests for the necessary releases to staff at the Baltimore District Corps of Engineers and WSSC Water, respectively. In addition, in consultation with Fairfax Water and WSSC Water staff, CO-OP is to determine withdrawal

³ The Drought-Related Operations Manual for the Washington Metropolitan Area Water Suppliers was last revised on June 13, 1988.

⁴ Available at https://waterdata.usgs.gov/nwis/dv/?site_no=01646502&agency_cd=USGS&referred_module=sw

rates from the Occoquan and Patuxent reservoirs. During Drought Operations, CO-OP keeps the WMA suppliers and regional stakeholders informed on hydrometeorological conditions, WMA withdrawals, reservoir storage levels, reservoir releases, and special conditions affecting river flows via twice-daily email reports and, when appropriate, via phone calls and teleconferences.

In addition to its response roles during low-flow periods, the Operations Manual requires CO-OP to issue long-term Water Supply Outlooks from May through September. CO-OP typically publishes its Water Supply Outlook near the beginning of each month from April through October. However, during the 2023 dry period, CO-OP published special issues for November and December.

WMA Suppliers

The WSCA's Operations Committee is responsible for overseeing implementation of and monitoring compliance with the WSCA and the Operations Manual. The Operations Committee also has the authority to

- "as necessary, review decisions of the Director of CO-OP and by unanimous agreement, change such decisions and so inform the Director of CO-OP;" and
- "upon unanimous agreement, to revise the Operations Manual as circumstances may require."

In the summer and fall of 2023, the Operations Committee consisted of the General Managers of Fairfax Water, Washington Aqueduct, and WSSC Water.

During Drought Operations and annual drought exercises, CO-OP staff coordinate closely with the WMA water supplier staff to devise operational strategies that take into account any special system conditions or circumstances, including reservoir storage levels, source water quality concerns, and constraints due to special maintenance and other projects. In addition, it has been customary for the Director of CO-OP Operations to request the General Managers' "concurrence" for the initiation of reservoir releases. During a very low flow period on Friday, September 8, concurrence was requested via email for potential reservoir releases in the coming weeks should CO-OP's forecast models indicate a need to augment Potomac River flows. This request elicited several questions from the General Managers and highlighted the need for frequent verbal communications between CO-OP staff and the General Managers during Drought Operations (see Take-Away 1).

MWCOG

MWCOG's Chief Administrative Officers Committee, along with water supplier general managers and CO-OP, with support by state water supply coordinators, the NOAA Climate Prediction Center, and the USGS, comprise the Drought Coordination Committee (DCC) under the *Metropolitan Washington Water Supply and Drought Awareness Response Plan* ("MWCOG Plan"). The DCC is responsible for issuing drought stage declarations for the WMA, i.e. Watch, Warning, and Emergency, along with appropriate public messaging. The purpose of the messaging is to inform the public in a coordinated and consistent manner of current conditions to support the potential for water use restrictions that might be needed during portions of a drought. The DCC is supported by the Drought Coordination Technical Committee (DCTC) of local government, water utilities, NOAA, USGS, and CO-OP. In the fall of 2023, the DCTC met on September 5 and decided that declaration of a Watch Stage was not warranted.

Other Organizations

The USACE's Baltimore District Office manages Jennings Randolph Reservoir and provides daily release targets for Savage Reservoir, which is managed by the Upper Potomac River Commission. Typically, the

USACE meets their targeted daily flow at the USGS stream gage at Luke, Maryland, with a Jennings Randolph release combined with a 20% match from Savage Reservoir. The USACE makes releases from Jennings Randolph "water quality storage" on a daily basis but only makes releases from Jennings Randolph "water supply storage" when requested by CO-OP, where water supply storage is 44.56% of the Reservoir's storage at the conservation pool level. During droughts, CO-OP may request a Jennings Randolph water supply release from the USACE by specifying a flow rate at Luke via a telephone call to Baltimore District Office staff by 9 A.M. During periods when CO-OP is requesting water supply releases from Jennings Randolph Reservoir, USACE staff provide CO-OP staff with recent daily Jennings Randolph water supply and water quality storage volumes based on their storage accounting rules.

The USGS's Maryland-Delaware-D.C. Water Science Center maintains a system of stream gage stations in Maryland. It is responsible for keeping each station's stage-discharge relationships up-to-date by making periodic visits to make field measurements across stream transects. During low-flow periods, USGS staff typically make more frequent than usual field visits to their Point of Rocks and Little Falls gage stations to make sure that reported flows are accurate. The CO-OP suppliers provide partial funding for five USGS stream gage stations in the Potomac basin:

- Potomac River at Point of Rocks, MD (Station No. 01638500);
- Potomac River at Shepherdstown, WV (Station No. 01618000);
- Seneca Creek at Dawsons ville, MD (Station No. 01645000);
- Savage River near Bartonsville, MD (Station No. 01596500); and
- Potomac River at Edwards Ferry near Poolesville, MD, stage monitor only (Station No. 01644148).

Black Hill Regional Park, part of the Maryland-National Capital Park and Planning Commission (M-NCPPC) Montgomery Parks system in Montgomery County, Maryland, is the location of Little Seneca Reservoir. Park personnel manage recreational activities and the parklands surrounding the Reservoir, though WSSC Water employees manage Little Seneca dam and its operations. When releases from Little Seneca become likely, CO-OP sends letters to the Montgomery County Executive and Council and to the M-NCPPC to notify them that reservoir releases may occur in the coming weeks (see Appendix A). CO-OP staff also keep park personnel abreast of release plans so that signage can be placed downstream of the dam prior to a water supply release. When a release from Little Seneca Reservoir is required, it is coordinated through WSSC Water's System Control office, which can remotely control the operations of the dam.

Triggers and stages

The three regional agreements discussed above all contain numerical thresholds that may trigger certain actions. The status of these thresholds was of ongoing interest to stakeholders during the drought of 2023. The thresholds are summarized in Table 1, below. In this table, the following definitions are used:

Q_{POR}	= Potomac River daily mean flow at the USGS stream gage at Point of Rocks, MD (Station ID 01638500), cfs
Q_{LF}	= Potomac River daily mean flow at the USGS stream gage at Little Falls pump station near Washington, DC (Station ID 01646500), MGD
W	= Total WMA Potomac River withdrawals, MGD

$Q_{LF, Adj}$ = Potomac River daily mean adjusted flow at Little Falls pump station near Washington, DC (Station ID 01646502), MGD
= $Q_{LF} + W$

Table 1: Summary of WMA drought thresholds.

