UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
Four Penn Center
1600 John F. Kennedy Boulevard
Philadelphia, Pennsylvania 19103-2852

Report Title:	Safe Drinking Water Act Compliance Inspection Report				
Regulatory Program(s):	Public Water System Supervision (PWSS)				
Inspection Date(s):	Tuesday, July 26, 2022 – Thursday, July 28, 2022				
System Name:	City of Richmond				
PWS ID:	VA4760100				
System Address:	3920 Douglasdale Road				
	Richmond, Virginia 23221				
Latitude:	37.544420		**Longitude:**	-77.499260	
NAICS Code:	221310		**SIC:**	4941	
Unique Project #:	3E22DW019A				
Site/Facility Representative(s):				**Point of Contact**	
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I. Introduction

A. Purpose of the Inspection

On Tuesday, July 26 through Thursday, July 28, 2022, the United States Environmental Protection Agency (EPA), Region III and its contractors from ERG and PG Environmental, (hereinafter, "EPA Inspection Team") conducted an announced Compliance Evaluation Inspection under Section 1445 of the Safe Drinking Water Act (SDWA), 42 U.S.C. §300j-4, of the City of Richmond Public Water System (PWS) (PWS ID VA4760100) ("System") to evaluate the System's compliance with the SDWA and the National Primary Drinking Water Regulations (NPDWR) found in 40 C.F.R. Part 141. On July 1, 2022, EPA notified Douglas Towne of the System via phone and email that an inspection would be conducted the week of July 25, 2022.

The inspection was led by Leah Zedella, who explained the purpose and scope of the inspection. Mike McFadden, Kettie Rupnik, and Amy Cohen presented their EPA Inspector credentials to System Representatives, named below, at the start of the inspection. The following inspectors and representatives were present during the inspection:

Name	Affiliation/Title	Email
EPA Region III & Contractor Inspectors		
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All information included in this report is the result of EPA observations, statements from System Representatives, and materials provided by System Representatives prior to, during, or after the inspection.

Photographs were taken during the inspection by Amy Cohen, Jessica Landkrohn, Mike McFadden, and Kettie Rupnik (see *Attachment A: Photograph Log)*. Not all photographs taken during the inspection are included in the Photograph Log.

B. Opening Conference

The EPA Inspection Team arrived at the System located at 3920 Douglasdale Road, Richmond, Virginia, at approximately 8:00 am EST on July 26, 2022, for the inspection. After inspector credentials were presented, Leah Zedella started the inspection with an opening conference. An opening conference sign-in sheet was used to memorialize all attendees (see *Attachment B: Opening Conference Attendance Log*).

The opening conference involved a discussion of topics including, but not limited to, source water, population served, wholesale contracts, treatment processes, asset management and work order systems, Supervisory Control and Data Acquisition (SCADA) systems and alarm types, cross-connection control plan implementation, main break trends and water loss, emergency response planning and staffing, as well as sampling and monitoring plans for the Lead and Copper Rule (LCR) and the Revised Total Coliform Rule (RTCR). Discussion points of the opening conference are summarized in more detail in Section II.

II. Site Activity

A. System Description

The System is a community PWS that provides drinking water to an estimated 197,000 to 226,000 consumers with over 64,000 service connections; population is described further in Sections III and V. The System sells up to 35 million gallons per day (MGD) to Henrico County, up to 32 MGD to Chesterfield County, and up to 20 MGD to Hanover County. Annually, on average, the System produces approximately 65 MGD; approximately 45% of produced water is sold through wholesale contracts and 55% serves the city of Richmond directly. Emergency connections are available with Henrico and Chesterfield Counties for limited demand only; no emergency connections are available with Hanover County. The System includes the following assets, as described by System Representatives:

- (2) Source water intakes
  - (1) James River to pre-sedimentation basin
  - (1) James River to Kanawha Canal
- (2) Separate, parallel treatment trains, Plant 1 and Plant 2 at one water treatment plant facility (WTP) location
- (10) Storage facilities
  - (1) Covered reservoir
  - (9) Elevated and ground-level tanks
    - (2) Additional tanks out-of-service at time of inspection; no plans to return to service
- (12) Pump stations
  - (3) Treatment plant facility pump stations
  - (9) Distribution pressure zone pump stations

The production capacity of the System is 132 MGD from the treatment plant. The finished water storage capacity is 53.3 million gallons (MG) at the Byrd Park Reservoir, the largest storage facility of the System. Total storage capacity of the additional nine active water storage facilities is approximately 70 MG.

The System lifts water approximately 365 feet total through 1,000 miles of distribution lines into the different pressure zones. The total combined and firm pumping station capacities consist of 200 MGD from constant speed pumps and 150 MGD from variable speed pumps. “Firm capacity” refers to the pumping capacity available to meet demand when the largest pump is out of service. The most common distribution pipe materials in the distribution system are cast iron, ductile iron cement lined, and cast-iron cement lined.

The System's accredited laboratory conducts in-house analysis for fluoride, total coliform, and the water quality parameters of heterotrophic plate count, presence of *E. coli*, pH, phosphate, and alkalinity; the remaining analyses for drinking water regulatory compliance are subcontracted to other laboratories. There is an operator's process control laboratory located at the treatment plant used to evaluate temperature, alkalinity, hardness, chlorine residual, free ammonia, pH, log inactivation for giardia, phosphate, manganese, and color.

B. Source Water Description

The System uses the James River as the sole water source with a maximum allowable withdrawal rate of 150 MGD. There are two intakes on the James River: one intake is located north of the William's Island Dam and diverts water through an approximately 0.4-mile feeder channel to the pre-sedimentation basin; the other intake is located further north and conveys water through the Kanawha Canal for approximately one mile to the plant intake area, bypassing the pre-sedimentation basin. The source water from the Kanawha Canal intake is intended to supplement the source water from the William's Island Dam intake and is not used independently of the William's Island Dam Intake. The intakes are located toward the eastern edge of the Middle James River Basin.

C. Treatment Description

The System has two separate, parallel treatment trains at the plant that can be operated independently. Plant 1 was built in 1924. Plant 2 was built to the south of Plant 1 and immediately north of the James River in 1950 (see *Attachment C: Map - Overview of System Sources and Treatment Plants*).

Treatment at the plant begins with a pre-sedimentation basin that runs north of and parallel to the James River for approximately 0.8-mile between the initial intake north of William's Island Dam and the plant intake. The pre-sedimentation basin is occasionally treated with copper sulfate ($CuSO_4$) in warmer months for algae control and as an oxidizing agent.

A residuals settling lagoon is located immediately south of and adjacent to the pre-sedimentation basin and north of the James River. The lagoon accepts process water from the plant's sedimentation basin sludge removal equipment and filter backwash process. There is a sluice gate at the northern end of the pre-sedimentation basin through which the decanted water from the lagoon is recycled back into the treatment process.

There is a triangular-shaped flood wall constructed around the perimeter of the treatment plant. Intakes move water from the pre-sedimentation basin beneath the flood wall into a raw water basin. The intake from the Kanawha Canal feeds directly into the raw water basin on an as needed basis and is manually controlled.

Water is gravity-fed from the intake through pre-sedimentation basin into the raw water basin. Pumps then move water from the raw water basin through a raw water coagulation channel toward the flocculation basins. A walkway bisects Plants 1 and 2; there is a raw water coagulation channel along either side of the walkway between Plants 1 and 2. The following chemicals are added in the raw water coagulation channel: potassium permanganate ($KMnO_4$), used for taste and odor control and oxidation during April through October; powdered activated carbon (PAC), used for taste and odor control as necessary; and aluminum sulfate ($Al_2(SO_4)_3$), used as a coagulant for flocculation. The chemicals are added upstream of one rapid mixer in each coagulation channel.

There are eight total flocculation basins, with Plant 1and 2 each containing four basins. Each individual flocculation basin contains 4-stage serpentine flocculation with tapered mixing. A coagulant polymer is added upstream of each basin to aid in floc development. After passing through the flocculation basins, water moves to the sedimentation basins (see *Attachment D: Map - Sedimentation and Flocculation Basins of Plants 1 and 2*).

Each plant has a sedimentation basin that is divided into halves, for four sedimentation basins total with 35 MG capacity each. Inclined plate settlers are installed at the downstream end of each of the four sedimentation basins. Water is gravity-fed through the flocculation and sedimentation basins.

After moving through the sedimentation basins, the water moves into one of four applied water channels and receives its first sodium hypochlorite (NaClO) application for disinfection. "Applied water," also known as settled water, is the term used by the System to describe water that has passed through the sedimentation basin before filtration. Two of the applied water channels are immediately adjacent to the raw water coagulation channels between the two plants, and two are along the outermost wall of the sedimentation basins.

Plant 1 is equipped with ten filters within an enclosed, roofed structure; Plant 2 is equipped with 12 filters that are not covered by a roof and are exposed to external weathering and elements. The 22 filters are comprised of garnet, sand, and anthracite. The filtered water moves to the respective Plant's separate clearwells and is then pumped to separate finished water basins. During filter backwash events, the clearwell water is pumped to the filter; backwash water from the filter then moves to the lagoon for recycling.

In the finished water basins, water is treated with sodium hypochlorite and then ammonia (NH_3) for disinfection by chloramination. Lime is then added to increase pH, followed by fluoride for dental health, zinc orthophosphate ($Zn(PO_4)$) for corrosion control, and then caustic soda to increase pH. Once the water travels through the finished water basins the water is pumped to the distribution system.

III. Observations

A. Inspection Day 1: Tuesday, July 26, 2022

The EPA Inspection Team ("EPA" hereafter) inspected the System assets and/or locations as described below:

1. Opening Conference - General Discussion
    - The System Representatives stated that they do not have a secondary source of water independent from the James River.
    - The Plant Operations Superintendent ("Superintendent" hereafter) explained that a Class I operator is always required at the plant. The plant is staffed with three operators per shift and two shifts/day. There are 20 operators at the plant and 37 employees in distribution.
    - The System Representatives stated that the operator's process laboratory equipment is managed and calibrated in-house by operations staff.
    - The Program & Operations Supervisor explained that backflow prevention devices are installed and inspected in-house for cross-connection control.
    - The Engineering Supervisors explained that the System conducts hydrant inspections every two years. The operators utilize a Standard Operating Procedure (SOP) for hydrant inspections, which includes, in part, hydrant flushing.

- The Engineering Supervisor stated the most recent distribution storage tank inspections were in 2017 and the System was moving toward a five-year inspection schedule. Reports provided during the inspection indicate tank inspections were last performed in May and December 2015.
- The Engineering Supervisor explained that there is not an existing asset management plan. However, GIS maps been developed for distribution. Additionally, the critical treatment plant assets have been identified with tags.
- System Representatives stated that two separate computerized maintenance management systems (CMMSs) are utilized.
- From January to July 2022, the System experienced over 17 water main break events per 100 miles of active water main. The most common water main pipe material to experience breaks was cast iron.
- The Engineering Supervisor explained that the System is currently conducting a new materials inventory assessment with the company Blue Conduit, ahead of implementation of the Lead and Copper Rule Revision.
- The System has been offering up to $2,500 per residence for lead service line replacement; prior line replacements between the curb and the home’s shut off valve were conducted at the expense of the homeowner.
- The Engineering Supervisor explained that when a lead service line is discovered in the distribution system, it is noted in the System’s database and the resident is contacted about line replacement. The Engineering Supervisor explained that there is no program that otherwise documents service line materials.
- The Laboratory Supervisor explained that they currently conduct sampling at 120 sites for RTCR monitoring, based on a population of 220,000.
- The Laboratory Supervisor explained that the System utilizes Eurofins Scientific as the subcontractor for regulatory compliance monitoring activities that are not completed at the System’s accredited laboratory.
- The Laboratory Supervisor explained that an audit was performed at the laboratory the week prior to the inspection, and the accreditation certification qualified for renewal.
- System Representatives explained that they are in the process of updating the Emergency Response Plan (ERP), last updated in 2017. An updated but unsigned ERP dated September 2020 was provided during the inspection. The 2020 ERP had an outdated contact list appended, and several of the response action descriptions were located in a separate Emergency Operations Manual (EOM). An updated but unsigned EOM for the City of Richmond DPU dated April 2021 was provided.
- The System does not perform tabletop emergency scenario planning exercises in the event of large-scale power failures, contamination events, or other occurrences that would impact production; however, the Superintendent stated that the local fire department performs such activities, and the System occasionally participates.
- The System reports water loss using total production volume versus total metered volume (including large wholesale customers) which results in a non-revenue water statistic; the water loss within the City limits is not calculated separately using only the City production and metered volumes. As a result, water loss within the City of Richmond is not evaluated independently from wholesale customers.

- System Representatives explained that complaints are received at a general Customer Service Divison of the DPU; complaints are then sent to the appropriate departments to investigate. The laboratory receives all drinking water quality complaints to investigate and follow up with customers.

2. Pre-sedimentation Basin, Residuals Settling Lagoon, and Raw Water Basin
   - The Superintendent explained that the flood wall is inspected by the United States Army Corps of Engineers (USACE) annually. It was funded by USACE but is owned by the City of Richmond (see *Attachment A: Photo 1*).
   - EPA observed lagoon dredging activities. The Superintendent explained the dredging process started in April 2021 and takes approximately two years to complete. The System uses five-year contracts for lagoon dredging. The Superintendent explained there are no operational impacts to drinking water production during the lagoon dredging process (*Photo 2*).
   - The Superintendent explained that the trigger for lagoon dredging is a visual inspection and when it appears to be full.
   - Lagoon waste is dredged and pumped through above-ground pipes across the lagoon and pre-sedimentation basin to a dewatering operation at the southeast corner of the pre-sedimentation basin. The dredged material is pressed and used in land application offsite (*Photo 3*).
   - System Representatives stated that turbidity is measured at the entry of the pre-sedimentation basin as needed.
   - System representatives explained that flow is not measured from the lagoon to the pre-sedimentation basin; flow moves by gravity through a sluice gate between the lagoon and basin.
   - EPA observed an earthen berm between the lagoon and the pre-sedimentation basin. The Engineering Supervisor explained that the berm was compromised approximately 15 years ago and that there are not regular inspections of the berm.
   - The Superintendent explained that one 50-pound copper sulfate bag is added weekly to the treatment process at the northern end of the pre-sedimentation basin during summer months, as needed. It is unclear when the operators decide copper sulfate treatment is needed.
   - System Representatives explained there is not routine water quality monitoring of the pre-sedimentation basin.
   - EPA observed two bar screens at the southern end of the sedimentation basin with vegetation growing around the structure. The Superintendent stated the screens are cleaned once/week (*Photos 4-5*).
   - EPA observed at least ten approximately 300-gallon containers of polymer without secondary containment near the dewatering operation to the northeast of the pre-sedimentation basin (*Photo 6*). The Superintendent explained the polymer is used in the dewatering process for the lagoon dredge material.
   - The Program & Operations Supervisor explained that the Kanawha Canal intake at the raw water basin is exercised annually (*Photos 7-8*).
   - System Representatives explained that the Kanawha Canal source water has a different water quality than the pre-sedimentation basin source water even though they both have an original source from the James River.

