The Potomac River Basin Drinking Water Source Protection Partnership

Quarterly Meeting Summary held via webinar on August 3rd, 2022

Attendees

Water Suppliers

Berkeley County PSWD:
Steve DeRidder

DC Water:
Salil Kharkar

Fairfax Water:
Doug Grimes
John Kingsbury
Gregory Prelewicz
Niffy Saji

Frederick County:
Joshua Smith

Loudoun Water:
Thomas Barrack
Jessica Edwards-Brandt
Julie Karceski
Mark Peterson
Bradley Schmitz

Town of Leesburg:
Brian Stone

City of Rockville:
James Woods

Washington Aqueduct:
Anne Spiesman

WSSC Water:
Nicole Horvath
Jin Shin
Daniel Yuan

State and Local Agencies

DC DOEE:
Joshua Rodriguez

**City of Gaithersburg:*
Michael Weyland

**Howard County:*
Lindsay DeMarzo

MDE:
Robert Peoples
Greg Sandi
Rebecca Warns

PA DEP:
Dave Bolig
Adrian Bouknight

VDH:
Raven Jarvis

WVDEP:
Mindy Neil

WV DHHR:
Monica Whyte

Federal and Regional Agencies

EPA Region 3:
Christopher Anderson
Virginia Vassalotti
Calvin Yahn

ICPRB:
Renee Bourassa
Curtis Dalpra
Christina Davis
Rikke Jepsen
Janina Jones
Heidi Moltz
Andrea Nagel
Stephanie Nummer

MWCOG:
Steve Bieber
Lisa Ragain

USGS:
Mary Kay Foley

*Guess Attendee

Business Meeting

Due to social distancing requirements resulting from the coronavirus pandemic, the August 3, 2022 Quarterly Meeting was held via webinar. There were 44 attendees, including the moderator and presenters.

A recording of the webinar is available on the ICPRB YouTube page.

Presentations

Sometimes Less is More: Maryland's Voluntary Smart Salt Approach
Greg Sandi, MDE (presentation)

Mr. Sandi began his presentation on Maryland's voluntary Smart Salt program by introducing some of the background research available regarding salt and the interactions between salt and what it encounters. A key contact that MDE has made is with Dr. Sujay Kaushal at the University of Maryland. Salt is important to understand because, at a molecular level, it overwhelms and breaks several bonds that occur in the environment and leads to the release of other chemicals, such as other metals and calcium.

There are several anthropogenic sources of salt, as well as some natural sources, that are contributing to the salinization of fresh water. Primarily, it is the anthropogenic additions that are increasing over time. The introduction of these salts and subsequent chemical reactions/release of chemicals creates additional stressors for aquatic systems and our drinking water. Chemicals released due to interactions with salt include magnesium sulfate and calcium, which is now something that drinking water suppliers need to consider as well.

In Maryland, it is important to consider salt and salinization of fresh water because there are 28 rivers and streams that are listed as impaired on the 303(d) list. These impaired rivers and streams are largely located around the I-95 corridor and other major roadways. This association between increased salinization and higher road traffic does provide the opportunity for the state to influence and implement road salt reduction strategies because these high-traffic areas also happen to be associated with 11 MS4 NPDES Phase 1 permits.

Mr. Sandi and other researchers recognize that there are other sources of salts in the environment, but the primary source is deicing salts. This can be attributed to overapplication of deicing salts to increase public safety during winter storm events. Of the deicing salts applied to roadways, a decent portion comes from the State Highway Administration and another good-sized portion comes from non-highway roads. In addition to these contributors, it was found that private roads and parking lots were large contributors to the excess use of deicing salts and subsequently freshwater salinization.

To address the increase in freshwater salinization associated with deicing salts, legislation was passed in 2010 that called for the State Highway Administration to develop a Salt Management Plan and institute it. In response, a Snow College has been developed and implemented for operators and contractors. This has reduced salt use by about 50%. MDE has made strides to reduce salt use by introducing additional requirements for the next generation of stormwater permits, including a proposed salt management plan, and creating a voluntary applicator certification. The main goal MDE is working on is to increase education and outreach to help spread awareness of the issue. Additional work is being done to investigate alternative means to ensure safe travel during the winter while also reducing salt application, such as variable speed limits.