Agreement	Name	Numerical threshold	Units	Action
WSCA - Operations Manual	CO-OP Daily Monitoring	$Q_{POR} < 2000$	cfs	Daily supplier reporting & CO-OP email reports
WSCA - Operations Manual	CO-OP Drought Operations	$Q_{LF, Adj} < 2*W + 100$ <i>or equivalently,</i> $Q_{LF} < W + 100$	MGD	Twice-daily supplier reporting & CO-OP email reports; possible operational decisions
LFAA	Alert Stage	$Q_{LF, Adj} < 2*W$ <i>or equivalently,</i> $Q_{LF} < W$	MGD	If threshold is reached, then Washington Aqueduct may declare an Alert Stage. In an Alert Stage, Washington Aqueduct keeps the LFAA Moderator informed
LFAA	Restriction Stage	$Q_{LF, Adj} < (1.25*W + 125)$ <i>or equivalently,</i> $Q_{LF} < 0.25W + 125$	MGD	If threshold is reached, then Washington Aqueduct may declare a Restriction Stage, which requires the National Park Service to look for strategies to reduce water flowing into the C&O Canal. Also, certain Maryland and Virginia consumptive use restrictions may be triggered for upstream users.
LFAA	Emergency Stage	When estimated flows are not expected to meet demands plus the 100 MGD environmental flow-by over next 5 days	MGD	Emergency water allocations by Washington Aqueduct
MWCOG Plan	Watch	NOAA D1 conditions in the Potomac basin		Based on NOAA D1 conditions, the MWCOG DTC may declare a Watch Stage. During a Watch Stage, MWCOG issues press releases on voluntary water use restrictions.
MWCOG Plan	Warning	Combined Jennings Randolph and Little Seneca water supply storage < 60% of capacity for 5 days	Percent	When this threshold is reached, the MWCOG DTC may declare a Warning Stage, which requires MWCOG and the regional suppliers conduct voluntary water use restriction messaging.
MWCOG Plan	Emergency	50% probability of not meeting WMA demands over next 30 days	Percent	Mandatory water use restrictions

Drought Reporting

Data Portal website

The CO-OP Data Portal website is a secure, password-protected platform dedicated to gathering, processing, and publishing water supplier data for effective drought operations. Powered by the Drupal content management system and hosted by Amazon Web Services, the website facilitates efficient data exchange and collaboration among water suppliers, ensuring drought preparedness and response mechanisms.

Water supplier participation plays an important role in the website's success. Suppliers send their water withdrawal and reservoir storage data to coop@icprb.org. Upon submission, these data are automatically processed by the Data Portal and used to generate comma-separated value files containing both recent withdrawals and projected withdrawals for the Potomac and off-Potomac sources.

Submission issues: Recent operations have highlighted several recurring challenges with data submissions that require our attention:

- *Formatting problems:* Some submissions use formats that are not approved, leading to integration errors in the automated process;
- *Contact information changes:* Issues have arisen when suppliers use multiple sender email addresses, which can result in missed communications;
- *Submission errors:* Both automated and manual data entries have experienced switched value errors; and
- *Data omissions:* Submissions are occasionally incomplete, notably including regular omissions of WSSC Water hourly withdrawals for yesterday and today during Drought Operations.

Process enhancements: CO-OP staff are actively working to improve the data submission process:

- *Standardization and guidance:* We are promoting explicit formatting guidelines and providing detailed submission instructions to each supplier;
- *Future developments:* We aim to implement an enhanced verification system that will automatically detect common errors and prompt the appropriate people to make corrections.

Uses of withdrawal data & forecasts

The Data Portal acts as a communication tool and facilitates data exchange between water suppliers, the DroughtOps_DSS dashboard, and the Low Flow Forecast System. This integration boosts efficiency, promoting smooth collaboration and information flow. The Data Portal includes a demand forecasting tool that predicts daily demand for each water supplier. The demand forecast equations, derived from the 2020 Washington Metropolitan Area Water Supply Study, incorporate data-informed annual demand estimates for each of the major water suppliers, Fairfax Water, Washington Aqueduct, and WSSC Water, as well as Loudoun Water. Independent variables used to estimate current and next day demand include the number of consecutive days with rainfall less than 0.15 inches, the day of the week, today's and tomorrow's estimated maximum temperature, and estimated and forecasted rainfall for both days. Additionally, the model uses maximum temperature and rainfall data from the previous two to five days, respectively.

Data submission options

During both Daily Monitoring and Drought Operations, water suppliers are expected to adhere to specific submission guidelines, including:

- Providing morning hourly withdrawal data by 7:30 A.M., covering both the previous day and as much of the current day as possible;
- Submitting afternoon hourly withdrawal data by 1:00 P.M., extending as far into the current day as feasible. This is only needed during Drought Operations when afternoon updates occur. However, if the process is automated it can continue through the year;
- Following either automated data protocols or manual submission instructions outlined on the Data Portal Submission Page, ensuring timely and accurate data transmission; and
- Being readily available for operational calls, enhancing collaboration and responsiveness during critical periods.

To simplify the submission process, suppliers are encouraged to leverage automated data files and submission processes whenever feasible, both in the morning and afternoon. In case of data revisions, suppliers can easily resend updated information using the same established processes.

For further convenience, the Data Portal offers suppliers the flexibility to review and edit their submissions. This includes generating graphs, tables, and comma-separated value files of their data, modifying submissions, and adjusting demand forecast assumptions.

Withdrawal forecasts

Withdrawal forecasts are generated through collaborative efforts between the Data Portal and the Low Flow Forecasting system. The forecast equations are calibrated to production data used in the 2020 water supply and demand study. Therefore, the withdrawal forecasts assume the following production loss rates to convert to withdrawals: FW Corbalis (Potomac) at 3%, FW Griffith (Occoquan) at 10%, LW Potomac at 0%, LW FW Purchase at 0% for FW produced water, WSSC Potomac at 3%, WSSC Patuxent at 3%, and WA Potomac at 3%. Figure 4 summarizes the forecasts of total withdrawals (Potomac plus “off-Potomac” sources for each supplier) compared to actual values, while Table 2 summarizes the error analysis results. Mean Forecast Error (MFE) is the mean difference of the actual demand minus the forecast demand and indicates a tendency to underestimate or over-estimate in the forecasting model, Mean Absolute Error (MAE) offers the average magnitude of errors regardless of direction, and Root Mean Squared Error (RMSE) factors in both average error and error variability, giving more weight to larger errors.