- EPA observed an inactive basin adjacent to and south of the raw water basin. The Superintendent explained that the sedimentation basins in Plant 1 had to be reduced in size to match the sedimentation basins in Plant 2 during the plate settler upgrade installation (*Photo 9*).

3. Treatment Plant intake area, Raw Water Coagulation Channel
    - EPA observed raw water screens at the treatment plant intake that were in poor condition with corrosion and holes; one of the screens was not attached and had fallen to the bottom of the raw water basin (*Photos 10-11*). These screens were permanently out of service per comments by System Representatives.
    - The Superintendent stated that traveling screens and rakes were not operational, however the Program & Operations Supervisor explained that they can be used if needed. The screens did not appear to be exercised or used as part of an operational protocol. System Representatives explained that the screens were to be replaced and the bid package was in preparation for award (*Photo 12*).
    - EPA observed vegetation growth near the entry of the concrete raw water coagulation channel at the water line (*Photo 13*).
    - EPA observed that the potassium permanganate chemical application was not in operation at the time of the inspection, as the water discharging from the chemical pipe was clear rather than purple. The Superintendent acknowledged that the chemical application would be purple if the chemical application was dosing properly. The Superintendent confirmed that the chemical system was in operation, but that the chemical feed had failed (*Photo 14*). The Superintendent said that he notified operators to address the issue.
    - System Representatives explained that operators primarily use zeta potential analysis to determine aluminum sulfate dose. If there is an issue with the zeta potential meter, there is also a streaming current monitor and supplies for jar testing.
    - System Representatives explained that a flow meter is used to determine chemical dosing. The flow meter on the coagulation channel for Plant 2 has not been working properly. Operators were testing a hypothesis of sun interference, and a piece of plywood was placed over the flow meter to create shading (*Photo 15-16*).
    - System Representatives stated there is no pH adjustment in the raw water coagulation channel.

4. Flocculation Basins and Sedimentation Basins
    - System Representatives stated that the four rapid mixers that were originally installed at each plant are available for operation but not in use. These mixers are located on the south end of the flocculation basins. There is one Water Champ flash mixer at each plant being used in place of the rapid mixer sin the raw water coagulation channels (*Photos 17-18*).
    - System Representatives explained that the solids residual collector system in the sedimentation basins was upgraded 4-6 years ago. Each plant has nine solids removal units that move across each sedimentation basin according to the following schedule at the time of the inspection: units 1-3 (closest to the flocculation basins) operate four times/day, units 4-6 (middle of sedimentation basins) operate twice/day, and units 7-9 (closest to the plate settlers) operate once/week. The units closest to the flocculation

basins (unit 1) are also equipped with a nozzle to allow for backflushing the vacuum (*Photos 19-21*).

- The Superintendent stated that each sedimentation basin is drained twice/year to be cleaned. The Superintendent also stated that the plate settlers are cleaned in sections weekly with a fire hose. EPA observed more solids collected on the Plant 1 plate settlers than Plant 2 (*Photos 22-23*).
- EPA observed one flocculator in three separate basins that were out of service.
- Flocculator 4-2A had exposed wiring to the motor on the platform above the basin (*Photo 24*); this flocculator is one of the three that was out of service during the inspection.
- The flocculation basins are discussed in more detail with the Sr. Plant Operations Supervisor on Day 3 (July 28, 2022) below.

5. Plant 2 Filters
   - Filters 14, 15 and 19 of Plant 2, as well as Filter 2 of Plant 1 were out of service at the time of inspection due to issues with rate of flow effluent valve actuators (*Photo 25*). No date was provided for their return to service.
   - EPA observed cracking in the concrete, some more than 12” in length and 1/8” in width, in the concrete structure above the filters of Plant 2. EPA also observed vegetation growing out of several of the cracks in the concrete above the filters (*Photos 26-28*).
   - System Representatives demonstrated via SCADA that filter backwash trigger points were set at 80 hour run time, 5’ head loss, or >0.1 NTU. They also explained that the most common reason to conduct a backwash is run time, occasionally head loss. Filter-to-waste runs for 9 minutes after the filter is back online. System Representatives explained that water should be less than 0.1 NTU when brought back online after backwash and filter-to-waste. Operators can extend the filter-to-waste process manually, if needed.
   - The Superintendent stated that a media assessment was recently conducted with the filters, and a media changeout is in early design stages. The Superintendent noted that the filter media was not found to be in good condition and some filters were missing several inches of media; however, none of the filters were in such poor condition that they needed to be removed from service. The Superintendent explained that assessment of the concrete and structural components of the filters would be conducted separately.
   - System Representatives stated that usually 2-4 filters are backwashed/shift, or approximately 4-8 filters backwashed/day.
   - The Superintendent explained that the volume being pumped to the residuals settling lagoon area limits how frequently backwashes can be conducted.
   - The Sr. Plant Operations Supervisor stated that maintenance for the filters includes periodic expansion and drop tests.

6. Filter 16 backwash
   - EPA observed that the air scour appeared moderately more aggressive near the influent valve on the southern edge of the filter. Some trapped air was noticed after the air scour process.

- EPA observed significant cracking around the concrete at Filter 16, especially above the influent valve area on the southern wall (*Photo 29*).
- EPA observed a piece of debris along the wall between the filter troughs and the influent/effluent channel, approximately 18" long and 2-4" wide; the debris was located near the influent valve on the southern side of the filter (*Photos 30-31*). The debris remained in place throughout the backwash cycle but was at risk of falling into the filter media.
- The influent valve actuator was making an abnormally loud noise when opening; the Sr. Plant Operations Supervisor confirmed the noise was atypical and directed an employee to start a work order for the issue.

7. Plant 2 Finished Water Basin
    - EPA observed leaf litter and other debris collected at the entryway of the finished water basin of Plant 2. EPA also observed dirt and other debris on the landing area and entry of the finished water basin. The landing area, directly above a portion of the finished water basin, did not have walls or structures at its base to prevent dirt and debris from falling directly into the finished water basin (*Photos 32-33*).
    - The Superintendent explained that the finished water basins were formerly uncovered aeration basins, but roofs were added approximately three years prior to the inspection.
    - The Superintendent explained that chlorine contact time begins in the applied water channels after the sedimentation basins when the water is initially treated with sodium hypochlorite.
    - System Representatives stated that the finished water basins are inspected every two years, and Basin 2's inspection was recently completed. One basin is inspected each year.
    - EPA inquired on how the System checks that chemical feeds are functioning and dosing properly, and the Superintendent explained that the submerged chemical application points are not accessible without emptying the basins. The Superintendent explained that the operators check parameters of the finished water quality to indicate equipment malfunctions.

8. Operator control room and SCADA system location
    - System Representatives explained both the plant and distribution SCADA systems that operate independently. The distribution SCADA screens showed the seven pressure zones, elevations at each tank, as well as pressures and flows at the pump stations. System Representatives stated that operators can start/stop pumps from the control room to manage overall storage levels throughout the distribution system. However, EPA later learned that some pump stations are not controlled in SCADA (see Day 2 Observations, July 27, 2022). There is an offsite distribution control room with distribution SCADA system at the Trafford Pump Station that has the primary responsibility for distribution operations.
    - EPA observed several alarms on the operator's screen for the plant SCADA system. Many of these alarms were on 5/25/22 around the same time of day. System Representatives could not attribute the alarms to a particular event, but they noted that occasional power interruptions (or "bumps") would cause certain alarms to activate when power is restored.

- The Sr. Plant Operations Manager explained that the SCADA system automatically prioritizes alarms to high, medium, or low. The System Representatives explained that they generate work orders generated as a result of some alarms and prioritize among an ongoing list. EPA observed several ongoing alarms shown on the SCADA screen with the date May 25, 2022. EPA asked about the alarms on display, and the Sr. Plant Operations Manager explained that the date of the alarms was the same because on that date the power went out and was restored. When the power was restored, the alarms dates reset. The System Representatives explained some of the SCADA alarms have been ongoing and cannot be resolved or removed from the display.
- The Superintendent showed the SCADA trend analyses for turbidity, and EPA observed several entries where turbidity exceeded 0.1 NTU after the 9-minute filter to waste cycle, which exceeds the turbidity goals the System Representatives stated for filter performance.
- The Sr. Plant Operations Manager explained that repairs to critical assets are documented, and assets have historical repair records in paper format.
- The Sr. Plant Operations Manager explained that SCADA produces data on 15-minute intervals for monthly operational reports (MOR). The Superintendent is the MOR signatory, responsible for certifying accuracy and approving the report, and checks trends from SCADA to identify any events or data errors that would require data invalidation.

9. Day tanks and other chemical storage, second floor of Plant 2
    - EPA observed four 4,000-gallon day tanks, two each for sodium hypochlorite and aluminum sulfate.
    - There are 13 total pumps used for sodium hypochlorite: three for the raw water channel (not used), six for the applied water channel (includes two per plant and two used for backup), and four at the finished water basins (two per plant).
    - EPA observed six sodium hypochlorite pumps operating at the time of inspection in the day tank chemical storage area: four pumps to the applied water channels (one pump for each channel), and two pumps to the finished water basins (one pump for each plant).
    - There are 12 total pumps used for aluminum sulfate application; EPA observed six operating at the time of inspection.
    - System Representatives stated that they use approximately four truckloads of aluminum sulfate per day. The Superintendent stated that the dosage for aluminum sulfate is approximately 93 parts per million (ppm) during the time of inspection.
    - Aqueous ammonia is stored on the second floor of Plant 2; EPA observed three ammonia tanks and six pumps. Two of the six ammonia pumps were operating at the time of inspection.
    - System Representatives explained that they treat water with four parts chlorine to one part ammonia. They stated that grab samples are taken twice/day to monitor dosing and the ratio, and operators can adjust the dosages in SCADA.
    - System Representatives stated that lime is used to increase pH, and that it is cheaper to use than caustic soda.

- While EPA did not observe the chemical offloading area during Day 1, System Representatives explained that there are SOPs for chemical offloading that require special keys to access chemical fill lines. The Superintendent stated that aluminum sulfate and sodium hypochlorite supply intakes are located at opposite sides of the building to prevent errors.
- Zinc orthophosphate is stored separately from the other chemicals on the second floor of Plant 2; there were two 6,153-gallon tanks and six pumps.
- EPA observed two of the six zinc orthophosphate pumps operating; pump #5 was labeled out of service.

B. Inspection Day 2: Wednesday, July 27, 2022

On July 27, 2022, the EPA inspected the System assets and/or locations, as described below, beginning at approximately 8:00 am EST. For portions of the day, the inspection group broke up into two separate teams. The attendees at the locations below are designated accordingly.

Team 1	Team 2
Leah Zedella (EPA)	Kettie Rupnik (EPA/PG)
Mike McFadden (EPA/ERG)	Jessica Landkrohn (EPA)
Stephen Fitzner (EPA)	Kate Abazis (EPA)
James Reynolds (VDH)	Arnold Eberly III (Richmond DPU)
Dwayne Roadcap (VDH)	Douglas Towne (Richmond DPU)
Kenny Weeks (Richmond DPU)	
Leroy Rice (Richmond DPU)	

1. Korah 1 Pump Station (full team)
   - System Representatives explained that Korah 1 pumps to the Byrd Park Reservoir.
   - EPA observed a caustic soda line with chemical on the exterior of the pipe. There was caution tape around the pipe and the immediate area (*Photos 34-35*).
   - EPA observed pH meters reading 8.16 and 7.62; System Representatives explained they are used to control caustic soda dosing (*Photo 36*). EPA observed dust and dirt built up on the analyzers and the screen.
   - The caustic soda is stored in a separate area adjacent to the pump station in two tanks, one is 9,000 gallons and the other is 8,000 gallons (*Photo 37*). There are four pumps, two were in operation at the time of the inspection (pumps 2 & 3). There was secondary containment at each of the pumps. The caustic soda is injected at the end of the finished water basin.
   - EPA observed exposed wiring at the K1-2 pump (*Photo 38*).

2. Korah 2 and 3 Pump Station (full team)
   - EPA observed several meters reading chemical levels after the finished water basins and before the Korah pumps for: pH, turbidity, fluoride, and total chlorine. The following readings were observed at the time of inspection where ‘north’ readings correspond to Plant 1 and ‘south’ readings correspond to Plant 2:
     - pH: 7.27 north, 8.04 south
     - turbidity: 0.361 NTU north, 1.061 NTU south
     - fluoride: 0.67 ppm north, 0.62 ppm south
     - chlorine: 3.30 ppm north, 2.83 ppm south

(*Photos 39-42*)

- None of the instrumentation appeared to have calibration stickers at the time of inspection, and EPA requested calibration documentation for online instrumentation and process laboratory instruments (turbidimeters, pH and chlorine analyzers, etc.).
- On the lower level of the pump station, EPA observed a white PVC pipe discharging process water from 3-4’ above ground level near pump K3-2. Water was not being captured and was left to drain across the entire lower-level floor toward the floor drain. (*Photos 43-45*).
- EPA also observed the water line on the K2-2 pump motor was discharging about 2” from the drain and none of the water was being captured. Water was leaking on the equipment and draining across the floor (*Photos 46-47*).
- EPA observed a corroded fitting leaking from a pipe with water accumulating on the ground below it (*Photos 48-49*).

3. Trafford Pump Station (full team)
    - EPA observed security fencing around the pumphouse with barbed wire on one side. System Representatives explained that new transmission mains were recently installed, and more permanent fencing is to be installed eventually (*Photo 50*). The new transmission mains will increase redundancy and reliability of power.
    - There is a distribution operator control room at the Trafford Pump Station. System Representatives explained that one operator is always on duty, and the SCADA in the Trafford control room is for distribution only. System Representatives explained that there are not automatic shutoffs, and storage facilities can overflow if an operator is not correctly operating the pumps.
    - System Representatives explained that storage facilities and pump stations are inspected three times per week: Tuesday, Thursday, and half each on Saturday and Sunday. Information logs are at each pump station for the operators to complete during their inspections; the data is then entered into the computer weekly by the Program & Operations Supervisor.
    - Pump T-2 was operating at the time of inspection; pumps T-1, T-3, T-4, and T-5 were not operating.

