The Potomac Aquifer Recharge Oversight Committee
Meeting Minutes
November 20, 2023

In attendance: Whitney Katchmark (Committee Chair), Mark Bennett, Jay Bernas, Charles Bott, Ryder Bunce, Brian Campbell (remote), Weedon Cloe (remote), Curtis Consolvo, Haley Edmonds (remote), Dan Holloway, Seyyedhadi Khatami (remote), Preston Kirby, Mark Kram (remote), William Mann, Scott Morris, Mark Nelson (remote), Ivy Ozmon, Charlie Paullin (remote), Harold Post (remote), Doug Powell (remote), Leila Rice (remote), Mike Rolband, Gary Schafran, Mark Widdowson.

Ms. Katchmark (HRPDC) called the meeting to order at 11:07 a.m.

The minutes of the previous meeting were approved as distributed.

Dr. Mark Widdowson (PARML) updated the committee on the status of the strategic planning process for PARML and research funded by the EPA Grant. Beate Wright was selected to facilitate meetings throughout the PARML strategic planning process. Dr. Widdowson anticipates holding the kickoff meeting for plan development in early 2024 to present the final draft of the strategic plan by April 2024. Dr. Widdowson also shared that the researchers working with him on the Enhanced Aquifer Recharge project funded by the EPA grant are developing a project schedule, and he expects to move forward with the project soon. He noted the EPA recently approved their Quality Assurance Project Plan (QAPP).

Dr. Widdowson also presented findings from analyses of SWIFT water travel distances from the injection wells at the SWIFT Research Center (SRC) in Suffolk. He shared several aerial images with SWIFT water travel distances superimposed around injection well sites to illustrate the extent of the radial plume of SWIFT water in the Upper, Middle, and Lower sections of the Potomac Aquifer (UPA, MPA, and LPA, respectively). Over 500 million gallons (MG) of SWIFT water has been pumped into injection well TW-1 since May 2018 and over 125 MG through injection well MAR-01 since November 2022. Sulfate concentrations in groundwater are used to indicate the presence of SWIFT water. Dr. Widdowson presented groundwater modeling results for the average and maximum distances SWIFT water has traveled. SWIFT water has traveled further in the Upper and Middle Potomac Aquifers (UPA and MPA) than in the Lower Potomac Aquifer (LPA). The average modeled SWIFT water radial extent was 680-780 ft, 450-570 ft, and 120 ft in the UPA, MPA, and LPA, respectively. The maximum distances traveled by SWIFT water were 970 ft in the UPA and 800 ft in the MPA. PARML and HRSD researchers speculated that travel distance differences may be due to the greater number of well screens in the MPA and UPA, the higher potential of well screen clogging in the LPA, and the higher density of LPA groundwater compared to groundwater in the MPA and UPA. Dr. Widdowson shared estimates of the travel extent for various chemical compound classes, attributing differences in distances traveled to how these compounds interact in the sub-surface environment. He shared plots for conceptual bands of conservative constituents like sulfate and other anions, recalcitrant total organic carbon (TOC), and PFAS compounds. Conservative constituents have traveled the farthest, with TOC and PFAS lagging due to their adsorptive properties. Dr. Widdowson was asked whether groundwater monitoring data collected from nearby USGS observation wells confirmed model results. The SWIFT water plume does not yet extend into the area where those

wells are located, but sulfate monitoring data will provide a check of the model once the plume reaches the USGS wells.

Dr. Gary Schafran (PARML) provided updates on ongoing studies and analytical capabilities at PARML. PARML lab analysts performed experiments to determine if exhausted granular activated carbon (GAC) used in process reactors at the SRC could be regenerated through treatment to remove adsorbed organic compounds. GAC was determined to be exhausted when it could no longer remove PFOA to achieve GAC effluent concentrations under four ppt PFOA. Exhausted GAC was removed from the SRC reactors and treated with methanol to extract adsorbed chemical compounds. Dr. Schafran presented the results of PFOA measurements in the methanol used in two batch extractions. Samples were analyzed by PARML and an external lab, Eurofins. Laboratory results agreed for the experiment on the batch of exhausted GAC from the SRC GAC reactor 1 in February 2023. PFOA concentrations measured around 80 nanograms (ng) PFOA per gram (g) GAC. The experiment was conducted again in September 2023 on the batch of exhausted GAC from the SRC GAC reactor 2, and PARML analysts measured 100 ng PFOA/g GAC. Results provided confidence in the reproducibility of batch extractions. Dr. Schafran described another experiment conducted using a Rapid Small Scale Column Test (RSSCT) to investigate whether methanol can remove adsorbed PFOA within the treatment process (in situ) to extend the life of GAC before replacement. Exhausted GAC was placed into the RSSCT, treated with methanol, and thoroughly rinsed before running partially treated SRC process water through the RSSCT to investigate PFOA removal capacities. Dr. Schafran reported that in-situ methanol extraction achieved only 55% of the removal observed when treating GAC with methanol in batch, concluding that in-situ regeneration with methanol is not worth the effort. When asked if other GAC investigations by PARML are planned, Dr. Schafran shared that a previous experiment using sodium hydroxide (NaOH) to extract adsorbed material from exhausted GAC proved unsuccessful. He speculated that PFOA must be much less soluble in NaOH than methanol.