During the 2023 CO-OP Daily Monitoring and Drought Operation period (June 12 – Nov 22), the average mean absolute error (MAE) for the combined withdrawal of the three CO-OP suppliers (WSSC Water, Fairfax Water, and Washington Aqueduct) amounted to 31 MGD, with individual MAE values ranging from 10 to 15 MGD. Notably, Loudoun Water demonstrated a lower error rate of 3 MGD. Additionally, RMSE values for WSSC Water (13), Fairfax Water (29), Washington Aqueduct (17), and Loudoun Water (4) reflect the overall accuracy and variability of the forecasting model's performance across the different suppliers. These RMSE results highlight potential areas for improvement in the forecasting model, particularly concerning the Fairfax model, which makes assumptions for Fairfax Water's sales to Loudoun Water and purchases from Washington Aqueduct. The positive MFEs for the suppliers were 7, 0.5, 6, and 1, respectively, indicating a consistent tendency to underestimate withdrawals for all suppliers.

To provide context on the accuracy of the actual withdrawals on a percentage basis, the Mean Absolute Percent Error (MAPE) was also summarized in Table 2. The MAPE values are 5.75% for WSSC Water,

8.82% for Fairfax Water, 8.70% for Washington Aqueduct, and 10.71% for Loudoun Water. These percentages indicate the relative accuracy of the forecasts in relation to the actual withdrawal, highlighting that while Loudoun Water has a lower MAE, its MAPE is relatively higher due to its smaller actual withdrawal compared to the other suppliers.

One area of improvement for the withdrawal forecasts is to investigate average versus maximum day temperature inputs. The 2020 production models are currently calibrated to maximum day temperatures, but the Low Flow Forecast System is providing average day temperatures. Additionally, refining the relationship between Fairfax Water and Loudoun Water is crucial, especially with Loudoun Water shifting their Potomac withdrawal to match their Broad Run releases as required by their permit. Finally, additional review is needed to ensure that Fairfax Water’s purchases from Washington Aqueduct are properly accounted for in both the Washington Aqueduct and Fairfax Water withdrawal models to ensure more accurate forecasting.

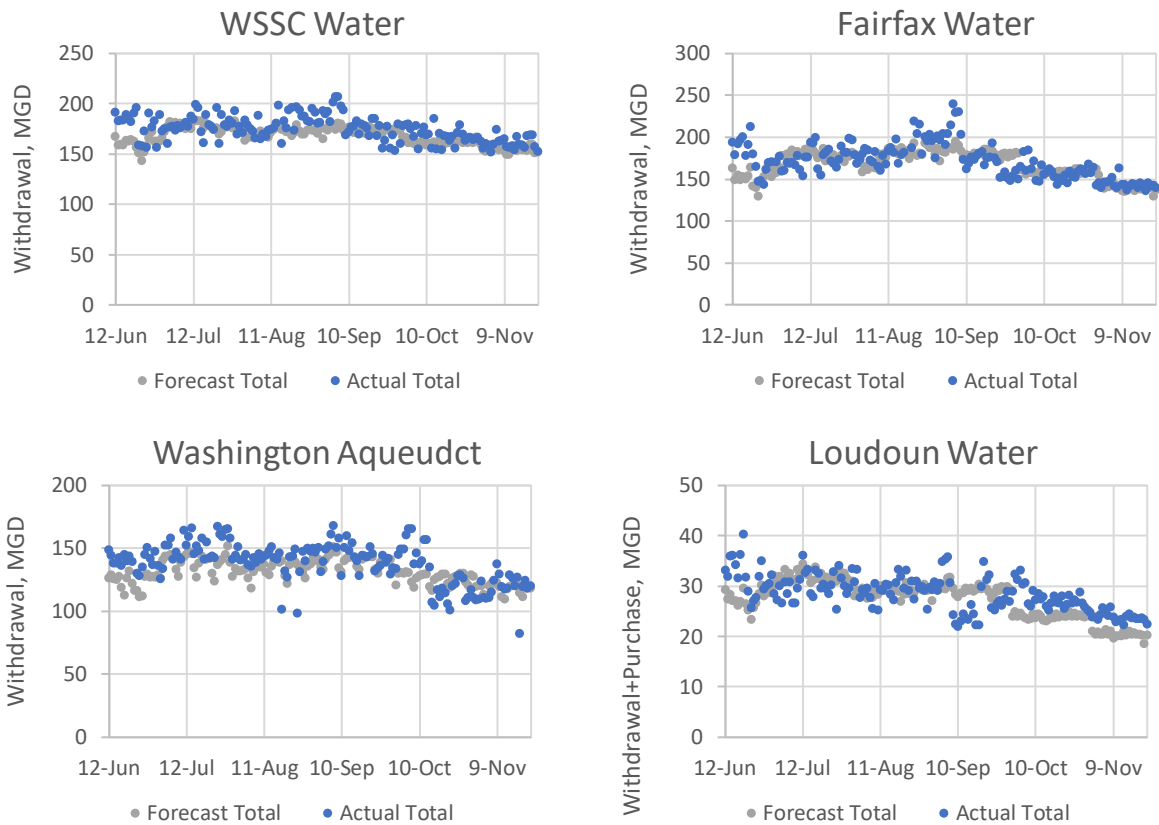


Figure 4: Forecasts and actuals of total withdrawals for the CO-OP Daily Monitoring and Drought Operations period between June 12 and November 22, 2023. Total withdrawals includes both Potomac and off-Potomac sources.

Table 2: Withdrawal forecasts error analysis for the June 12 through November 22, 2023, period in units of MGD.

Supplier	Mean Actual Withdrawal, MGD	Mean Forecast Error (MFE) (Actual minus Forecasted Withdrawal), MGD	Mean Absolute Error (MAE), MGD	Root Mean Squared Error (RMSE), MGD	Mean Absolute Percent Error (MAPE), %
WSSC Water	174	+7	10	13	6
Fairfax Water	170	+0.5	15	29	9
Washington Aqueduct	138	+6	12	17	9
Loudoun Water	28	+1	3	4	11

CO-OP's Drought Operations decisions process

Overview

CO-OP staff make four main types of operational decisions every morning during Drought Operations. Each of these is based on forecasts of river flow and WMA withdrawals and takes into account the travel times to Little Falls of reservoir releases and other operational changes (see Figure 5).