4. Byrd Park Reservoir (full team)
    - System Representatives explained that the roof of the reservoir is scheduled to be replaced over the next four years, and the contract award for the project is in process. The roof will be changed from concrete to aluminum, and one side/cell will be completed at a time. System Representatives discussed the need to increase pumping rates so that supply and capacity is maintained throughout the system.
    - System Representatives explained that the reservoir cells had been inspected annually, but the inspections stopped in 2017 or 2018 due to safety concerns. The structure of the reservoirs will be inspected when they are emptied for the roof project.
    - EPA observed security fencing with barbed wire around the perimeter of the reservoir. EPA observed significant vegetation in some areas of the fencing (*Photos 51-52*).

- The reservoir is a clay foundation with a concrete liner, and the roof covers 8 acres (*Photos 53-54*). Several areas of the roof had vegetation growing in between the stones (*Photos 55-56*).
- System Representatives stated that the full capacity of the reservoir is at a water level of 27', and that they usually operate with the reservoir at 18-24'. At the time of inspection, the reservoir level read 23.34' (*Photo 57*).
- EPA observed pooled water on top of the reservoir roof that was seeping out of the aluminum siding in several areas of the roof (*Photos 58-60*).
- EPA observed significant plant growth at the base of the reservoir roof and sidewalk (*Photos 61-63*).
- System Representatives stated that the Byrd Park Reservoir does not contain an overflow. System Representatives identified a stormwater runoff drainage system.
- System Representatives explained there is an access walkway between the two cells at the northern side of the reservoir roof. They stated that the vent panels along the eastern and western edges of the walkway between the cells can be removed for access (*Photos 64-65*). EPA observed rough and fine screening in place on the vents.
- At the end of the northern access walkway, EPA observed three metal plates on the ground, approximately 3' x 6' each, between the walkway and the vents; some of the caulking around the plates was not intact. There was a significant amount of leaf litter and debris on top of the metal plates (*Photo 66*). System Representatives lifted the middle plate, and EPA observed a significant amount of standing water beneath the hatch; the vault was filled with water up to approximately one foot from the ground surface (*Photo 67*). System Representatives were not sure if the water could be a combination of finished and stormwater, only stormwater, or only finished water, indicating a lack of regular inspection.
- EPA observed another walkway on the southern side of the reservoir, slightly shorter in length than the access walkway on the northern side. It is unclear if the southern walkway portion also serves as access, but it was arranged similarly with vents on the eastern and western walls and metal plates on the ground. EPA observed leaf litter and debris on top of the metal plates, as well as more mature vegetation growing around the base of the structures. EPA observed an access panel with electrical wiring open with leaves and other debris inside (*Photos 68-69*).

5. Cofer Road A & B Tanks (Team 1)
   - EPA observed two ground level tanks. System Representatives stated that they were recently refurbished.
   - EPA observed weighted plates on a hinge at the ends of the overflow pipe at each tank. The plates had both rough and fine mesh screening. The seal of the plates was not tight on either tank's pipe; debris was visible on the inside of the screen and pipe at Tank B (*Photo 70*).
   - EPA observed a Modular Automatic Cathodic Protection Unit (MACPU) digital unit on each tank, but it was turned off. System Representatives explained that it would be turned on a year after the completion of the refurbish project to ensure no corrosion issues need to be addressed first (*Photo 71*).
   - System Representatives stated the tanks are to be inspected every four years.

6. Cofer Road Pump Station (Team 1)
   - EPA observed Pump 2 on at the time of the inspection, Pumps 1 and 3 were not operating. The Pump 2 flow meter read approximately 9,000 gallons/minute (*Photo 72*).
   - EPA observed water leaking at Pump 2 near the check valve.
   - EPA observed a backup generator with fuel tank at the pump station.

7. Jahnke Road Tank (Team 1)
   - EPA observed security fencing without barbed wire around the perimeter of the tank (*Photo 73*). There were two altitude valve pits with air relief valves within the fence line.
   - EPA observed a small tree and as well as algal growth at the base of the tank (*Photo 74*). There were large, overhanging trees at the rear of the tank (*Photo 75*).
   - EPA observed a significant amount of rust on the outside of the tank (*Photo 76-77*). System Representatives explained that the rust appears to be where the aluminum roof meets the side of the steel tank. There was not as much visible rust in the rear of the tank where the trees overhang the roof and cover the steel gutter.
   - EPA did not observe fine mesh on the tank overflow, there was only rough mesh in place (*Photo 78*).
   - EPA observed some corrosion and degraded sealant at the base of the tank (*Photo 79*).

8. Jahnke Road Pump Station (Team 1)
   - EPA observed a backup electric transmission connection at the pump station.
   - EPA observed six pumps total in the pump station: Pumps 1-3 for the System, and Pumps 4-6 owned by Chesterfield County (*Photo 80*). All six pumps were operating at the time of inspection.
   - Pump 1 and Pump 2 were operating with a suction pressure of approximately 15 psi and a discharge pressure of 80 psi. Pump 3 was operating with a suction pressure of approximately 15 psi and a discharge pressure of 110 psi.
   - System Representatives stated that they are some of the older pumps of the distribution system.

9. Warwick Road Tank (Team 1)
   - EPA observed a sign at the front of the tank explaining that it is used for cellular transmitters.
   - EPA did not observe security at the perimeter of the tank.
   - System Representatives stated there was not active mixing in the tank. There is a common inlet/outlet pipe.
   - EPA observed corrugated steel around the base of the elevated tank; there was some algal growth visible where the base of the tank met the corrugated steel siding (*Photo 81*).
   - EPA and System Representatives were not able to locate a visible overflow for the tank. System Representatives suspected that the overflow could be connected to a storm or sanitary sewer.
   - EPA observed a newer 16” gate valve in the influent/effluent pipe. There were several areas where concrete structures supported the pipe, but one of the supports

was damaged and was augmented with several pieces of wood. The stacked pieces of wood did not appear to be functional to support the pipe (*Photos 82-83*).
- EPA observed significant corrosion on top of the control valve (*Photo 84*).
- System Representatives explained that the level of the Warwick Tank is managed by Jahnke. Operational level of the tank is 24'.

10. Huguenot Road Pump Station (Team 1)
    - System Representatives explained that this is the smallest pump station.
    - EPA observed Pump 2 operating at the time of inspection with suction pressure of 8 psi and discharge pressure of 58 psi.
    - A permanent backup generator is in a separate room of the pump station.
    - EPA observed a log sheet for the pump station that showed pump H1 out of service (*Photo 85*).

11. Huguenot Road Tank (Team 1)
    - EPA observed temporary fencing around the front of the tank and permanent security fencing without barbed wire at the rear of the tank. System Representatives explained there is ongoing construction in the area and the temporary fencing will be replaced. EPA also observed staining on portions of the tank (*Photo 86*).
    - EPA observed tree branches rubbing against the side of the tank. EPA observed extensive vining vegetation at the rear of the tank. EPA observed some staining and/or algae growth on the exterior coating of the tank (*Photos 87-88*).
    - EPA observed three overflow/discharge pipes at the rear of the tank, below grade and within a concrete wall: one 10" pipe that did not have any screening, one 10" pipe that had fine screening but was blocked with debris, and one 6" pipe that had ¼" rough screening (*Photos 89-90*).

12. Columbus Pump Station (Team 2)
    - EPA observed the pump station building was surrounded by a metal fence and locked doors.
    - EPA observed the pump station had four pumps, two of which (Pumps 3 and 4) were in service. The Program & Operations Supervisor reported that Pump 1 was undergoing a vibration analysis and the variable frequency drive (VFD) for Pump 2 was not operational.
    - EPA observed that the programmable logic controller (PLC) display screen in the main pump station building was not operational (*Photo 91*).
    - EPA observed a threaded tap on a finished water line (*Photos 92-93*).
    - EPA observed the PLC screen in the electrical building was functioning and showed that the Columbus Discharge Pressure Setpoint was "0.00 PSI". The Program & Operations Supervisor was unsure why the set point was 0.00 (*Photos 94-95*).
    - EPA observed the PLC screen in the electrical building showed a suction pressure of 4.72 PSI, which the Program & Operations Supervisor stated was low.
    - EPA observed that the pump station did not have a suction pressure gauge. The Program & Operations Supervisor explained the suction pressure displayed on the PLC Screen and SCADA is calculated based on the water level reading of the Byrd Park Reservoir.

- According to the Program & Operations Supervisor, the pump station did not have a dedicated sampling location.
- EPA observed the backup power for the pump station is provided by an onsite generator.

13. Byrd Park Reserve Pump Station (Team 2)
    - EPA observed the pump station has four pumps, Pumps 1 through 3 were operational and on.
    - The Program & Operations Supervisor stated the pump station does not have a dedicated sampling location.
    - The Program & Operations Supervisor stated the pump station does not have a generator or quick connect but relies on two feeds from Dominion Power for electricity.

14. Byrd Park Main Pump Station (Team 2)
    - The Program & Operations Supervisor stated the pump station feeds finished water from the plant to Byrd Park Reservoir.
    - The Program & Operations Supervisor that the pump station has been in service since 1928.
    - The Program & Operations Supervisor explained the pump station is operated manually, the System does not have the ability to support automatic or remote operation of the pump station.
    - EPA observed graffiti on the door of the building, indicating security issues (*Photo 96*).
    - The System is in the process of upgrading the pump station. At the time of the inspection, the upgrade project was at approximately 60% of the construction design phase.
    - EPA observed the System had recently installed an overhead crane in the pump station and was in the process of renovating the pump station ceiling. EPA observed ceiling debris on the ground and equipment throughout the pump station (*Photos 97-98*).
    - EPA observed the tracking sheet at the pump station is used to record the pump run times of the pumps, not the suction or discharge pressure readings.
    - EPA observed the pump station had three pumps. Pumps 1 and 3 were operational and on. Pump 2 was out of service. The Program & Operations Supervisor stated Pump 2 had recently been repaired and was ready to be brought back online but needed to be tested.
    - EPA observed seals leaking on two gate valves and observed corrosion on the bolts of the gate valves (*Photos 99-100*).
    - EPA observed poor housekeeping conditions throughout the pump station, including debris, standing water on the ground, and lubrication leaking from the pumps (*Photos 101-102*). EPA also observed a nearly full and uncovered five-gallon bucket of oil/water mix (*Photo 103*).
    - EPA observed a hose connected to finished water line without a vacuum breaker. The end of the hose was lying on the ground near water accumulated on the floor, presenting potential cross connection concerns (*Photos 104-105*).

- EPA observed the pressure gauges and flow meters in the pump station were not operational (*Photos 106-107*). The System does not have capabilities to read SCADA at this location. It was unclear how the System read suction and discharge pressures at the pump station.
- According to the Program & Operations Supervisor, the pump station did not have a dedicated sampling location.
- The Program & Operations Supervisor stated the pump station does not have a generator or quick connect but relies on two feeds from Dominion Power for electricity.

15. Westhampton Pump Station (Team 2)
    - EPA observed the pump station is located at intersection of two busy residential streets, without a security fence in place (*Photo 108*).
    - EPA observed four pumps at the pump station, Pump 4 was operational and on.
    - EPA observed a threaded tap and a connected hose on finished water line without a vacuum breaker (*Photo 109*).
    - According to System Representatives, the pump station did not have a dedicated sampling location.
    - The System Representatives explained that backup power for the pump station consisted of a quick connection for a portable generator.

16. Ginter Park Tank (Team 2)
    - The System Representatives stated the tank has 1 MG capacity. The tank feeds pressure zone 2N of the System.
    - The System Representatives experienced difficulty locating the tank's overflow pipe. The Program & Operations Supervisor identified the overflow pipe at the access hatch, which was piped directly underground. The Program & Operations Supervisor was unsure where the pipe led to and if there was a method in place to prevent cross connections or backflow (*Photo 110*).
    - EPA observed a gap between the bottom of chain-linked fence surrounding the tank and the ground, approximately 16 inches high, presenting a security concern.
    - EPA observed heavy vegetation growing on the security fence from a nearby tree.
    - According to The Program & Operations Supervisor, the pump station did not have a dedicated sampling location.
    - The Program & Operations Supervisor stated the tank did not have a backup power source.

17. Church Hill Pump Station and Tank (Team 2)
    - The pump station and tank were constructed approximately 4 years ago in 2018 or 2019.
    - Tank has 5 MGD capacity.
    - The pump station houses three pumps total; pumps 2 and 3 were operating at the time of the inspection.
    - The pump station is equipped has an automatic bypass line for the tank.
    - EPA observed an onsite generator to serve as backup power for the pump station.

18. Plant 1 Filters (full team)
    - Filter 2 was out of service at the time of inspection.
    - Filter 4 was being backwashed at the time of the inspection; EPA observed the filter-to-waste water being sent to the process drain in the pipe gallery of Plant 1 (*Photo 111*).
    - EPA observed significant corrosion on the air scour pipes above the filters at Plant 1. The room with the filters was fully enclosed (*Photos 112-113*).

19. Plant 1 Pipe Gallery (full team)
    - EPA observed Pump 1, Pump 2 and Pump 3 that take water from the clearwell to the finished water basin in Plant 1 had significant corrosion with metal loss to the fasteners that secure the pumps to the floor at their base (*Photos 114-116*).

20. Fluoride Chemical Pumps (full team)
    - EPA observed three fluoride pumps, and only Pump 1 was operating at the time of inspection.
    - Pump 1 is designated as 1-N basin (Plant 1), and Pump 3 is designated as 1-S basin (Plant 2). System Representatives explained Pump 2 is redundant and can be used for either basin.

C. <u>Inspection Day 3: Thursday, July 28, 2022</u>

The group resumed the inspection at the water treatment plant at approximately 8:00 am EST and inspected the System assets and/or locations, as described below.

1. Flocculation basins
    - The Sr. Plant Operations Supervisor explained that the streaming current monitor was newer on Sedimentation Basins 3-4 for Plant 1. The monitor read negative 0.24 mV at the time of the inspection (*Photo 117*).
    - The Sr. Plant Operations Supervisor explained that streaming current is read through SCADA by the operators once per hour and trends are compared every six hours, or four times/day, to ensure accurate chemical treatment.
    - The Sr. Plant Operations Supervisor explained that the amount of aluminum sulfate used depends on seasonal impacts; for example, more is used during drought conditions. System Representatives stated that they are using approximately 14,000 gallons/day, or 3.5 truckloads/day, of aluminum sulfate. During the winter, they stated that they would use approximately one truck every two days.
    - A coagulant polymer is added in the first stage of each flocculation basin. The Sr. Plant Operations Supervisor explained that the polymer is not flow-paced like the other chemicals, and it must be manually adjusted for the correct dosage.
    - The Sr. Plant Operations Supervisor explained that water from the pre-sedimentation basin is used during the maintenance cleaning activities once/year rather than using finished water.