The voluntary applicator certification and associated training program is a large part of what MDE hopes to contribute to the conversation regarding freshwater salinization. They found that a lot of those submitting updated stormwater permits would appreciate having access to a consistent training program that is already prepared. Currently, MDE is working on the second phase of the training program. This involves working with the University of Maryland to develop online and in-person courses. With these courses, MDE is looking to have different levels of training available for seasonal crew members, permanent crew members, property managers, commercial applicators, the public, and others.

This voluntary training program aims to cover the following information:

- Basics: Why am I here and why should I reduce salt use
    - Chemical types/use and impacts
        - Human health
        - Public health (Drinking Water)
        - Environmental (Species Loss)
        - Infrastructure (Public & Private)
- Smart Salting and Cost Benefit Analysis
    - Describe Smart Salting practices and how they can save money
        - Costs associated with infrastructure damage
- Pre-season Preparations, Site Planning, and Contracts
    - A well-thought-out plan helps operators during storms
- Storm Operations
    - How to use the tools provided to calculate the correct amount of salt to use
- Post-Storm and End-of-Season Actions
    - How effective were your efforts and what can you do better next season?

The hands-on portion of the voluntary training will act somewhat like a lessons-learned collaborative where calibration and the use of specific equipment will be reviewed. The goal is to allow individuals to bring their questions to the group and go over practical application of winter salt. These hands-on classes can be used to bring light to new technologies and ensure people have the time and tools necessary to be successful.

MDE has been working on the training program and is still in the process of refining it. Currently, MDE is reviewing the curriculum that was created for statewide winter operations training, including a manual. This training and manual include information for the maintenance of parking lots, sidewalks, and side roads, as well as information for property owners, local representatives, and the general public. The hope is to have a beta version of this manual available in 2023. In addition, MDE has created regulations for this voluntary certification program that is still being reviewed. For the future, MDE is looking to focus on increasing outreach efforts through an increased web presence, coordination with local MS4 programs, and working with the University of Maryland Extension to create outreach materials, including videos.

Outreach priorities for MDE:

- Engage with Emergency Management Services & local elected officials.
- Continue to work with WSSC Water & the Baltimore Reservoirs Group.
- Engage property management and winter operations industry groups.
- Support the development of educational programs in schools.
- Work with UMD Extension to create outreach materials.

Lastly, Mr. Sandi noted the Winter Salts story map, developed by an MDE intern, presented areas where research opportunities exist and preliminary findings that have come out of current/previous research. For example, saline solution has been important for cleaning industrial filters while also impacting stormwater BMPs and leading to concretion when the saline solutions interact with organic matter. The timing and extent, including long-term impacts, of salt on groundwater is another area where future research is needed. Additionally, the long-term economic impacts of salt and the impacts on finished drinking water provide other areas for future road salt research.

Trends in Potomac River Salt Concentrations, 1992-2021
Christina Davis & Rikke Jepsen, ICPRB (presentation)

Dr. Davis and Ms. Jepsen presented an analysis of sodium and chloride trends in the Potomac basin from 1992 to 2021. Their analysis focused on sodium and chloride as they contribute to the salinization of waters that are also used as a source for drinking water.

While there are standards set for sodium and chloride levels in drinking water, they are non-enforceable. Specifically, the EPA has health-based advisory levels of 20 mg/L of sodium for those on sodium-restricted diets and secondary maximum contaminant levels of 250 mg/L for chloride. The secondary maximum contaminant levels for drinking water aim to avoid taste and aesthetic issues associated with too much chloride in drinking water. Currently, there are no health-based advisory levels for sodium for those who do not have dietary restrictions. Criteria does exist for chloride levels in ambient or natural waters. In Virginia, the limit for a 4-day average, or the chronic limit, is 230 mg/L and a 1-hour average limit, or acute average limit, is 860 mg/L.

Salts make their way into natural waters through a variety of sources and mechanisms. These include anthropogenic sources such as road salts and deicing chemicals, residential and industrial wastewater, and fertilizers and agricultural runoff. Additionally, mineral dissolution is a source of salts in our ambient/natural waters. As minerals and rocks dissolve, they release salts, calcium, magnesium, and sulfates into the environment.

The addition of sodium and chloride into the environment presents challenges for multiple sectors. Higher sodium in natural freshwater systems can lead to a toxic environment for aquatic life. When water used in residential homes and commercial buildings has elevated sodium and chloride levels, the plumbing and water pipes may be subject to increase corrosion. Excess salts in the environment, not just in natural waters, can lead to corrosion of vehicles and infrastructure, such as roads and bridges. Additionally, higher salinity in drinking water presents several challenges, including health issues for customers on a low-sodium diet; a salty taste; additional stress on conventional water treatment methods as they are ineffective at salt removal; and the potential loss of groundwater sources due to higher salt levels. The challenge associated with excess salts in the environment was the basis of the Virginia SaMS project. In addition, the chloride TMDL led to larger efforts made to reduce salt application and manage salts in Virginia.