1. Load-shift to the Patuxent: If forecasts indicate a chance that today's average Potomac River flow at Little Falls Dam will drop below the 100 MGD environmental flow-by, WSSC Water will be requested to decrease its Potomac River withdrawal and increase its withdrawal from the Patuxent reservoirs. During low-flow conditions, CO-OP estimates that it takes approximately 10 hours for a change in withdrawal at WSSC Water's Potomac River intake to be reflected in a change in flow measured at the USGS's Little Falls gage.
2. Little Seneca release and possible load-shift to the Occoquan: If forecasts indicate that flow at Little Falls Dam may fall below 100 MGD tomorrow, WSSC Water will be requested to release water from Little Seneca Reservoir. To help preserve Little Seneca storage, Fairfax Water will be requested to reduce its Potomac withdrawal, if feasible, and to meet more of its demand from the Occoquan Reservoir. CO-OP estimates that during low flow periods it takes a little over a day for a release from Little Seneca to arrive at the USGS's Little Falls gage. Similarly, CO-OP estimates that it takes approximately 15 hours for a change in withdrawal at Fairfax Water's Potomac River intake to reach Little Falls in addition to time required to implement this change, and hence, CO-OP assumes that it takes approximately a day for a request to Fairfax Water to reduce its Potomac withdrawal to have an impact on flow at the Little Falls gage.
3. Jennings Randolph water supply release: If forecasts indicate that flow at Little Falls Dam will drop below 100 MGD nine days in the future, the USACE Baltimore District Office will be requested to release water from Jennings Randolph Reservoir water supply storage. This request is conveyed to the USACE as a flow rate target at the downstream USGS stream gage at Luke, Maryland. CO-OP estimates that during low flow periods it takes approximately nine days for a release from Jennings Randolph Reservoir to arrive at the USGS's Little Falls gage.
4. Load-shift to Little Falls: If forecasts indicate that flow above Washington Aqueduct's Great Falls intake is nearing 500 MGD, CO-OP staff notify the Washington Aqueduct that the *Potomac River Environmental Flow-by Study* recommends they begin shifting "withdrawals to the Little Falls Dam intake to maintain at least 100 MGD plus the Washington Aqueduct's allocation up to 200

MGD between Great Falls and Little Falls Dam." CO-OP estimates that during low flow periods it takes approximately nine hours for a change in withdrawals at Great Falls to be reflected in flows measured at the USGS's Little Falls gage.

Each of these four decisions is supported by CO-OP's DroughtOps_DSS dashboard, which provides flow forecasts and estimates of reservoir release rates needed to meet WMA demands and the 100 MGD environmental flow-by. More details concerning each of these decisions, including the balancing of reservoir storages, are available in Schultz et al. (2017)⁵ and Ahmed et al. (2020)⁶.

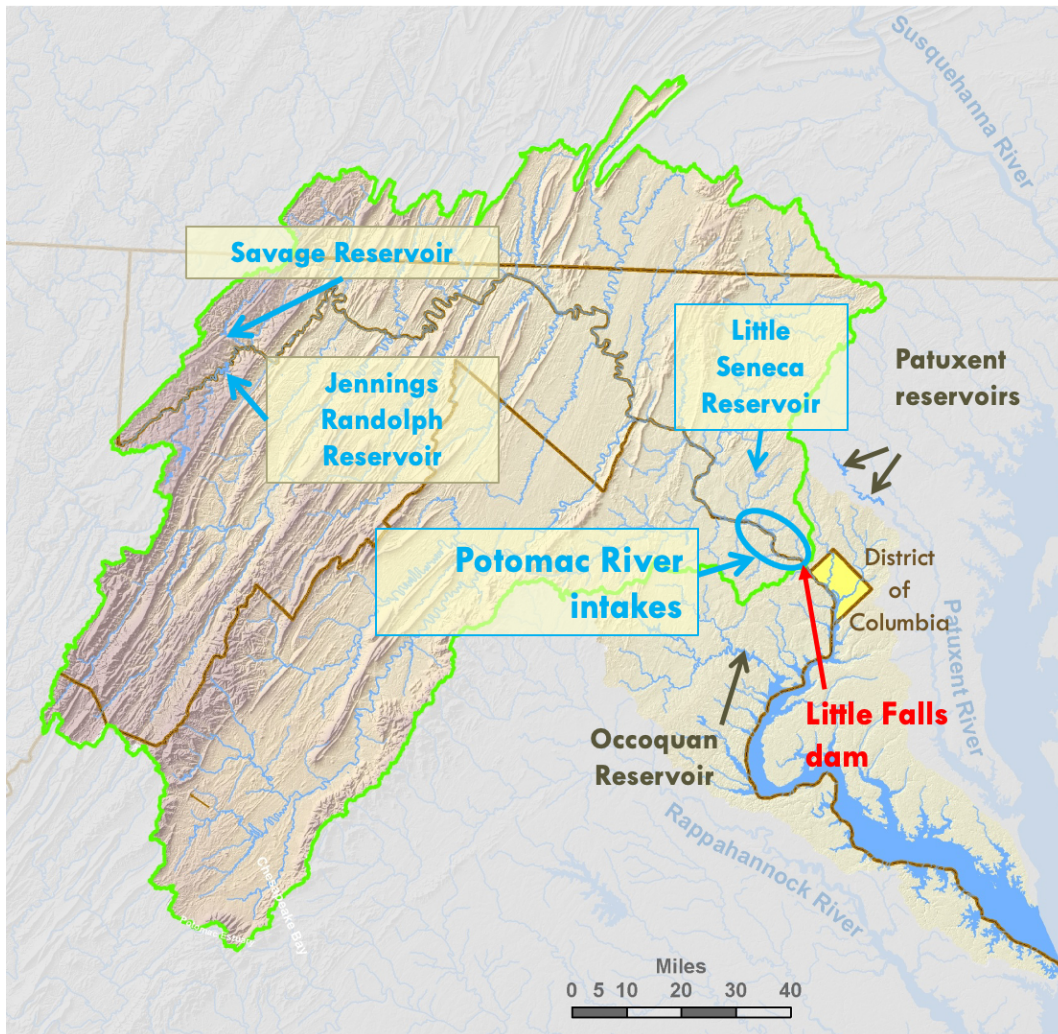


Figure 5: CO-OP system resources, WMA intakes, and Little Falls Dam.

⁵ Schultz, C.L., Ahmed, S.N., Moltz, H.L.N., Seck, A. 2017. 2020 Washington Metropolitan Area Water Supply Alternatives. Interstate Commission on the Potomac River Basin, ICPRB Report No. 17-3, Rockville, Maryland.

⁶ Ahmed, S.N., Moltz, H.L.N., Schultz, C.L., Seck, A. 2020. 2020 Washington Metropolitan Area Water Supply Study: Demand and Resource Availability Forecast for the Year 2050. Interstate Commission on the Potomac River Basin, ICPRB Report No. 20-3, Rockville, Maryland.