2. West Chemical Building – Sodium Hypochlorite bulk storage & pumps
    - Sodium hypochlorite is stored in six 24,500-gallon tanks in one half of the building. The tanks are contained within concrete walls as secondary containment. The portion of the building with sodium hypochlorite is air conditioned.

- EPA observed three chemical transfer pumps that are used to supply the day tanks in Plant 2; the pumps were elevated from ground level to protect from flooding or spills.
- The Sr. Plant Operations Supervisor explained that the day tank levels are maintained via SCADA, and pumps in the West Chem Building will automatically start when the day tanks fall to the set level.
- The Sr. Plant Operations Supervisor explained that the sodium hypochlorite tanks can be filled to 24,000 gallons and there is an overflow at 27'.
- The Sr. Plant Operations Supervisor stated that the System uses approximately seven truckloads of hypochlorite/week.
- The Sr. Plant Operations Supervisor explained that the tanks are inspected every 7-8 years. The tanks are fully emptied and rinsed, and the and inspection is conducted with photographs.
- EPA observed an active leak in Tank T-SH-1-3, dripping at the bottom of the gasket of the access hatch of the tank at approximately one drop/minute (*Photos 118-120*).
- EPA observed a truck delivering and offloading sodium hypochlorite at the time of the inspection. While in the tank storage room, EPA observed a line in the elevated plumbing system actively dripping sodium hypochlorite down into the room (*Photos 121-122*).

3. West Chemical Building – PAC storage & pumps
    - A portion of the middle of the building, separated by concrete walls, is storage of the PAC slurry
    - The Sr. Plant Operations Supervisor explained that the PAC is usually only used approximately once every other year.
    - EPA observed four pumps, none in operation at the time of inspection.
    - The Sr. Plant Operations Supervisor stated there is a positive displacement pump to the raw water channel for PAC application.
    - The Sr. Plant Operations Supervisor also stated there is a mixer in the tank for the slurry. They explained that if the mixture is not used within 3-4 years, the slurry will be used and applied as treatment and then replenished.

4. West Chemical Building – Aluminum Sulfate bulk storage & pumps
    - Aluminum sulfate is stored in six 24,500-gallon tanks in the opposite half of the building from the sodium hypochlorite tanks. The aluminum sulfate tanks are contained within concrete walls as secondary containment.
    - EPA observed three pumps used the supply the two day-tanks in Plant 2 elevated from ground level.
    - The PAC slurry storage room access hatch is in the aluminum sulfate storage room.
    - EPA observed crystalized chemical on the exterior of one of the day-tank supply lines (*Photo 123*).
    - EPA observed an SOP for aluminum sulfate transfer and storage dated May 22, 2012.

5. West Chemical Building – Potassium Permanganate storage & pumps
    - The Sr. Plant Operations Supervisor stated they were in the process of ordering seven additional containers of potassium permanganate.

- EPA observed two separate feeders and pumps for potassium permanganate. The Sr. Plant Operations Supervisor explained that only one pump is used at a time.
- The Sr. Plant Operations Supervisor explained that there are often failures with the feeder system and the variable frequency drive because not enough potassium permanganate is used for the machinery to operate properly. They explained that the System usually treats a dosage of 0.3 ppm but that the feeder tends to trip out using less than 0.5 ppm.
- The Sr. Plant Operations Supervisor stated that there is no process system in place to check the residual concentrations of potassium permanganate since the laboratory moved 12 years ago. However, System Representatives explained that other indirect observations, like color at the application point, failure alarms, or changes in chlorine demand, can indicate issues with the treatment.
- EPA observed a backflow prevention device with a failed inspection tag dated October 20, 2021 (*Photo 124*). It was unclear if any remedial action was taken to address the failed inspection. EPA also observed a hose on the floor attached to a threaded tap with no backflow prevention.

6. Raw Water Coagulation Channel
   - EPA observed that the potassium permanganate was also not operating at the time of inspection due to the lack of purple color in the treatment area (*Photo 125*). The Sr. Plant Operations Supervisor called operators to inform the injection point was not actively treating with potassium permanganate.
   - The Sr. Plant Operations Supervisor explained that chemical treatment in the raw water coagulation channel is based on flow. The System uses a Venturi flow meter for Plant 1 that works well and is reliable. For Plant 2, however, the System used a magnetic flow meter that was later upgraded to an ultrasonic flow meter; both types of flow meters had electrical and signal issues, and they have been unreliable for Plant 2. The Sr. Plant Operations Supervisor explained that operators conduct manual calculations for dosage.
   - The Sr. Plant Operations Supervisor explained that zeta potential grab samples are analyzed through two means: a new Zetasizer manufactured by Malvern, or a standard zeta meter. They also stated that operators can use a jar test.

7. Process Laboratory in Plant 2 operator control room
   - The Sr. Plant Operations Supervisor explained that operators collect grab samples at the following frequencies (*Photo 126*):

Location	Analytes	Frequency
Raw water channel	Turbidity pH alkalinity	Every 4 hours (6x/day)
Flash mixer	Turbidity pH alkalinity chlorine	Every 4 hours (6x/day)
	Zeta potential	Every 6 hours (4x day)
Settled/post Sedimentation Basin	turbidity pH	Every 12 hours (2x/day)

	chlorine	
Finished water	pH alkalinity chlorine turbidity	Every 4 hours (6x/day)
	Zinc orthophosphate Fluoride	Every 12 hours (2x/day)
	Free ammonia Temperature	Every 24 hours (1x/day)

- The Zetasizer is in the process laboratory. The Sr. Plant Operations Supervisor stated it is not on SCADA (*Photo 127*).
- The Sr. Plant Operations Supervisor explained there are not quick reference guides to explain goals for chemical dosing that is easily available to the operators. They explained there are historical SOPs available for reference.
- The Sr. Plant Operations Supervisor explained that the Class I operators can adjust chemicals; trainees may observe but not change chemicals alone.
- EPA observed the jar test apparatus outside of the operator control room in Plant 2 (*Photo 128*).
- EPA observed several data sheets that are completed by the operators to record water quality at different points throughout the treatment process. The 'Monochloramine and Free Ammonia' data sheet reflects several instances where free ammonia levels exceed 0.1 mg/L, primarily in Plant 2 with some instances in Plant 1 (*Photo 129*).

8. Laboratory and compliance monitoring discussion
    - EPA met with the Laboratory Supervisor at the treatment plant to discuss different compliance monitoring protocol, including customer compliant response and management, as well as monitoring under the Lead and Copper Rule, Revised Total Coliform Rule, and the Unregulated Contaminant Monitoring Rule.
    - For the Lead and Copper Rule, the Laboratory Supervisor explained that the distribution group uses tap records from their consultant in addition to information on replacements already conducted to predict where sites with lead service lines could be located. The System is required to sample 50 homes triennially, and they have a pool of 100 sites. The System starts with sending out sampling kits to 60 homes and then sends more to the additional 40 sites as needed. System Representatives stated that there have not been updates to the initial site list, and the Tier evaluations of the sample sites have not been re-evaluated to check if a replacement has occurred. The System is in the process of conducting the materials survey inventory ahead of the requirements of the Lead and Copper Rule Revisions. The Laboratory Supervisor explained that they provide the sampling kits and education, and then they pick up the samples and send them to subcontractors for analysis.
    - For the Revised Total Coliform Rule, System Representatives explained that they used data from the 2020 Census to update population levels to 220,000. The System is required to sample 120 sites/month in accordance with the BSSP, signed March 14, 2022. The System has a sample site pool of 170 sites, and they usually sample 150 sites each month, rotating through the pool. System Representatives stated that there were five total coliform positive results recently, but *E. coli* was negative; four sites

were in the same vicinity and tested positive the same day and the chlorine residual was 3.7 ppm. System Representatives explained that positive results are not analyzed for trends to identify causes.

- For complaints, the Laboratory Supervisor explained that they are all logged electronically. All complaints for drinking water are sent to the laboratory. The most common calls relate to cloudy water, taste, odor, and staining.
- System Representatives explained that they were not aware of any nitrification problems in the distribution system, and that they do not periodically or seasonally switch to chlorine treatment to prevent biofilm growth.

IV. Records Review

EPA requested and received and/or viewed copies of the following documents throughout the course of the inspection:

- CMMS Work Orders – completed work orders from May 2022
- Organization chart
- Finished Water Storage Tank inspection reports
- Filter media assessment
- Emergency Response Plan and Emergency Operations Plan
- Backflow prevention device inspection report
- Description of the treatment processes from source water to entry point and diagrams
- Description of the distribution system from entry point to customer tap and diagrams
- Distribution system map (water mains, finished storage, booster stations, etc)
- Lead and Copper results (the most recent period) and 90th percentile determination
- DBP monitoring results
- Monthly Operating Reports (past 6 months)
- Water main break log (the most recent 12 months)
- Water quality/compliance online instrumentation calibration records (e.g., pH, turbidity, chlorine analyzers)

EPA requested but did not receive and/or view copies of the following documents throughout the course of the inspection:

- CMMS Work Orders for or list of – critical assets currently out of service
- SOPs or Operation & Maintenance (O&M) manuals for the treatment plant and distribution system operations (hydrant flushing, chemical feed adjustments, etc.)
- Process lab instrumentation calibration records (e.g., benchtop turbidimeter)
- Lead and Copper Sampling Plan
- DBP Monitoring Plans

V. Closing Conference

On Thursday, July 28, 2022, after inspecting the System areas described above, Leah Zedella led a closing conference with the System Representatives; a sign-in sheet was used to memorialize attendance (see *Attachment E: Closing Conference Attendance Log*).

During the closing conference, the EPA Inspection Team summarized preliminary observations from the inspection with the System Representatives. The EPA Inspection Team reiterated to the System Representatives that these preliminary observations were not compliance determinations. Any and all preliminary observations shared are subject to further investigation by EPA upon the review of additional records and documentation. Therefore, this inspection report may include observations that were not identified at the time of the closing conference.

The inspection concluded at approximately 2:30 pm.

A. Areas of Concern

The following Areas of Concern were identified during the course of the inspection:

1. Source Water

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Backwash Water Recycle Rule	There is a lack of flow control and monitoring of recycled water from lagoon to pre-sedimentation basin that could increase the risk of actual flow rates higher than flows metered in the upstream process.	Recycled water flows by gravity from the lagoon to the pre-sedimentation basin through a manually operated sluice gate without flow measurement.	40 CFR §141.76(d)(2) requires the System to "list all recycle flows and the frequency with which they are returned." 12VAC5-590-550.16.a.-f. describes the recycle flow information that the waterworks is required to collect and retain on file. System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).
	There is a lack of flow control and monitoring of recycled water from lagoon dredging operation that could increase the risk of actual flow rates higher than flows metered in the upstream process.	System Representatives were not aware of the lagoon dredge process water discharge location, and there are no flow measurements of process water from that operation	40 CFR §141.76(d)(2) requires the System to "list all recycle flows and the frequency with which they are returned." 40 CFR §141.76(b) requires the System to notify the State of "[a] plant schematic showing the origin of all flows which are recycled (including, but not limited to, spent filter backwash water, thickener supernatant, and liquids from dewatering processes), the hydraulic conveyance used to transport them, and the location where they are re-introduced back into the treatment plant." 12VAC5-590-550.16.a.-f. describes the recycle flow information that the waterworks is required to collect and retain on file. System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).

Pre-sedimentation Basin	The basin cannot be bypassed for instances such as emergency or maintenance.	There is not a means for water to bypass the pre-sedimentation basin from the intake north of the William's Island Dam and the Kanawha Canal cannot be used as a sole source.	12VAC5-590-865.C.4. requires that "[p]rovisions for bypassing presedimentation basins shall be provided."
	The basin does not undergo maintenance.	The pre-sedimentation basin is not equipped with any means to remove sludge, and it does not appear to be on a regular maintenance schedule like the adjacent residuals settling lagoon.	12VAC5-590-865.C.2. states that the design of pre-sedimentation basins "shall address future needs for solids removal and handling."
Raw Water Quality Monitoring	Raw water quality testing analytes and frequency is minimal for early detection issues that could affect treatment.	The System analyzes for pH, turbidity, and alkalinity in the raw water. The System does not conduct any other periodic monitoring of raw water to test for potential contaminants.	"Recommended Standards for Water Works" (2018 Edition) Part 2.19.h. – "Real time water quality monitoring with continuous recording and alarms should be considered at key locations to provide early warning for possible contamination events."
Kanawha Canal	There is a lack of flow monitoring of water from the Kanawha Canal, which could increase the risk of actual flow rates higher than flows metered in the upstream process; unknown flow could lead to unknown impacts to raw water quality.	Canal water flows by gravity without flow measurements. System Representatives stated that use of the Canal creates differences in water quality, and there is no prescribed procedure to adjust treatment for these instances.	"Recommended Standards for Water Works" (2018 Edition) Part 2.13 states that "[a]ll water supplies shall have an acceptable means of measuring the flow from each source, the wash water, the recycled water, any blended water of different quality, and the finished water." Part 2.19.h. states that "[r]eal time water quality monitoring with continuous recording and alarms should be considered at key locations to provide early warning of possible contamination events." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).

2. Chemical Treatment & Storage

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Finished Water Quality	Free ammonia concentrations exceed 0.1 mg/L when entering distribution.	July 2022 data sheets reflected several instances where free ammonia exceeds 0.1 mg/L, with a maximum of 0.41 mg/L.	12VAC5-590-1002 states that "[c]ontrol should be sufficient to limit free ammonia leaving the chloramination facility to no more than 0.1 mg/L as nitrogen."
Raw water coagulation channel	There was only one flash mixer for each plant and no operational procedure to respond to a failure.	There were not any redundant mixers for the flash mixer at each plant in the channel.	12VAC5-590-871.A.2. states, in part, that "[w]here mechanical mixing devices are utilized, duplicate units or spare mixing equipment shall be provided." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).
	Raw flow meters used for chemical dosage are unreliable.	The flow meters were unreliable and inaccurate while flow is critical in determining chemical dosing. Jar tests not completed on a regular schedule or required by the operators; they are only conducted as needed.	12VAC5-590-360.A. states that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter. This requirement shall pertain to the source water, transmission, treatment, storage, and distribution system facilities and the operation thereof. The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).
	Potassium permanganate treatment out of service.	The System intended for potassium permanganate treatment based on seasonal needs, however, the treatment was out of service on two separate checks during the inspection due to an	12VAC5-590-360.A. states, in part, that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter."

		instrumentation failure. Potassium permanganate residuals are not tested in treated water to confirm proper dosage.	System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).
Chemical storage	Chemical leaks were observed.	The chemical line for caustic soda in the Korah 1 Pump Station had crystalized product on the exterior and the area was taped off. The SH-1-3 tank and the tank fill line had active leaks at the time of inspection. EPA observed leaking aluminum sulfate in the bulk storage area.	12VAC5-590-470. Waterworks condition. The waterworks shall be maintained in a clean and orderly condition.
	Capacity for chemical storage may not be a 30-day minimum.	The aluminum sulfate storage capacity may be less than a 30-day supply based on the System's average daily production rate. The capacity of the bulk and day tanks are 155,000 gallons. The System uses 14,000 gallons/day of aluminum sulfate, providing an 11-day supply.	12VAC5-590-860.D.1.a. states that "[s]pace shall be provided where at least 30 days of chemical supply can be stored…"
Chemical Treatment & Process Control	Operational SOPs for chemical application systems are not utilized or readily available.	Operators do not have an updated SOP to reference for chemical treatment processes; System Representatives explained there may be an SOP in the operator control room although it is dated from the 1990s. Polymer is not flow-paced and must be manually adjusted.	12VAC5-590-360.A. states that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter. This requirement shall pertain to the source water, transmission, treatment, storage, and distribution system facilities and the operation thereof. The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health."