Dr. Schafran also updated the committee on other PARML analytical developments. PARML recently began measuring particles in SWIFT water grab samples using flow cytometry to compare to data collected by online analyzers at the SRC. Online particle counters and flow cytometers generate particle count data and determine particle size distributions. Analyzers throughout the SWIFT process continuously measure turbidity and particle counts at various process water sampling points. Dr. Schafran shared results from two PARML monitoring events, reporting head loss measurements, filter run times, particle concentrations, and turbidity measurements across the SWIFT treatment process. Investigations into particle concentrations and size distributions may have implications for optimizing process operations to reduce the number of particles making their way through the SWIFT process into the injection well. The group speculated that particles may be involved in clogging of well screens. Separately, PARML analysts are working on setting up a new analytical instrument, an ion chromatography system, for measuring anions, carbohydrates, amino acids, organic acids, and bromate. PARML aims to measure volatile fatty acids (VFAs) to investigate whether those compounds are available as metabolic substrates to anaerobic microorganisms in the aquifer.

Dr. Charles Bott (HRSD) updated the committee on HRSD research and development efforts related to the planned full-scale implementation of partial denitrification-anammox (PdNA)

treatment at the York River, James River, and Nansemond Treatment Plants. He reviewed the fundamentals of the nitrogen cycle and conventional wastewater treatment processes to set the stage for drivers behind PdNA treatment research. Dr. Bott detailed various wastewater treatment process configurations for removing nitrogen and phosphorus nutrients, focusing on biologically mediated removal under the various dissolved oxygen conditions associated with different portions of the conventional wastewater treatment process. The PdNA process achieves "shortcut nitrogen removal," which requires substantially less energy and supplemental carbon-based chemical addition compared to conventional wastewater treatment processes capable of the nitrogen removal capacities of PdNA. Dr. Bott indicated that partial nitritation-anammox (PNA) is the superior form of shortcut nitrogen removal; however, significant process challenges have yet to be addressed to make PNA feasible at full scale. Anammox bacteria mediating PdNA require shorter solids retention times than ammonia-oxidizing bacteria and nitrate-oxidizing bacteria involved in conventional BNR treatment processes. PdNA expands treatment capacities by requiring less treatment tank space to achieve the same level of nutrient reductions. Dr. Bott covered the timeline of research efforts leading up to the full-scale development of PdNA. Pilot projects investigating various components of PdNA began in 2012 and have continued through the present. The York River Plant will be HRSD's first full-scale PdNA upgrade, with an expected start-up in 2024. Annual operations and maintenance cost savings of approximately $1 million (M) were noted, and the project avoids between $80M and $100M in capital costs. Successful implementation of PdNA requires accurate and continuous operation of advanced oxygen and nitrogen sensors that automate changes in process conditions to control the proportion of ammonia and nitrate/nitrite delivered to PdNA reactors. HRSD instrumentation staff have developed the capability to build customized nutrient auto-analyzers in-house, realizing significant cost savings for sensors compared to purchasing them from manufacturers. Pilot work to upgrade the James River plant to perform PdNA is ongoing, with an expected startup of 2026. PdNA feasibility studies are also ongoing at VIP and the Army Base HRSD plants. Dr. Bott was asked if changes in the fate of contaminants of interest have been observed comparing PdNA and conventional BNR wastewater characterization data. He said differences are possible due to the reduced solids retention times necessary for PdNA, and those investigations are ongoing.

Ms. Whitney Katchmark (HRPDC) opened a roundtable discussion on SWIFT inquiries from the public. She asked the committee how those questions should be directed – to the agency best suited to respond to the topic in question or to share with the entire committee for consideration. Mr. Ryder Bunce (VDH) indicated that VDH is happy to handle public health questions. Mr. Scott Morris (DEQ) shared that DEQ can try to help, but questions best suited for the environmental regulating agency could be addressed to the EPA. There was a consensus for fielding questions at the committee level. Ms. Katchmark said that future inquiries will be directed to the most appropriate entities to address.

Ms. Katchmark closed by sharing that doodle poll responses will help determine the 2024 committee meeting schedule. Ms. Ivy Ozmon (HRPDC) will distribute meeting polls to the committee in December.

There were no public comments.

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The meeting adjourned at 1:20 p.m.

Approved: Date:

February 20, 2024

Committee Chair

Committee Members:

- Mike Rolband, Director of Virginia DEQ
- Dr. Karen Shelton, Virginia State Health Commissioner
- Dr. William Mann, Governor Appointee
- Doug Powell, Governor Appointee
- Whitney Katchmark, HRPDC
- Dr. Stanley Grant, Director of Occoquan Watershed Monitoring Laboratory
- Dr. Mark Widdowson, Co-Director of the Potomac Aquifer Recharge Monitoring Lab
- Dr. Gary Schafran, Co-Director of the Potomac Aquifer Recharge Monitoring Lab

Non-voting members:

- Mark Bennett, Director of Virginia and West Virginia Water Science Center, USGS
- Leslie Gillespie-Marthaler, Deputy Director Water Division, US EPA Region 3