To investigate the long-term trends in salt and chloride in the Potomac River basin Dr. Davis and Ms. Jepsen used raw water sodium and chloride data, flow gage and specific conductivity data, and population data for the basin. The raw sodium and chloride data were obtained from Fairfax Water, WSSC Water, and Washington Aqueduct. Discharge data were obtained for the USGS flow gage at Point of Rocks. Specific conductivity data from the USGS flow gage at Point of Rocks, and the gage at Little Falls, were used for comparison in this analysis. Lastly, the population data were obtained from the 2000, 2010, and 2020 US Censuses and aggregated by HUC8 watershed.

To provide some geographic context to this analysis, Ms. Jepsen presented a graphic depicting the relative location of the intakes of the three water suppliers who generously provided sodium and chloride data and the two USGS gages from which data was obtained. This graphic shows that the Point of Rocks USGS gage occurs the most upstream of the five locations, followed by the three water supply intakes, and lastly, the Little Falls USGS gage is located the furthest downstream. The three water supply intakes occur with Fairfax Water being the most upstream, followed by WSSC Water, and then the Washington Aqueduct. Along with this graphic was a map that was used to highlight the long chain of islands that split the river near the WSSC intake which constrains flow and potentially concentrates pollutants in the area.

The analysis looked at monthly average data from 1992 to 2021. To visualize the data, seasonal boxplots and scatter plots were created with LOESS curves. Two different methods were used to determine if there was a significant trend in salt and chloride concentrations over time. First, when there was sufficient data without large monthly gaps, a Mann-Kendall analysis was performed. Secondly, when there were large gaps in monthly data a Mann-Kendall analysis could not be applied and thus the data was only analyzed through the visual representation. Both sodium and chloride trends were flow corrected using the discharge data from the USGS gage at Point of Rocks. All analyses performed in this study were done using the statistical software R.

The first set of graphs presented as a result of this analysis was boxplots of the seasonal chloride levels for each of the three water suppliers. For all water suppliers, the winter season presented the greatest variation, while the winter and spring seasons were the only seasons to have outliers. The winter season includes December, January, and February while the spring season includes

March, April, and May. The large variation in winter may be attributed to the large application of road salts in response to major snow and ice storms that occur during this time of year.

Digging deeper into chloride concentrations for the three water suppliers, the analysis then looked at monthly averages over time using scatter plots with LOESS curves. The first set of scatter plots presented did not have flow correction incorporated. Visually, all three water suppliers appear to have a large increase in chloride concentrations over time. The most notable increases appear to be at the WSSC Water intake and the Washington Aqueduct. There is adequate data to perform the Mann-Kendall analysis in this set of scatter plots. All three locations present with statistically significant p-values. Fairfax Water has a p-value equal to 0.02 and WSSC Water and Washington Aqueduct both have a p-value less than 0.001. A lower p-value indicates more confidence in an observed trend. An interesting pattern that appeared in this visual representation of the data is that WSSC Water has the highest chloride spikes while not being the furthest downstream intake. This may be due to the river islands noted previously or the input that comes from Watts Branch, which connects to the mainstem Potomac near the WSSC Water intake.

The scatter plots were then repeated for chloride concentrations observed at all three water suppliers, but this time concentrations were flow-corrected. Flow correction is a method that is used to remove the diluting effect of flow. Essentially, it removes flow from being a confounding factor in chloride concentrations. The flow data measured at Point of Rocks was used for flow correction in chloride concentrations collected from all three water suppliers and resulted in all water supplier intakes presenting with a steady increase in chloride concentrations over time. The Mann-Kendall analysis applied to all three locations presented significant trends. Fairfax Water resulted in a p-value of 0.01, which means there is greater confidence in the flow-corrected trend than the non-flow-corrected trend presented previously. In addition, WSSC Water and Washington Aqueduct both had a p-value less than 0.001, indicating high confidence in the observed trends.