	System does not utilize a nitrification control plan to monitor the disinfection process.	System utilizes chloramination for disinfection but has not developed formalized steps to respond to chloramination disinfection issues such as nitrification. The System has experienced unexplained coliform positive samples recently, and there is no plan or procedure in place to respond to or investigate the cause these events. System Representatives stated that the chlorine residuals in these areas was high and there are observed instances of high free ammonia in the operator logs.	"Recommended Standards for Water Works" (2018 Edition) Part 4.4.5.5.b. states that "[a] monitoring program shall be established…throughout the distribution system to verify proper chloramine formation and for determination of nitrification occurrence." Part 4.4.5.6.b. states that "[a] nitrification control plan that includes flushing and the temporary use of a free chlorine residual should be prepared along with the triggering criteria for implementation."
	Copper sulfate addition is not applied per a standardized procedure, increasing the risk of hazards due to improper dosing.	Copper sulfate is added to the basin without a process for testing water quality before or after application, or in the treatment process. System Representatives stated that 50-pound bags are added without a measured application.	12VAC5-590-960.A. states that "[c]ontinuous or periodic treatment of source waters with copper sulfate and other copper compounds to kill algae or other growths shall be controlled to prevent copper in excess of 1.0 mg/L, as copper, in the finished water leaving the treatment plant."
	PAC addition is not applied per a standardized procedure, increasing the risk of hazards due to improper dosing.	PAC is added without a formal procedure for dosage or application periods.	"Recommended Standards for Water Works" (2018 Edition) Part 4.10.4.e. states "[t]he required rate of feed of carbon in a water treatment plant depends upon the tastes and/or odors involved, but provision should be made for adding from 0.1 mg/L to at least 0.40 mg/L."

3. Filtration

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Plant 2 Filters	The exposed concrete filter beds and surface structures appeared	Concrete structures above filter beds had hairline cracks throughout. Structural	12VAC5-590-360.A. states that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a

	deteriorated due to weathering and age, and failure of additional filers could impact overall filter performance.	debris was observed on the center wall inside of Filter 16.	manner that will assure a high degree of capability and reliability to comply with Part II of this chapter. This requirement shall pertain to the source water, transmission, treatment, storage, and distribution system facilities and the operation thereof. The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).
Plant 1 Filters	The air scour pipes above the filters were significantly corroded on the exterior. Failure of the air scour process could impair the filter performance.	The filter beds are contained in an enclosed structure subject to the humidity and chlorine from the filter bed water; the exposed unpainted air scour piping had severe rust and corrosion damage.	
Filter Operation and Maintenance	Filter inspections or maintenance programs are not regularly performed.	The System completes filter rise tests, filter drop tests, and filter expansion tests, as required by VDH to confirm operational flowrates. Assessments to identify and address maintenance preventatively are not completed.	
	High filter turbidity SCADA alarm response was inconsistent.	System Representatives explained that filters are returned to service from filter-to-waste after a backwash procedure when turbidity is less than 0.1 NTU and any filter performance not less than 0.1 NTU is addressed. However, EPA observed Filter 16 turbidity increase above 0.1 NTU in the minutes following its return to service.	
		There are several instances in the MORs that demonstrate a filter in use with turbidity in excess of 0.1 NTU as "turbidity spikes" that do not exceed 2.00 NTU. Turbidimeters	

		appear to be set to a maximum read level of 2.00 NTU for an unknown reason.	

4. Finished Water & Distribution

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Clearwell Pumps	Pumps are corroded and deteriorated at the base, risking a loss of capacity due to deteriorated structures.	EPA observed significant corrosion at the base of Pumps 1, 2, and 3 that move water from the clearwell to the finished water basin.	12VAC5-590-360.A. states that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter. This requirement shall pertain to the source water, transmission, treatment, storage, and distribution system facilities and the operation thereof. The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health."
Finished Water Basin 2	Risk of contamination from entry and landing structure.	Debris collected at the door base and was easily tracked inside, and the landing area had dirt and debris and portions without a baseboard or other barrier to prevent it from falling into the finished water basin.	12VAC5-590-470. Waterworks condition. The waterworks shall be maintained in a clean and orderly condition. 12VAC5-590-1081.J. states that "[e]very catwalk over finished water in a storage structure shall have a solid floor with raised edges designed so that shoe scrapings and dirt will not fall into the water."
Byrd Park Reservoir	There was a risk of contamination from rooftop stormwater due to valve pit flooding, and there is a lack of inspections of the pit.	The valve pit between the two cells of the reservoir was flooded. The valve pit shares common walls with the reservoir cells, and the walls are penetrated by multiple pipes. System Representatives were not informed of the flooding	12VAC5-590-1081.H. states that "[t]he roof and sidewalls of all structures shall be watertight with no openings…"

		and did not know the cause, indicating the valve pit is not inspected on a regular basis.	
	Lack of overflow for reservoir.	The reservoir does not have an overflow and the installation of one is not included in any upcoming capital improvement projects.	12VAC5-590-1081.D. describes overflow requirement for finished water storage structures.
Warwick Road Tank	Overflow discharge location was not able to be located, unknown contamination risks.	System Representatives were not able to locate overflow pipe, indicating they are not inspected regularly. A potential overflow outfall point was not accessible due to heavy vegetation. System Representatives stated that the overflow may be connected to a sanitary sewer line; EPA could not inspect air gap, screening, or connection location to ensure protection from contaminants.	12VAC5-590-1081.D. describes overflow requirement for finished water storage structures.
	Lack of structural support to gate valve on the primary tank transmission main as designed to prevent failure.	Inside the tower at ground level, a 16” gate valve was installed on the tank transmission main connection above grade. EPA observed several pieces of wood stacked to create an insignificant support structure; it did not appear to be functional.	12VAC5-590-360.A. states, in part, that “[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter…The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health.”
Cofer Road Tanks	Concern of contamination due to unreliable seal at the overflow pipes.	The overflow pipes were equipped with a weighted, screened cover; however, the weight was not heavy enough to provide an adequate seal to the overflow pipe.	12VAC5-590-1081.D. describes overflow requirement for finished water storage structures.

Jahnke Road Tank	There was no fine mesh on the overflow to prevent contamination or pests.	EPA only observed rough mesh on the overflow pipe that was large enough to allow pests into the finished water storage.	12VAC5-590-1081.A.2. states that "[a]ll finished water storage structures shall be designed to prevent vandalism and entrance by animals or unauthorized persons." "Recommended Standards for Water Works" (2018 Edition) Part 7.0.7.b. states that "[t]he overflow shall open downward and be screened with twenty-four mesh non-corrodible screen…"
Huguenot Road Tank	The overflow pipe was not able to be identified, and the pipes were below grade in a low-lying area that were not screened or were blocked with debris.	EPA could not confirm the location of the overflow pipe. There were three potential overflow pipes; only one was screened properly but it was blocked with debris. The condition of the pipes and surrounding area indicate they are not inspected regularly.	12VAC5-590-1081.D. describes overflow requirement for finished water storage structures. "Recommended Standards for Water Works" (2018 Edition) Part 7.0.7.b. states that "[t]he overflow shall open downward and be screened with twenty-four mesh non-corrodible screen…"
Ginter Park Tank	It was not known if backflow prevention was in place on the overflow to prevent cross contamination with a sanitary or storm sewer line.	The overflow pipe was located underground in an access hatch, but no backflow prevention was visible. System Representatives were not aware if backflow prevention was installed.	12VAC5-590-600. Describes the cross-connection control program responsibilities for public water system owners.
Byrd Park Main Pump Station	The pump station had debris and leaks throughout, and a hose was on the floor without a vacuum breaker presenting a high contamination risk to the finished water.	EPA observed dirt and debris across the floor from the ceiling renovation, as well as buckets of oil waste and other trash throughout the pump station. EPA also observed a hose on a threaded tap connected to a finished water line; the hose was resting in an area that was wet from other leaks in the pump station, indicating potential for	12VAC5-590-600. Describes the cross-connection control program responsibilities for public water system owners.

		contamination during pressure loss.	
Finished Water Storage Facilities	Lack of regular inspections performed on the finished water tanks and storage facilities.	System Representatives stated that the tanks were last inspected in 2017; however, reports reflect the inspections were performed in 2015. Clearwells and finished water basins were not included in the tank inspection reports provided.	12VAC5-590-360.A. states that "[t]he owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and reliability to comply with Part II of this chapter…The owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health."
	Several tanks had overgrown vegetation within 6' and/or overhanging the structures.	Overgrown vegetation was observed at the Jahnke Road Tank and Huguenot Tank within proximity and/or overhanging. There is potential for damage to the structure in storm conditions.	12VAC5-590-360.A. states, in part, that "[t]he owner shall identify and evaluate factors with the potential for impairing the quality of the water delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health."
Pump Station Maintenance	Byrd Park Main Pump Station operations at the pump station are manual and poorly maintained, reducing reliability to operation, capacity, and emergency response.	The pump station is not tied to SCADA and requires manual operation. There were several housekeeping concerns at the pump station. There were not adequate logs or recordkeeping at the pump station for operator activities.	12VAC5-590-470. States that "[t]he waterworks shall be maintained in a clean and orderly condition."
	Korah Pump Stations safety concerns	The building that houses Korah Pump Station #2 and #3 had active water drainage to the floor from at least two sources. The pump for Korah 1-2 had exposed wiring.	12VAC5-590-1050.A.8. states that "[a] suitable outlet for drainage from pump glands shall be provided without discharging onto the floor."

5. Compliance Monitoring

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Lead and Copper Rule	Lack of inventory developed for service lines, and sampling sites are not validated.	No inventory of service line materials exists; only 100 sample sites were identified in 1992. Ground truthing activities are not conducted to ensure proper Tier levels for sample sites to ensure current material of service lines.	12VAC5-590-375.B.1.a. describes the requirements for lead and copper monitoring sample site location, including a materials evaluation of the distribution system.
Revised Total Coliform Rule	Population figures used to determine compliance requirements may be understated.	Population served at the System is determined by Census data, which determined a population of 226,000 in 2020. The System’s RTCR sampling plan uses a population of 220,000, thereby impacting the number of compliance samples to be collected.	12VAC5-590-370 describes the Bacteriological monitoring required, including Table 370.1 that describes number of required samples per population group. For Systems serving 220,001 to 320,000, System must collect at least 150 samples.
	Recent total coliform positive events have unknown cause.	System Representatives discussed five recent total coliform positive results. The results were not formally evaluated to identify the cause.	12VAC5-590-380.D. states that “[a] total coliform-positive result is indicative of a breakdown in the protective barriers and shall be cause for repeat monitoring and special follow-up action to locate and eliminate the cause of contamination.”

6. System Management

CATEGORY	AREA OF CONCERN	SUPPORTING OBSERVATIONS	RELEVANT CITATIONS
Cross-Connection Control	Backflow prevention device inspection does not appear to occur annually with corrective action taken for failures.	Tags on several backflow prevention devices throughout the System were failed and/or out of date for annual inspections.	12VAC5-590-600.E. requires at least annual testing after initial installation, relocation or repair of backflow assemblies. 12VAC5-590-600.H.-I. describes the backflow prevention recordkeeping and inventories owners shall maintain.
	Threaded taps were located on finished water	EPA observed several hoses without vacuum breakers that were tied to a finished water line	12VAC5-590-600. Describes the cross-connection control program

	lines without vacuum breakers, presenting cross contamination risk during pressure loss.	throughout the plant and the distribution system.	responsibilities for public water system owners.
CMMS Work Orders	Calibration of critical instrumentation and chemical feed pumps is irregular or as needed.	System Representatives stated that flow meters at the pump stations are verified as needed. Work orders from 2022 show preventative maintenance calibration of some pH analyzers and turbidimeters, but no chlorine analyzers. The chemical pump output is overseen by operators who submit work orders for maintenance if they sense output is not correct. Calibrations are not on a regular schedule.	12VAC5-590-480.E. states that “[p]rocess control instruments, monitors, gauges, and controllers, including reading, recording, and alarm features, required in Part III, Manual of Practice (12VAC5-590-640 et, seq.), shall be maintained fully operational and calibrated in accordance with the manufacturer instructions.”
	Preventative maintenance documentation appears to be limited and corrective maintenance does not appear to be documented, and there is no tracking for out of service assets. Loss of critical assets creates risk for meeting production demands.	Work orders from 2022 only reflect some preventative maintenance activities, and they are not used to track all maintenance activities or operational status. System Representatives explained that the CMMS system does not allow for an inventory of critical assets out of service. EPA observed several flocculators, filters, and pumps out of service with no forecasted date to return to service, potentially impacting overall capacity.	“Recommended Standards for Water Works” (2018 Edition) Part 2.19(c) states, in part, that “…provisions should be made for maintaining an inventory of critical parts.”
Emergency Response Planning	The ERP needs to be updated and finalized.	The ERP references out-of-date information and needs updated. Both the DPU EOM and the System’s ERP need to be finalized and signed for full implementation.	12VAC5-509-505. Describes requirements of an emergency management plan for extended power outages. “Recommended Standards for Water Works” (2018 Edition) Part 1.1.17.a.-d. describes considerations for Security, Contingency Planning, and Emergency Preparedness.