Decision rules used during Drought Operations have been extensively tested and refined using CO-OP's planning model, the Potomac Reservoir and River Simulation Model (PRRISM). PRRISM simulates at a daily timestep the processes and constraints that determine water availability at WMA intakes and at Little Falls Dam, including Potomac River flows, reservoir inflows, temperature and precipitation, upstream consumptive use, water demands, finished water transfers, WMA wastewater treatment plant discharges, reservoir releases, reservoir storages, Potomac River flow forecasts, and the potential impacts of climate change on both flows and demands. PRRISM also simulates other operational considerations, including maintaining a balance between Little Seneca Reservoir and Jennings Randolph Reservoir water supply storages as a percent of capacity and the Baltimore District's use of releases from Savage Reservoir to match Jennings Randolph water supply releases to help meet the targeted flow rate at Luke.

Intra-Daily Flow Fluctuations

Flows in the Potomac River are highly variable, with the flow at any given point reflecting the cumulative impacts of different hydroclimatic processes occurring in the many diverse portions of the upstream watershed. Intra-daily flow fluctuations are only imperfectly simulated in river flow forecast models and thus add uncertainty to CO-OP's flow forecasts. In the summer and fall of 2023, two factors caused additional intra-daily flow fluctuations: activities occurring at two hydroelectric facilities located on the Potomac River mainstem and intra-daily changes in WMA supplier withdrawals.

Dam 4 and Dam 5 operations

Significant intra-daily flow fluctuations occurred in the summer and fall of 2023 due to activities related to two upstream dams: Dam 4 and Dam 5. These two historic dams are owned by the National Park Service (NPS). Run-of-river hydroelectric power facilities are located at both dams and are currently operated by Eagle Creek Renewable Energy, a wholly owned subsidiary of Ontario Power Generation.

In the summer of 2023, contractors for the NPS initiated bathymetric surveys at both dams to help support the maintenance and historic preservation of these structures. Data collection required low flow conditions and involved shutting down turbines at various times. Changes in turbine operations caused fluctuations in daily flow of up to 1200 cfs. These fluctuations were visible, for example, on the hydrograph shown in Figure 6, which shows flows at the USGS stream gage at Shepherdstown, West Virginia, located downstream of both dams. These same fluctuations, only slightly attenuated, are also visible on the hydrograph further downstream, at Point of Rocks, Maryland. Under low flow conditions, the waves of water depicted in the hydrograph travel downstream from Shepherdstown to Point of Rocks with little distortion, though the higher flow portions of the hydrograph have somewhat faster travel times than the lower flow portions and some dispersion occurs. Similarly, the hydrograph for Potomac River flow at Point of Rocks provides a preview of future flow downstream at Little Falls Dam. For example, the two sharp peaks separated by a sharp dip in the hydrograph at Shepherdstown on August 23 and 24, 2023 appear at Point of Rocks approximately a day later (Figure 6). By the time these fluctuations reach Little Falls on August 26 and 27, the leading peak is significantly attenuated as is the dip.

ICPRB met with NPS and Eagle Creek staff twice during the drought of 2023: on September 5 and December 6. At these meetings, ICPRB staff obtained information on the project activities, timeline, and contacts. During these meetings, a strategy to reduce sharp swings in flow was discussed. Such a strategy was used shortly after the September 5 meeting but was not consistently implemented throughout the fall.

The intra-daily fluctuations from these dam operations are either not simulated or, in some cases, imperfectly simulated by the various flow prediction models relied upon by CO-OP during Drought Operations.

**USGS 01618000 POTOMAC RIVER AT SHEPHERDSTOWN, WV
 USGS 01638500 POTOMAC RIVER AT POINT OF ROCKS, MD
 USGS 01646500 POTOMAC RIVER NEAR WASH, DC LITTLE FALLS PUMP STA**

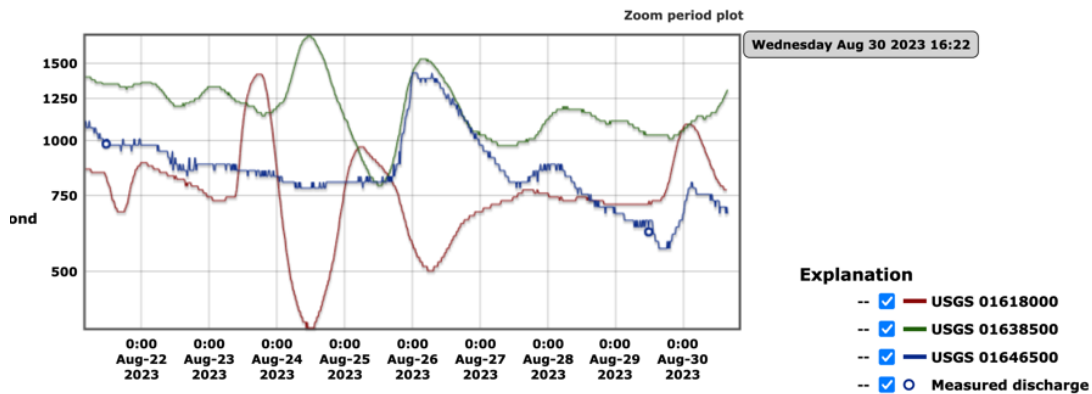


Figure 6: Hydrograph of flow at the USGS stream gages at Shepherdstown (red), Point of Rocks (green), and Little Falls (blue), showing the impact of activities at upstream hydroelectric dams.

WMA intra-daily withdrawal fluctuations

Potomac River withdrawals by WMA suppliers also cause intra-daily fluctuations in river flows. Figure 7 shows plots of Washington Aqueduct's Potomac River withdrawals at Little Falls and Fairfax Water's Potomac withdrawals, along with river flows recorded at the USGS's stream gage at Little Falls Dam. WSSC Water's withdrawals are not shown because they were reasonably constant during this period of time. In this graph, a clear correspondence between the Little Falls withdrawals and sharp drops in river flows are recorded. This is consistent with the fact that the Little Falls gage records changes in flow from processes such as withdrawals. Historically, there has been concern that when Washington Aqueduct turns on its pumps at Little Falls, which are located only tens of feet from the USGS stage monitor, a cone of depression may form, which would cause stage measurements to fall to levels that are lower than the actual river stage, causing Potomac River flows to be reported that are artificially low. Washington Aqueduct staff are proposing measures to reduce the possibility that this will happen - see Take-Away 11, below.

CO-OP's estimates of travel times of fluctuations in withdrawals to Little Falls Dam under low flow conditions are:

- From Fairfax Water intake: 15 hours;
- From WSSC's intake: 10 hours;
- From Washington Aqueduct's Great Falls intake: 9 hours; and
- From Washington Aqueduct's Little Falls intake: 0 hours, i.e., immediate.