The previous three graphical explorations were then conducted for monthly sodium concentrations at the three water supply intake locations as well. Similar to chloride, boxplots of sodium show greater variability in the winter season with a majority of the outliers occurring in spring and winter for all three intake locations. With that, the overall sodium concentrations are a bit lower than the chloride concentrations recorded for all three water suppliers. The similarity between the chloride and sodium trends provides evidence that the source of the sodium is sodium chloride, rather than something else, such as hardness.

Further analysis of the sodium concentrations using a scatter plot showed similar trends to what was observed with chloride. The observed sodium concentrations have a few considerations worth noting prior to more detailed visualization. Firstly, about 13% of the sodium observations at Fairfax Water were censored because they are listed as values below zero. These values just indicate that the sodium concentration was below the detection limit for the measurement method used. Because the detection limit used by Fairfax Water is consistent, we can still use the Mann-Kendall analysis to examine if there is a trend, provided that there is an adequate number of datapoints, which there is. However, there is not adequate data for sodium concentrations at the Washington Aqueduct prior to 2009 due to gaps in data that spans 2 to 3 months and thus the Mann-Kendall analysis cannot be used to determine if there is a significant trend. There was a statistically significant trend in the non-flow corrected sodium observations for the other two water suppliers. Fairfax Water had a p-value of 0.03 while WSSC Water had even higher confidence with a p-value of 0.01. A visual analysis of the scatter plot of the sodium concentrations at Washington Aqueduct appears to show an increase over time. Comparing the non-flow-corrected sodium concentrations to the non-flow-corrected chloride concentrations for the three water supplier intakes shows similar trends.

Flow correction using the Point of Rocks USGS gage was only applicable for the WSSC Water intake due to the detection limit-associated censorship of the data at Fairfax Water and the 2-to-3-month gaps in data at the Washington Aqueduct intake. Flow-correction and a Mann-Kendall analysis of the flow corrected data were appropriate at WSSC Water and presented with a significant increase over time in sodium concentrations (p=0.001).

Ms. Jepsen presented a specific conductivity analysis performed by Dr. Claire Buchanan of ICPRB. In this analysis, specific conductivity was compared between the upstream Point of Rocks USGS gage and the downstream Little Falls USGS gage using linear regression. Specific conductivity was used as an indicator of salt that is in solution at these locations. In the early 1990s, specific conductivity was higher at Point of Rocks, likely due to the upstream Karst topography. The farther downstream from the Karst topography, the more dilution influenced specific conductivity. On the other hand, the closer to urban areas the observations are, the more that the use of salts is going to influence the specific conductivity. This leads to an overall increase in specific conductance at the Little Falls gauge, with about a 13% increase in 30 years since 1992. This increase is largely due to watershed contributions.

Lastly, Dr. Davis and Ms. Jepsen examined the population of the Potomac basin as a surrogate for urbanization and growth in the region. With the assistance of Dr. Stephanie Nummer of ICPRB, they were able to obtain and aggregate the US Census population data from 2000, 2010, and 2020 by HUC8 watersheds. Ideally, this analysis would include data from 1990, but that is not easily obtained online.

Overall, the region is largely undergoing an increase in population and associated urbanization. Most of this is occurring in the Middle Potomac-Catoctin, Shenandoah, and Monocacy watersheds – which are all located adjacent to each other with Middle Potomac-Catoctin in the middle. Notably, the Middle Potomac-Catoctin watershed is where the Point of Rocks USGS gage and all three water supply intakes are located. These watersheds increased in population over the past 20 years ranging from a 33% increase to a 46% increase. All HUC8 watersheds upstream of the Middle Potomac-Catoctin saw a double-digit increase in population aside from the South Branch Potomac and North Branch Potomac. These two watersheds had a population decrease in the last 20 years.

This analysis, while presenting the trends in sodium and chloride from 1992 to 2021, has led to additional questions for future research. These questions include:

- What are the relative positions and flow rates of permitted discharges and drinking water intakes?
- What is the relationship between tributary flow and salt concentrations at drinking water intakes?
- To what extent do stormwater and runoff affect salinity?
- How do river geography and morphology influence salt concentrations?
- Is there a significant correlation between increasing salinity and increasing urbanization, as indicated by changes in:
    - population
    - impervious surface
    - forest and tree cover
- In addition to winter salt programs implemented by Maryland and Virginia, what programs or actions are needed to reverse the trend of increasing salinity in the Potomac River?