VI. List of Attachments

A. Photograph Log
B. Opening Conference Attendance Log
C. Map – Overview of System Sources and Treatment Plants
D. Map – Sedimentation and Flocculation Basins of Plants 1 and 2
E. Closing Conference Attendance Log

Appendix A
Photograph Log

Photograph 1. Flood wall between treatment plant and the lagoon/pre-sedimentation basin area.

Photograph 2. Lagoon dredging operation.

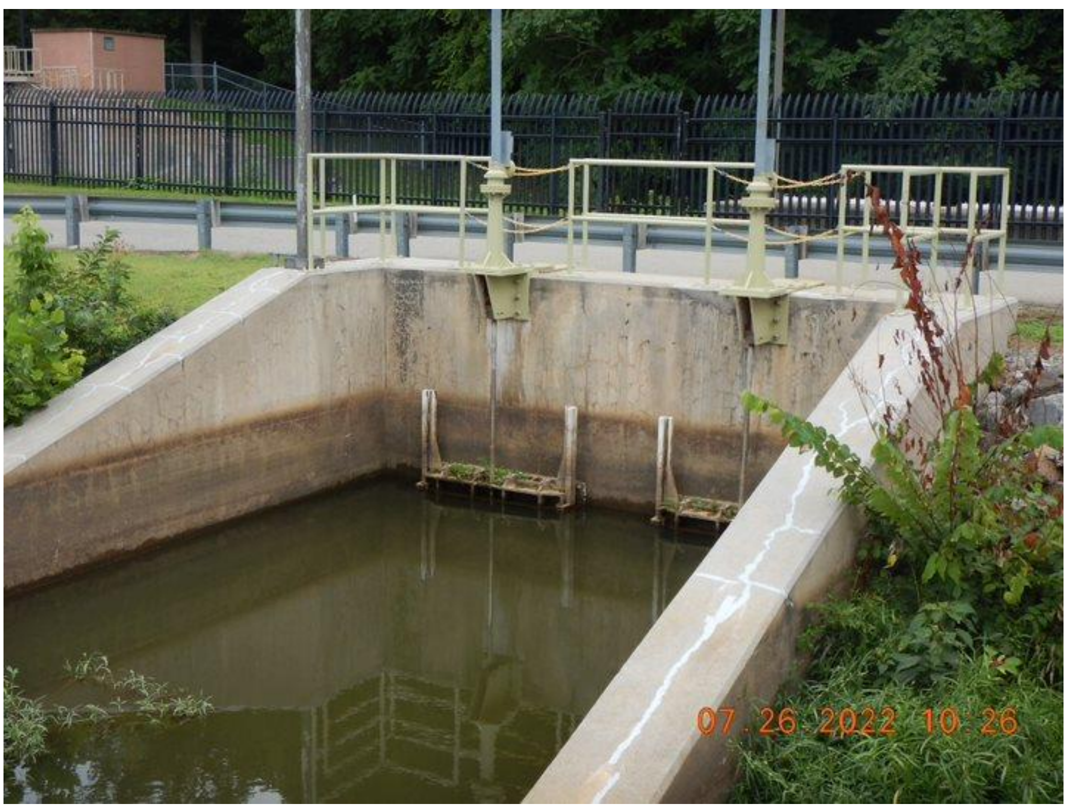
Photograph 3. Lagoon waste processing and dewatering operation.

Photograph 4. Bar screens and vegetation growing alongside the structure.

Photograph 5. Bar screen and waste containers with vegetation and other debris.

Photograph 6. Polymer containers without secondary containment in the dewatering area.

Photograph 7. Kanawha Canal near plant intakes.



Photograph 8. Plant intakes from Kanawha Canal.

Photograph 9. Inactive basin, former sedimentation basin area.


Photograph 10. Raw water intake and out of service screens.

Photograph 11. Out of service screens at raw water intake area.

Photograph 12. Traveling screens at raw water intake.

Photograph 13. Vegetation growing in concrete raw water channel at water line.

Photograph 14. Potassium permanganate chemical application area, not operating properly since water is clear instead of purple.

Photograph 15. Plant 2 flow meter above raw water coagulation channel, wood to block potential sun interference.

Photograph 16. Plant 2 flow meter above raw water coagulation channel, below piece of wood.

Photograph 17. Water Champ flash mixer controls at Plant 2.

Photograph 18. Water Champ flash mixer controls at Plant 1.

Photograph 19. Sedimentation basin of Plant 1 and solids residual collection system along middle walkway.

Photograph 20. Solids residual collection system cables and controls.

Photograph 21. Solids residual collection system, cable for the collectors.

Photograph 22. Plant 1 plate settlers.

Photograph 23. Plant 2 plate settlers.

Photograph 24. Exposed wiring at flocculator 4-2A.

Photograph 25. Filter 19, not in service.

Photograph 26. Cracks in concrete above Plant 2 filter beds.

Photograph 27. Cracks in concrete above and vegetation growing around Plant 2 filters.

Photograph 28. Vegetation growing around concrete structures above Plant 2 filters.

Photograph 29. Cracking above influent valve of Filter 16.

Photograph 30. Debris near influent/effluent channel of Filter 16.

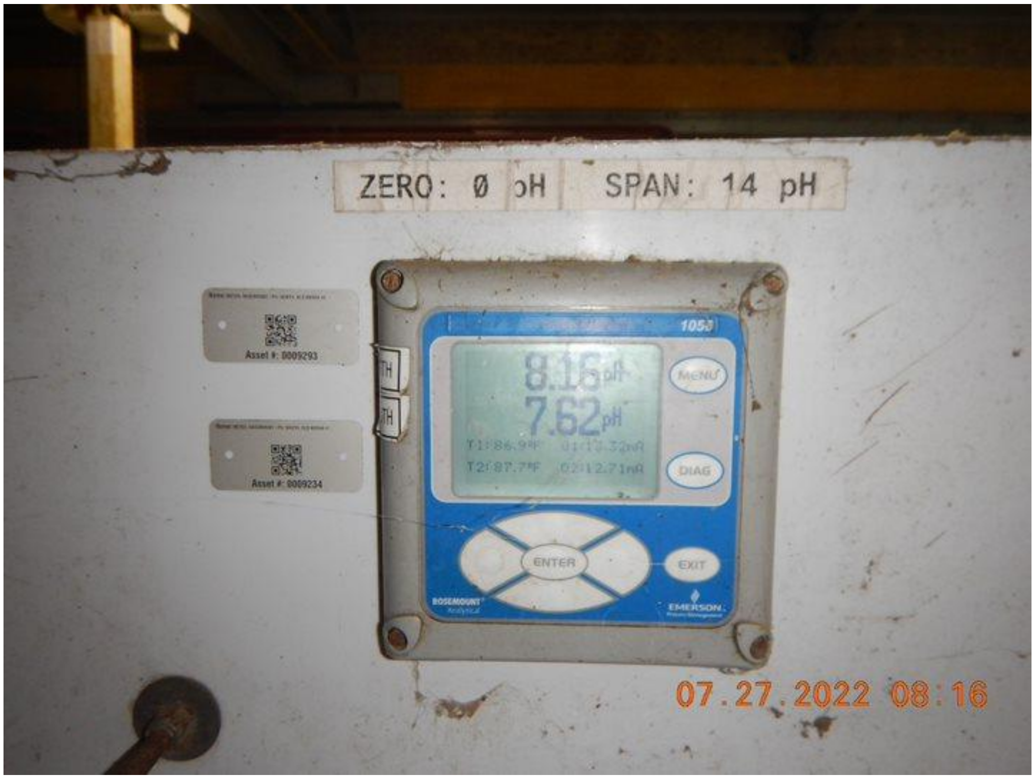
Photograph 31. Debris near influent/effluent channel of Filter 16.

Photograph 32. Landing area at entry of Plant 2 finished water basin; no baseboards to prevent debris from falling into water.

Photograph 33. Dirt and debris on landing area above Plant 2 finished water basin.

Photograph 34. Caustic soda line leak and caution tape in Korah 1 Pump Station.

Photograph 35. Caustic soda line leak in Korah 1 Pump Station.



Photograph 36. Korah 1 Pump Station pH analyzers.

Photograph 37. Caustic soda bulk storage area adjacent to the Korah 1 Pump Station.

Photograph 38. Exposed wiring on K1-2 pump at Korah 1 Pump Station.

Photograph 39. Korah 2 and 3 Pump Station – ‘south’ analyzers for pH, temperature, and turbidity.

Photograph 40. Korah 2 and 3 Pump Station – 'north' and 'south' fluoride analyzers.

Photograph 41. Korah 2 and 3 Pump Station – ‘north’ chlorine analyzer.

Photograph 42. Korah 2 and 3 Pump Station – 'south' chlorine analyzer.

Photograph 43. Process water pipe discharging to floor on lower level of Korah 2 and 3 Pump Station

Photograph 44. Water flowing across floor near K3-2 pump, and algal growth on floor near pump motor in Korah 2 and 3 Pump Station.

Photograph 45. Water and algal growth on floor of Korah 2 and 3 Pump Station.

Photograph 46. K2-2 pump motor discharging water onto Korah 2 and 3 Pump Station floor.

Photograph 47. K2-2 pump motor discharging water onto Korah 2 and 3 Pump Station floor.

Photograph 48. Leaking fitting from corroded pipe in Korah 2 and 3 Pump Station.

Photograph 49. Fitting leaking from corroded pipe onto floor in Korah 2 and 3 Pump Station.

Photograph 50. Fencing at the Trafford Pump Station.

Photograph 51. Fencing and vegetation growth at the Byrd Park Reservoir.

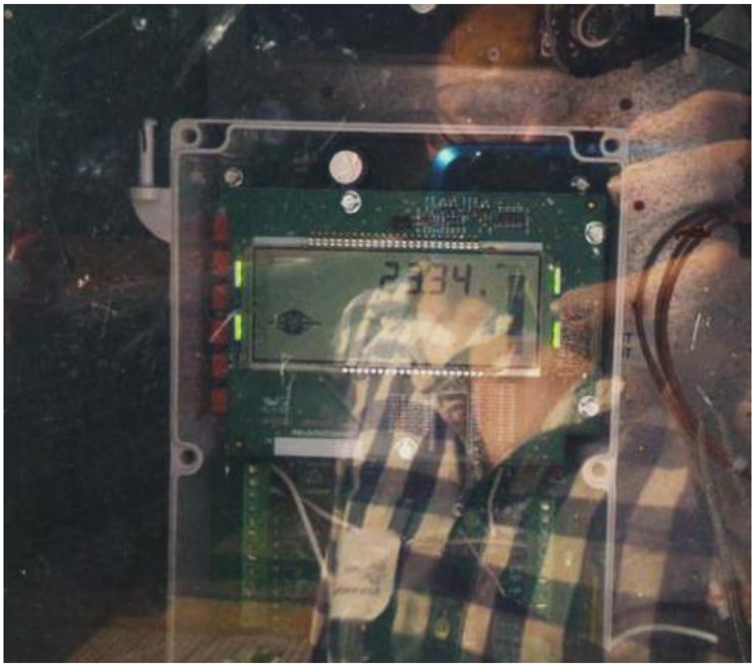
Photograph 52. Fencing and vegetation growth at the Byrd Park Reservoir.

Photograph 53. Roof of Byrd Park Reservoir.

Photograph 54. Roof of Byrd Park Reservoir.

Photograph 55. Vegetation growth on the roof of Byrd Park Reservoir.

Photograph 56. Vegetation growth on the roof of Byrd Park Reservoir.



Photograph 57. Level indicator at Byrd Park Reservoir reading 23.34 feet.

Photograph 58. Water leaking from siding on Byrd Park Reservoir roof.

Photograph 59. Water leaking from siding on Byrd Park Reservoir roof.

Photograph 60. Damage and water leaking from roof and siding on Byrd Park Reservoir.

Photograph 61. Plant growth at base of Byrd Park Reservoir.

Photograph 62. Plant growth at base of Byrd Park Reservoir.

Photograph 63. Plant growth at base of Byrd Park Reservoir.

Photograph 64. Vents on western side of north walkway at Byrd Park Reservoir.

Photograph 65. Vents on eastern side of north walkway at Byrd Park Reservoir.

Photograph 66. Metal plates in between vents in access area on northern walkway of Byrd Park Reservoir.

Photograph 67. Access vault filled with water in northern walkway of Byrd Park Reservoir.

Photograph 68. Southern access walkway at Byrd Park Reservoir.

Photograph 69. Opened electric box at end of southern access walkway at Byrd Park Reservoir.

Photograph 70. Cofer Road Tank B overflow and debris inside screen.

Photograph 71. MACPU unit, not in service at Cofer Road Tank A.

Photograph 72. Flow meter at Cofer Road Pump Station, reading 9065.0 gallons/minute.

Photograph 73. Fencing at Jahnke Road Tank.

Photograph 74. Vegetation and algal growth at base of Jahnke Road Tank.

Photograph 75. Overhanging trees at rear of Jahnke Road Tank.

Photograph 76. Rust on exterior of Jahnke Road Tank.

Photograph 77. Rust on exterior of Jahnke Road Tank.

Photograph 78. Rough mesh on overflow at Jahnke Road Tank.

Photograph 79. Corrosion and degraded seal at base of Jahnke Road Tank.

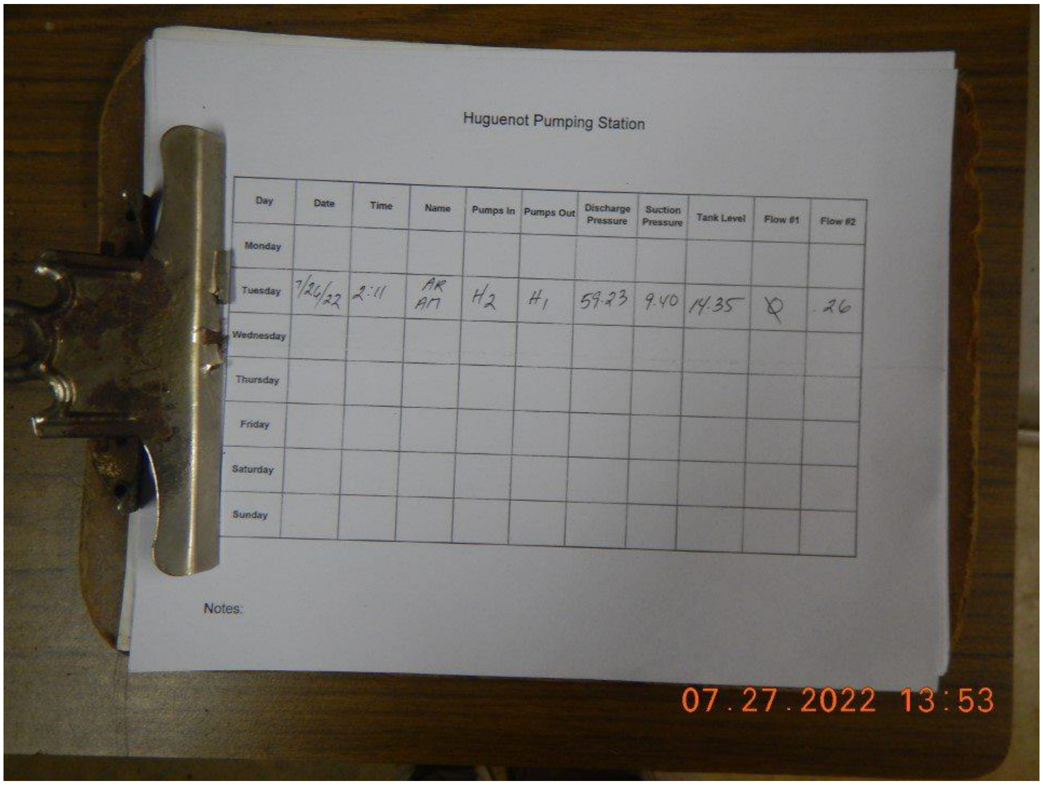
Photograph 80. Jahnke Road Pump Station.