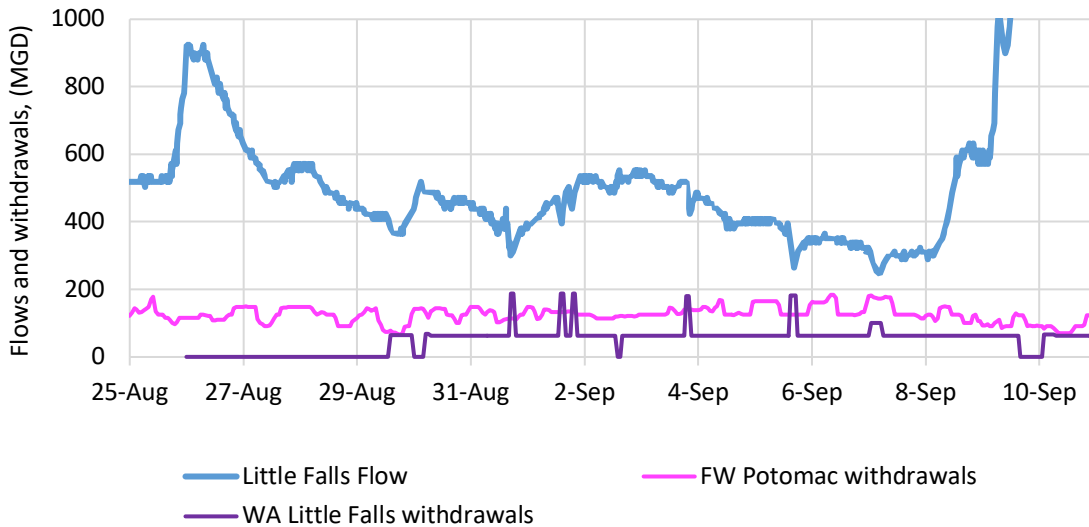


Figure 7: Fairfax Water (FW) and Washington Aqueduct (WA) hourly withdrawals and flows at Little Falls Dam.

In addition to these travel times, CO-OP staff also consider the approximate time it takes each supplier to implement a request for an operational change. Because of distribution system constraints, Fairfax Water staff estimate that it would take approximately 12 hours to implement a load-shift from their Potomac intake to their Occoquan intake. Both WSSC Water and Washington Aqueduct can implement such shifts in just a few hours.

During 2023 Drought Operations as well as in recent drought exercises, CO-OP staff have made daily operational requests that suppliers keep their Potomac River withdrawals "as steady as possible." The feasibility and appropriateness of this request were discussed at the Post-Drought Operations Review and at the subsequent meeting of the Operations Committee. CO-OP suppliers face a variety of challenges in keeping withdrawals steady related to electricity costs and operational constraints. WSSC Water is sensitive to intra-daily variations in PJM⁷ electricity rates. Thirty minutes of high power usage by Fairfax Water can raise their electricity rates for many months in the future.

Washington Aqueduct faces higher costs when it switches withdrawals from its Great Falls intake, from which water flows via the gravity flow to Dalecarlia Reservoir, to its Little Falls intake, where large pumps are required to pump water uphill to Dalecarlia. In addition, withdrawal rates at Little Falls are constrained by the fact that its six pumps all have fixed pumpage rates, as follows:

- one pump rated at 50 MGD (60 MGD observed);
- one pump rated at 75 MGD (94 MGD observed); and
- four pumps rated at 100 MGD (125 MGD observed).

Dealing with uncertainty

All of CO-OP's operational decisions depend on forecasts of flows and demands. However, future flows and demands are both influenced by future weather conditions and are thus subject to considerable

⁷ PJM is a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of 13 states, including Maryland, Pennsylvania, Virginia, and West Virginia, and the District of Columbia.

uncertainty. In addition, future flows depend on hydrological processes that are imperfectly approximated by available models, such as rates of inflow into the river from groundwater aquifers and travel times of river flow waves.

CO-OP addresses these forecast uncertainties in two ways: the use of multiple river flow forecast models and the addition of margins of safety to calculated reservoir release rates.

Use of multiple models

One of CO-OP's strategies for dealing with the considerable uncertainties in future river flows is using multiple models to inform operational decisions. A final decision on a particular operational change is based on the best professional judgment, considering the performance over the past several days of the various available models. Staff take into account the need to balance competing goals, such as the preservation of stored raw water resources and the need to keep to a minimum the risk of not meeting the environmental flow-by.

The river flow forecast models consulted by CO-OP staff during 2023 Drought Operations are listed below.

For flow at Little Falls Dam in nine days, we used results from

1. CO-OP's empirical flow recession model estimates - available in DroughtOps_DSS;
2. CO-OP's LFFS rainfall/runoff model estimates - available in DroughtOps_DSS; and
3. The Mid-Atlantic River Forecast Center ensemble forecasts 10 Day River Level Probabilities for Little Falls (see Figure 8) - available via https://www.weather.gov/erh/mmefs_marfc?id=BRKM2&model=NAEFS.

For flow at Little Falls Dam today and tomorrow, we used results from

4. CO-OP's upstream flow accumulation model with constant lag times - available in DroughtOps_DSS;
5. CO-OP's upstream flow accumulation model with flow-dependent lag times - available in DroughtOps_DSS;
6. CO-OP's LFFS rainfall/runoff model estimates - available in DroughtOps_DSS; and
7. The National Weather Service Advanced Hydrologic Prediction Service's 3-day forecast - available at <https://water.weather.gov/ahps2/hydrograph.php?wfo=lwx&gage=brkm2>.