Workgroup Updates

Agricultural Issues

Pam Kenel, Loudoun Water & Christy Davis, ICPRB

The Agricultural Issues workgroup recently met on July 29th, 2022, and discussed the following:

- Little Pipe Creek Watershed Assessment under the NRCS-NWQI program
    - The final deliverables were submitted to NRCS
    - A full presentation of the final product is intended to be presented at the November DWSPP Annual Meeting
- West Virginia NRCS has been working with several agencies, including ICRPB, on the NWQI planning phase in the Cacapon and Lost River area in West Virginia
    - With the current fiscal year wrapping up, they are re-submitting proposals for 6-7 HUC12s
        - This has been reduced from the original 29 HUC12s

Contaminants of Emerging Concern (CEC)

Brad Schmitz, Loudoun Water

The Contaminants of Emerging Concern Workgroup recently met on July 25th, 2022, and discussed the following:

- PFAS
    - ICPRB's PFAS conference is on September 22nd, 2022
    - Plans to reach out to the Water Quality Workgroup
    - The goal is to have similar messaging across the organizations
- Microplastics
    - Christy (ICPRB) and Brad (Loudoun Water) are exploring techniques
    - USGS, DOEE, and EPA are conducting sampling on Hickey Run

The workgroup plans to meet again on October 24th, 2022, at 2:00 pm in preparation for the next DWSPP quarterly meeting.

Early Warning & Emergency Response (EWER)
Doug Grimes, Fairfax Water
Recently the Early Warning & Emergency Response Workgroup has been working on:

- Sondes on the River
    - The Point of Rock sonde, which was put in a while ago, is now up and running and the data is available on the USGS website.
        - USGS is planning to update the data portal around January 2023
    - There are plans to move forward to put sondes on the Monocacy.
        - This is advantageous because the Monocacy meets the Potomac below Point of Rocks, and thus a significant amount of flow is missed at that gage.
        - The next step of this project is to finalize the agreement
- USGS has new technology using cameras to look at and identify spills, which was brought to the attention of the workgroup
    - It is still early in the development and testing but is something to keep an eye on for future potential uses
- With booming being an important part of early response, the workgroup is looking to see if a regional purchase agreement can be set up for booming
- The workgroup is reaching out to Colonial Pipeline to see if they are amenable to a meeting or workshop to potentially have a spill drill.

Reaching Out
Lisa Ragain, MWCOG & Renee Bourassa, ICPRB
The Reaching Out Workgroup has been working on:

- Setting up a meeting in the next few weeks to discuss Source Water Protection Week, which is the last week of September
- The biweekly source water protection newsletter has recently been updated and the contact list has been cleaned-up

Urban and Industrial Issues
Greg Prelewicz, Fairfax Water
Recently the Urban and Industrial Issues Workgroup has completed 2 permit renewals including:

- Milwaukee Metropolitan Sewerage District – Biosolids permit application renewal
    - Virginia statewide
    - The public comment period closes 8/19/22.
- Island Creel Coal Company – Underground injection permit renewal
    - Bayard, WV
    - Acid Mine Drainage water
    - The public comment period closes 8/17/22.

Additionally, the workgroup has discussed the use of information on PFAS from WaterSuite GIS contaminant source identification layer.

Water Quality (WQ)
Niffy Saji, Fairfax Water
Recently the Water Quality Workgroup worked on:

- Assisting with the Laboratory Workshop organized by DC Water and funded by EPA Region 3 that was held on June 2nd, 2022, for DC Water, NCR utilities, and regional and state laboratories.
    - The purpose of this workshop was to establish the laboratory capabilities available in-house and through contracts during events that influence the water sector. This includes sharing best practices and training.
    - There were approximately 50 participants at this event with presentations about the regional resources and capabilities of individual utility labs.
    - The workshop also included discussions regarding potential scenarios.
    - The final report from this workshop and associated presentations are available on the WQ Workshop Samepage.
- Collecting information regarding available monitoring data in the Potomac with work to:
    - Create a map of salt monitoring locations in the Potomac (sodium, chloride surrogates)
    - Update existing map of HAB monitoring locations
    - Understand the occurrences of PFAS monitoring in the basin

Administration Updates
Christy Davis, ICPRB
Administration updates presented at the August 3rd quarterly meeting include:

- Topics for the November 2nd DWSPP Annual Meeting
    - Little Pipe Creek Watershed Assessment for NWQI Planning Phase
    - PFAS
- The registration for ICPRB's *2022 Potomac River Conference: A Conversation on PFAS* is now open
- A reminder to pay the 2022 DWSPP annual dues if not completed already