Photograph 81. Base of Warwick Road Tank with algal growth on bottom.

Photograph 82. Pieces of wood stacked to attempt to provide support to the transmission pipe at Warwick Road Tank.

Photograph 83. Pieces of wood stacked to attempt to provide support to the transmission pipe at Warwick Road Tank.

Photograph 84. Corrosion on the control valve on the transmission pipe of the Warwick Road Tank.



Photograph 85. Huguenot Pump Station operator log sheet showing pump H1 as out of service.

Photograph 86. Huguenot Road Tank with temporary fencing and staining.

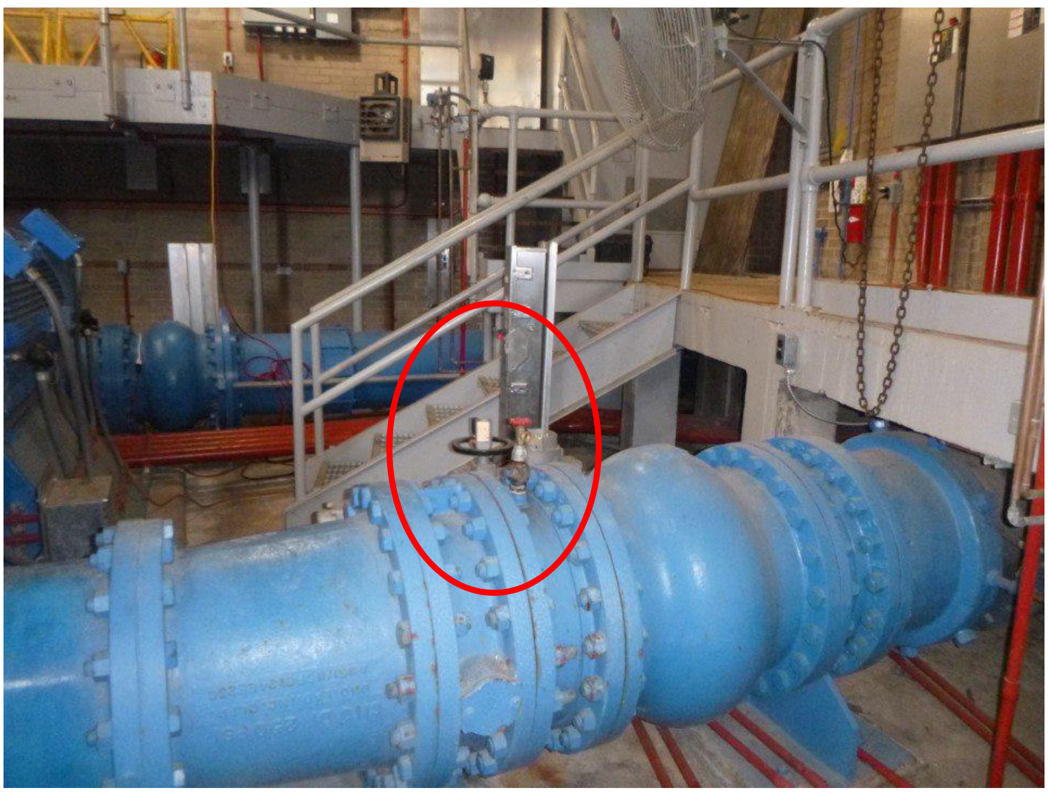
Photograph 87. Vegetation growing up and overhanging the Huguenot Road Tank.

Photograph 88. Vegetation growing up and overhanging the Huguenot Road Tank.

Photograph 89. Overflow and/or discharge pipes from the Huguenot Road Tank.

Photograph 90. Overflow and/or discharge pipes from the Huguenot Road Tank.

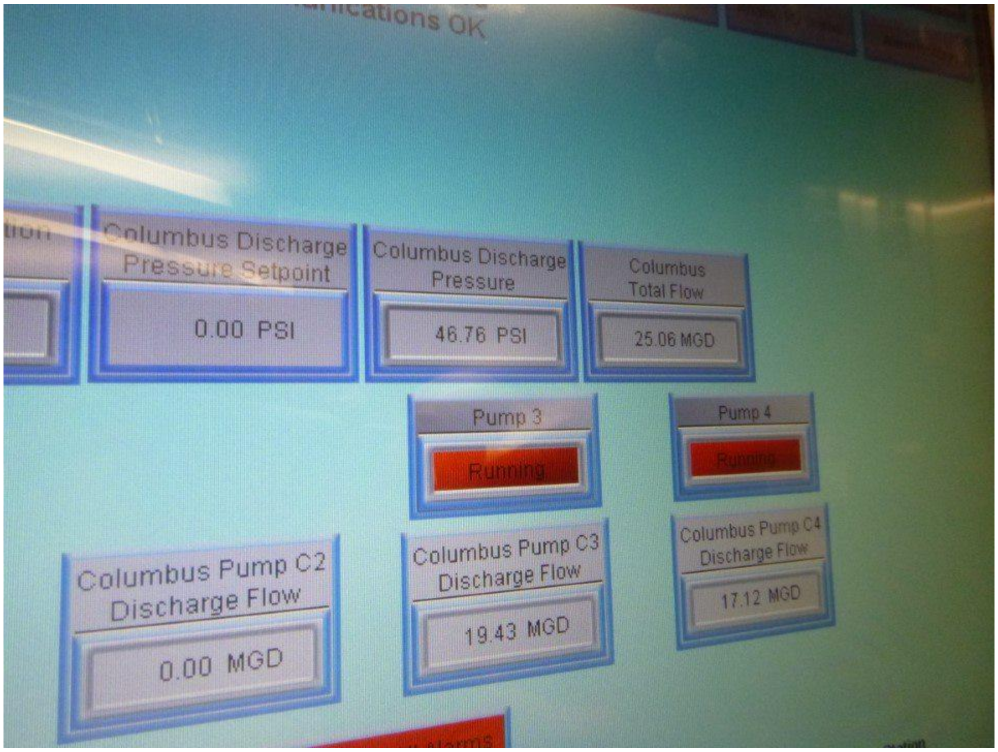
Photograph 91. Programmable logic controller (PLC) out of service at the Columbus Pump Station main building.



Photograph 92. Threaded tap on finished water line without backflow prevention at the Columbus Pump Station.

Photograph 93. Threaded tap on finished water line without backflow prevention at the Columbus Pump Station.

Photograph 94. PLC in electrical room at Columbus Pump Station.



Photograph 95. PLC in electrical room at Columbus Pump Station; discharge setpoint at 0.00 psi.

Photograph 96. Byrd Park Main Pump Station entrance with graffiti.

Photograph 97. Byrd Park Main Pump Station floor with debris.

Photograph 98. Byrd Park Main Pump Station floor with debris and bucket of water/oil.

Photograph 99. Leaking seals on gate valves at Byrd Park Main Pump Station.

Photograph 100. Leaking seals on gate valves at Byrd Park Main Pump Station.

Photograph 101. Leaking lubrication at pump at Byrd Park Main Pump Station.

Photograph 102. Standing water on floor at Byrd Park Main Pump Station.

Photograph 103. Five-gallon bucket of oil/water mixture at Byrd Park Main Pump Station.

Photograph 104. Hose on ground in standing water attached to finished water line without vacuum breaker at Byrd Park Main Pump Station.

Photograph 105. Hose on ground attached to finished water line without vacuum breaker.

Photograph 106. Non-operational meter at Byrd Park Main Pump Station.

Photograph 107. Non-operational meter at Byrd Park Main Pump Station.

Photograph 108. Four-foot fencing at Westhampton Pump Station in highly trafficked residential area.

Photograph 109. Hose connected to threaded tap without vacuum breaker at Westhampton Pump Station.

Photograph 110. Potential overflow pipe for Ginter Park Tank.

Photograph 111. Plant 1 pipe gallery and Filter 4 filter-to-waste drain in process.

Photograph 112. Corrosion on air scour pipes located inside the enclosed Plant 1 filter room.

Photograph 113. Corrosion on air scour pipes located inside the enclosed Plant 1 filter room.

Photograph 114. Corrosion on pump 1 that takes water from the Plant 1 clearwell to the finished water basin.

Photograph 115. Corrosion on pump 2 that takes water from the Plant 1 clearwell to the finished water basin.

Photograph 116. Corrosion on pump 3 that takes water from the clearwell to the finished water basin in Plant 1 pipe gallery.

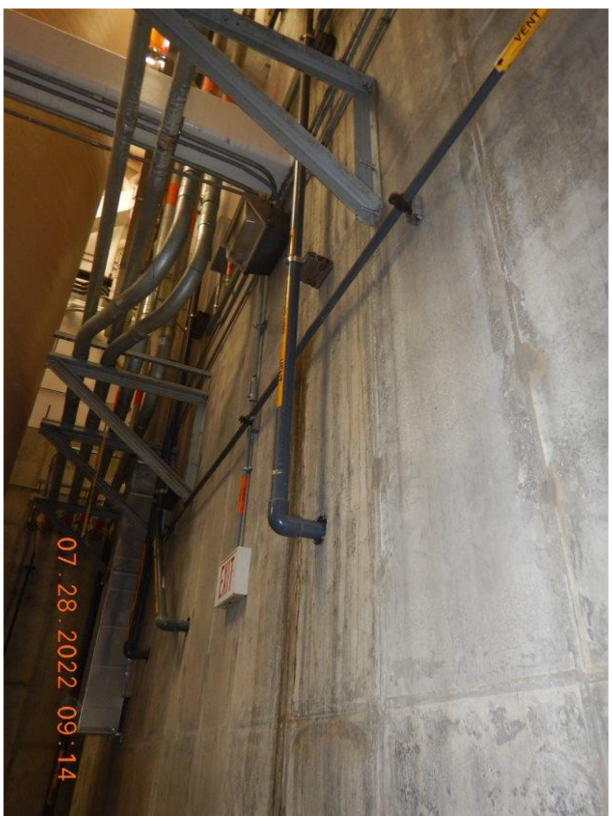
Photograph 117. Streaming current monitor for Plant 1, reading -0.24 mV.

Photograph 118. Floor below active sodium hypochlorite leak at Tank T-SH-1-3 at the West Chemical Building.

Photograph 119. Leak around gasket of sodium hypochlorite tank T-SH-1-3 at the West Chemical Building.

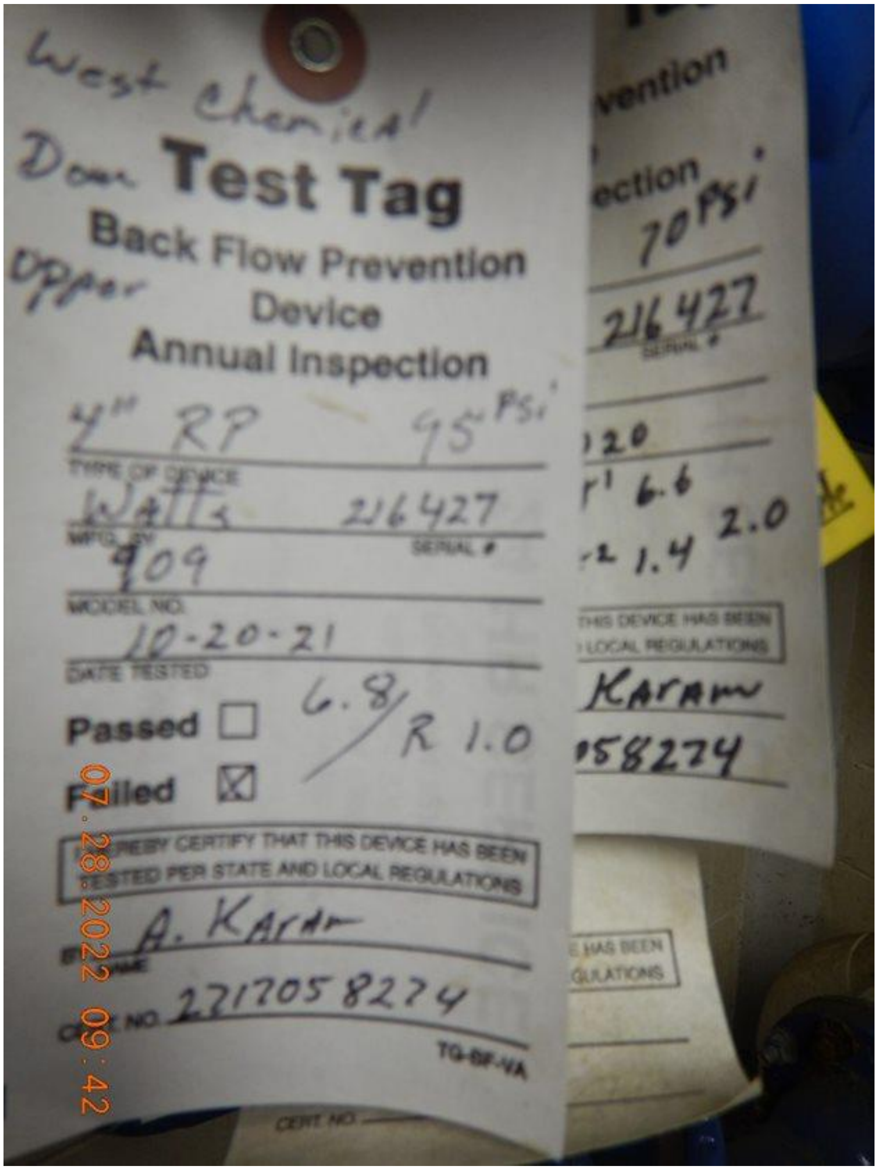
Photograph 120. Crystalized sodium hypochlorite around gasket at tank T-SH-1-3 at the West Chemical Building.