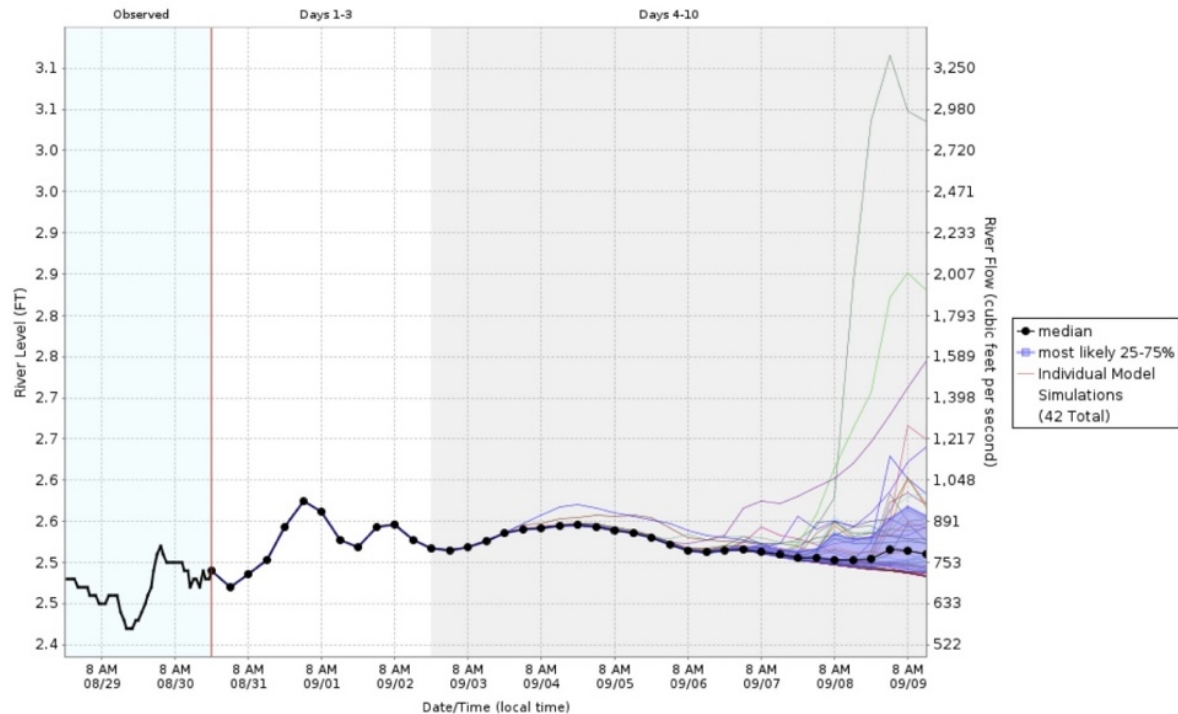
NAEFS - 10 Day River Level Probabilities

Based on North American Ensemble Forecast System Model Simulations
Used to Estimate the Range of Possible River Levels



Aug 31 - Sep 10, 2023

Potomac River at Little Falls near Washington, DC



Model runtime: 08:00 PM EDT Aug 30 2023
Middle Atlantic River Forecast Center

Figure 8: MARFC NAEFS ensemble forecast for Potomac River flow at Little Falls Dam made on Aug 31, 2023.

Margins of safety

CO-OP uses three margins of safety (MOSs) to compute reservoir release rates. For each of the three cases below, CO-OP staff make operational changes to try to ensure that Potomac River flow remains at or above (100 MGD + MOS), where 100 MGD is the current environmental flow-by at Little Falls Dam. Each of the three MOSs below has been extensively tested in PRRISM planning simulations using a range of climate change impacts on future flows. In each case, the goal of the tests was to find the smallest MOS that would meet CO-OP's reliability targets.⁸

8. To meet the environmental flow-by today via a load-shift to the Patuxent: $MOS_0 = 40$ MGD;
9. To meet the environmental flow-by tomorrow via a Little Seneca release and possibly a load-shift to the Occoquan: $MOS_1 = 120$ MGD; and
10. To meet the environmental flow-by in 9 days via a Jennings Randolph water supply release: $MOS_9 = 0$ MGD (but the calculated release may be adjusted to aim to maintain a balance between Jennings Randolph water supply and Little Seneca storage).

⁸ Ibid.

Take-Aways

The Take-Aways listed below are derived from suggestions and discussions at the November 3 "After Action Meeting," the November 29th meeting of the Operations Committee, and from CO-OP staff experience during the drought of 2023.

Governance and Communication

1. Preparation for reservoir releases and request for concurrence: When Potomac River flow forecasts indicate that reservoir releases may be initiated within the next ten (10) days or when CO-OP Drought Operations commences, whichever occurs first, CO-OP staff will prepare for the potential initiation of reservoir releases by taking the following steps:
 - a. Submitting to the CO-OP General Managers an email request for concurrence of initiation of reservoir releases, followed up by voice communications;
 - b. Scheduling regular verbal briefings to ensure that water supplier senior leadership understands why and how operational decisions are being made;
 - c. Providing a reminder to the suppliers to call a meeting of the Drought Coordination Technical Committee with MWCOG to create a press release to have on hand for the first reservoir release;
 - d. Sending letters to Montgomery County elected officials and to the M-NCPPC notifying them that water supply releases from Little Seneca Reservoir may occur in the coming weeks; and
 - e. Making verbal contact with the Manager of Black Hill Regional Park informing them that water supply releases from Little Seneca Reservoir may occur in the coming weeks and establishing a protocol for keeping park staff informed.
11. Drought email reports: Suppliers indicated that email was the best means of delivering twice daily reports, but that certain organizational and other enhancements would be beneficial:
 - f. Addition of a "Special Conditions" section to highlight information on recent or upcoming events such as USGS flow recalibrations, whitewater releases, and hydroelectric dam operations;
 - g. Highlighted updates on expected arrival of any North Branch water supply releases; and
 - h. Late afternoon updates (at 4-5 PM) during periods in which reservoir releases are being made, especially when flows are dropping.
2. Easy access to agreements and other reference material: CO-OP staff will make sure that copies of the regional agreements and reports pertaining to past droughts are easily accessible via the CO-OP section of ICPRB's website, or alternatively, via the Data Portal.
3. WMA drought triggers: CO-OP will construct an online table of the various WMA drought triggers. This table will provide today's status of all the triggers in Table 1. Also, the online table will include guidance for Washington Aqueduct regarding potential shifts between their Great Falls and Little Falls intakes.

Drought reporting

4. Data Resubmission Methodology: CO-OP staff recommend the automated email method for data resubmission, and suppliers confirm that it's convenient to regenerate automated submissions. However, it was suggested that testing be conducted of backup methods for resubmission and that validated templates be on hand.
5. Validation during Drought Operations: Currently, the automated data isn't undergoing validation from the suppliers until they receive it via CO-OP's drought email reports. It is recommended

that, during Drought Operations, supplier staff actively engage in verifying the data file, either by reviewing their file or checking what's available in the Data Portal. This procedure should also be tested during the next available opportunity - that is, a low flow period or drought exercise.

6. Collection of Off-Potomac Withdrawals: CO-OP staff's preference is that suppliers use the Data Portal submission form to provide any information on projected current day or future day use of "off-Potomac" (Occoquan or Patuxent), or, in the case of Washington Aqueduct, "alternate" (Little Falls) intakes. Two supplier staff members mentioned they experimented with the site. CO-OP staff should meet with suppliers and demonstrate how to do this.
7. Withdrawal Forecasts during Drought Operations: No concerns were raised about ICPRB's withdrawal forecast performance; peaks result from unforeseen operational changes. The Data Portal can accept revisions to this data, although the supplier staff did not indicate a need to overwrite ICPRB's forecast with their predictions for today and tomorrow total withdrawals.
8. Hourly Data Sheet Production Protocol at WSSC Water: It's crucial to have someone actively producing hourly data sheets at WSSC Water during Drought Operations, as the current process is not automated. Further communication and efforts are needed to streamline the process and transition to automated data generation.