Photograph 121. Sodium hypochlorite offloading in process at West Chemical Building.



Photograph 122. Elevated sodium hypochlorite bulk tank fill lines in the West Chemical Building.

Photograph 123. Crystalized aluminum sulfate on the day tank supply line.



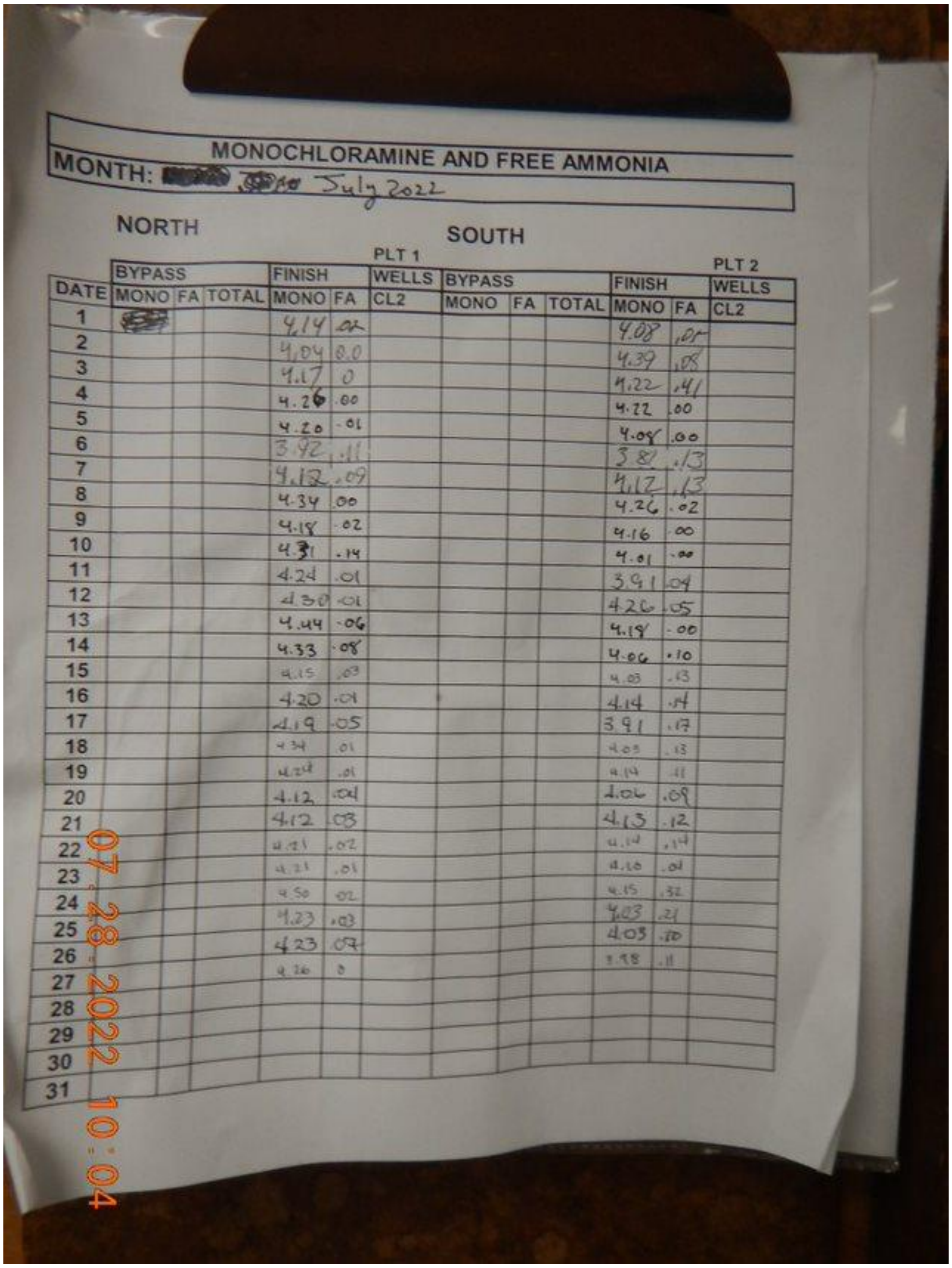
Photograph 124. Fail backflow prevention inspection tag dated October 20, 2021 located in the potassium permanganate storage and pump area.

Photograph 125. Potassium permanganate in raw water coagulation channel during Day 2 of inspection out of service with clear water at chemical application point.

Photograph 126. Grab sample location for operators in the Plant 2 process laboratory.

Photograph 127. Malvern Zetasizer in Plant 2 process laboratory.

Photograph 128. Jar test apparatus outside of SCADA control room and process laboratory of Plant 2.



MONOCHLORAMINE AND FREE AMMONIA

MONTH: July 2022

DATE	NORTH BYPASS MONO	NORTH BYPASS FA	NORTH BYPASS TOTAL	NORTH FINISH MONO	NORTH FINISH FA	PLT 1 WELLS CL2	SOUTH BYPASS MONO	SOUTH BYPASS FA	SOUTH BYPASS TOTAL	SOUTH FINISH MONO	SOUTH FINISH FA	PLT 2 WELLS CL2
1				4.14	.02					4.08	.05	
2				4.04	0.0					4.39	.08	
3				4.17	0					4.22	.41	
4				4.26	.00					4.22	.00	
5				4.20	.01					4.08	.00	
6				3.92	.11					3.81	.13	
7				4.12	.09					4.12	.13	
8				4.34	.00					4.26	.02	
9				4.18	.02					4.16	.00	
10				4.31	.14					4.01	.00	
11				4.24	.01					3.91	.04	
12				4.30	.01					4.26	.05	
13				4.44	.06					4.18	.00	
14				4.33	.08					4.06	.10	
15				4.15	.03					4.03	.13	
16				4.20	.01					4.14	.14	
17				4.19	.05					3.91	.17	
18				4.34	.01					4.05	.13	
19				4.24	.01					4.14	.11	
20				4.12	.04					4.06	.09	
21				4.12	.03					4.13	.12	
22				4.21	.02					4.14	.14	
23				4.21	.01					4.10	.01	
24				4.50	.02					4.15	.32	
25				4.23	.03					4.03	.21	
26				4.23	.07					4.03	.10	
27				4.26	0					3.98	.11	
28												
29												
30												
31												

Photograph 129. Monochloramine and free ammonia datasheet in Plant 2 process laboratory.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

Public Water System Inspection - Opening Conference Attendance Log
City of Richmond PWS – VA4760100
July 26, 2022 – 8:00 am

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

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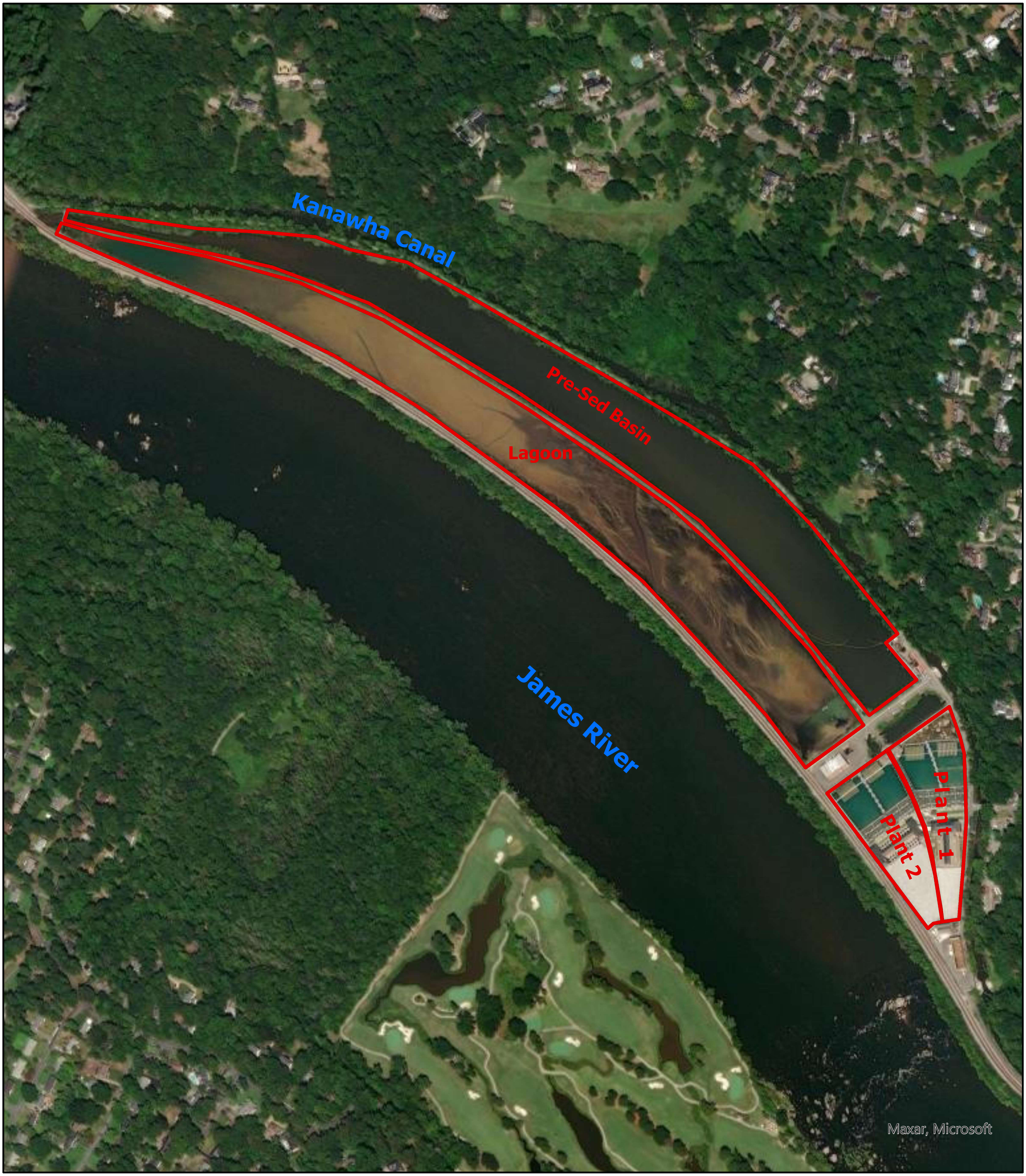
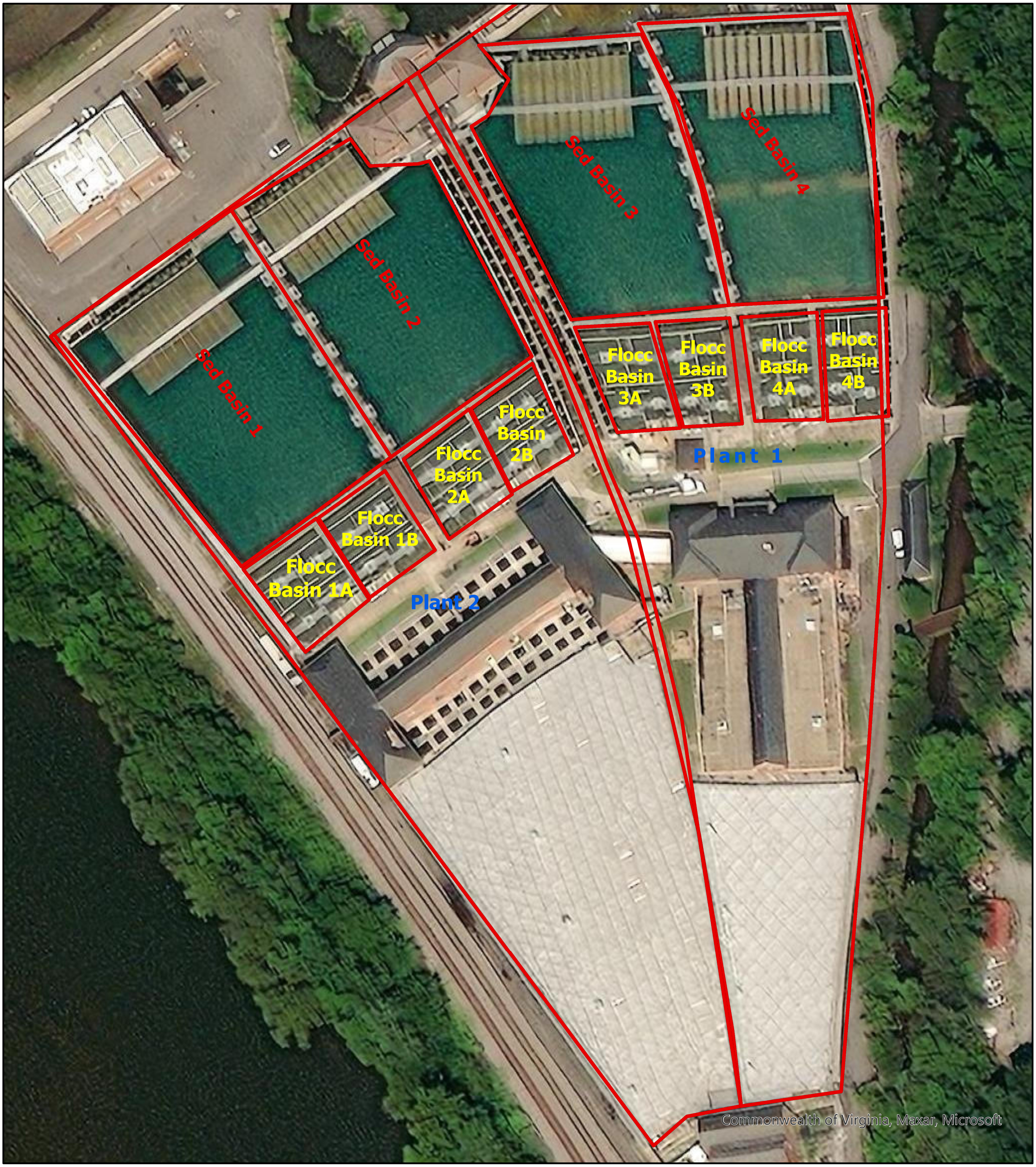


Attachment C
Overview of System Sources and Treatment Plants

0 0.07 0.15 0.3 Miles



Attachment D
Sedimentation and Flocculation Basins of Plants 1 and 2

0 0.01 0.03 0.05 Miles

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

Public Water System Inspection - Closing Conference Attendance Log
City of Richmond PWS – VA4760100
Date: 7/29/22 **– Time:** 2:00 PM

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