Drought operations decisions process

9. Dams 4 & 5 communications: To obtain advance warning of upcoming operations at Dams 4 and 5 that may cause intra-daily flow fluctuations during Drought Operations, CO-OP will maintain lines of communications with NPS and hydroelectric power facility staff. Current NPS and Eagle Creek staff were added to CO-OP's 2023 drought reporting email distribution list.
10. Little Falls withdrawals: To address the fact that temporary increases in Washington Aqueduct's Little Falls withdrawals are causing sharp drops in measured flow at Little Falls Dam,
 - a. Washington Aqueduct will seek to have the USGS move its stream gage station at Little Falls to the Virginia side of the river, which should eliminate any cone of depression effects; and
 - b. CO-OP staff encourage Washington Aqueduct to consider installation of at least one smaller pump at Little Falls.
11. Steady Potomac withdrawals: CO-OP operational requests to suppliers to keep Potomac River withdrawals "as steady as possible" will be restricted to periods in which releases from local reservoirs and load-shifts are occurring or are likely to occur.

APPENDIX A - Letters of Notification to Montgomery County

The following are notification letters to Montgomery County elected officials and to the M-NCPPC.

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

30 W. Gude Drive, Suite 450
Rockville, MD 20850
(301) 984-1908
www.potomacriver.org



Chair
Robert M. Sussman

September 9, 2023

Vice Chair
Susan K. Weaver

District of Columbia
Willem Brakel (*)
Tiffany M. Potter
Jeffrey M. Seltzer
Kimberly L. Jones (a)
Hamid Karimi (a)
James T. Tsai (a)

The Honorable Marc Elrich
Montgomery County Executive
Executive Office Building
101 Monroe Street, 2nd Floor
Rockville, MD 20850

Maryland
Gov. Wes Moore
Catherine R. McCabe, Esq.
D. Lee Currey (a*)

Dear Mr. Elrich:

Pennsylvania
Ramez Ziadeh
Rep. Dan Moul
William Willis
Susan K. Weaver (a*)
Adam McClain (a)

The Interstate Commission on the Potomac River Basin (ICPRB) coordinates drought-related water supply operations on behalf of the Washington, D.C., metropolitan area's (WMA's) water suppliers: Washington Suburban Sanitary Commission (WSSC Water), Fairfax Water, and the Washington Aqueduct Division of the U.S. Army Corps of Engineers. I am writing to inform you that we are currently engaged in active drought operations to ensure that the WMA's water supply needs are met while maintaining the required environmental flow-by of 100 million gallons per day (MGD) at the Little Falls dam near Washington, D.C.

Virginia
Paul A. Holland
Del. Alfonso Lopez
Michael Rolband
Scott W. Kudlas (a*)
Mark E. Peterson (a)

When drought occurs, releases from upstream reservoirs are used to augment Potomac River flow, ensuring a safe and reliable water supply for the over 4.8 million drinking water customers in the WMA, including Montgomery County citizens that are served by WSSC Water. The reservoirs available to increase flow in the Potomac River include Jennings Randolph Lake in western Maryland and Little Seneca Reservoir in Montgomery County. Little Seneca Reservoir was constructed with funds provided by the WMA water suppliers in 1981. It is an integral component of the cooperative drought-management system devised for the region, and releases are part of normal drought operations. Drought-related releases were made from Little Seneca Reservoir in 1999, 2002, and 2010. Releases were also made during the annual drought exercises of 2003, 2004, 2005, 2013, 2015, and 2020.

West Virginia
Harold Ward
Mindy S. Neil (a*)
Phyllis M. Cole (a)

United States
Darryl Madden
Robert Sussman (*)
BG Thomas J. Tickner
Amy M. Guise (a)

Executive Director
Michael A. Nardolilli

General Counsel
Robert L. Bolle

ICPRB's [September 2023 Water Supply Outlook](#) concludes that "[t]here is a much above-normal probability of releases from the Washington metropolitan area's backup water supply reservoirs for the 2023 summer and fall seasons." Therefore, I am writing to inform you that there may be releases from Little Seneca Reservoir in the coming weeks. The Maryland-National Capital Park and Planning Commission (M-NCPPC) has also been contacted about the potential for Little Seneca Reservoir releases in the near term.

(*) --Executive Committee
(a)--Alternate

The ICPRB is an interstate compact commission established by Congress in 1940. Its mission is to protect and enhance the waters and related resources of the Potomac River basin through science, regional cooperation, and education. Represented by appointed commissioners, the ICPRB includes the District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia, and the federal government.

If you have any questions, contact me at mnardolilli@icprb.org or 301-274-8105.

Sincerely,

Michael A. Nardolilli, Executive Director
Interstate Commission on the Potomac River Basin

CC:
Councilmember Gabe Albornoz
Councilmember Marilyn Balcombe
Councilmember Natali Fani-Gonzalez
Councilmember Andrew Friedson
Councilmember Evan Glass
Councilmember Will Jawando
Councilmember Sidney Katz
Councilmember Dawn Luedtke
Councilmember Kristin Mink
Councilmember Laurie-Ann Sayles
Councilmember Kate Stewart

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Chair
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Mr. Steve Root, Park Manager
Black Hill Headquarters
20930 Lake Ridge Drive,
Boys, MD 20841

District of Columbia
Willem Brakel (*)
Tiffany M. Potter
Jeffrey M. Seltzer
Kimberly L. Jones (a)
Hamid Karimi (a)
James T. Tsai (a)

Dear Mr. Root:

Maryland
Gov. Wes Moore
Catherine R. McCabe, Esq.
D. Lee Curry (a*)

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Executive Director
Michael A. Nardolilli

If you have any questions, contact me at mnardolilli@icprb.org or 301-274-8105.

General Counsel
Robert L. Bolle

(*) --Executive Committee
(a)--Alternate

Sincerely,

Michael A. Nardolilli, Executive Director
Interstate Commission on the Potomac River Basin

CC: Steve Muse
Mike Little

The ICPRB is an interstate compact commission established by Congress in 1940. Its mission is to protect and enhance the waters and related resources of the Potomac River basin through science, regional cooperation, and education. Represented by appointed commissioners, the ICPRB includes the District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia, and the federal government.