COMMONWEALTH of VIRGINIA

DEPARTMENT OF HEALTH

OFFICE OF DRINKING WATER

Richmond Field Office

Karen Shelton, MD
State Health Commissioner

Madison Building
109 Governor St., 6th Floor Richmond, VA 23219
Phone: 804-864-7409
Fax: 804-864-7520

Date: **April 7, 2025**

Subject: **Environmental Protection Agency (EPA) Safe Drinking Water Act Compliance Inspection Report.**

Follow-Up Site Visit Conducted by Virginia Department of Health-Office of Drinking Water's (VDH-ODW) Richmond Field Office

Author: **James Reynolds, PE- Field Director Richmond Field Office**

Executive Summary

The City of Richmond (COR) owns and operates a public waterworks (PWSID 4760100). The system is served by a Class 1 surface water treatment plant with a permitted capacity of 132 million gallons per day (MGD).

From July 26, 2022, through July 28, 2022, representatives from the Environmental Protection Agency (EPA) conducted a Safe Drinking Water Act Compliance Inspection Report of the water treatment plant and the distribution system facilities. A timeline of activities related to this site visit is provided:

- July 1, 2022- EPA announced inspection via phone and email to COR
- July 28, 2022- EPA reports initial observations with waterworks representatives and members of VDH-ODW as final activity of inspection
- October 25, 2022- EPA emailed a copy of the final inspection report to representatives from both COR and VDH-ODW. Requests response from COR by November 11, 2022
- April 20, 2024- EPA emailed COR to inform them of a change in the point of contact for EPA and to provide an opportunity for COR to provide supplemental information
- May 30, 2024- COR provided a response to the April 20, 2024, email to EPA
- October 11, 2024- VDH-ODW sent letter asking COR for updates to areas of concern identified in EPA report
- October 18, 2024- COR acknowledged receipt of VDH-ODW letter and requested a minimum of six weeks to review the report and provide formal response by December 6, 2024. VDH-ODW reiterated that EPA conducted the inspection and that any requests should be communicated to EPA
- November 29, 2024- COR sent email to EPA requesting a revised submission date of December 20, 2024, for providing updates on completed corrective actions

- November 29 to December 6, 2024- COR and EPA exchanged email correspondence
- January 3, 2025- COR submitted a response to EPA and copied VDH-ODW
- January 6 to11, 2025- Water treatment plant outage event. VDH-ODW on site January 7 to 11, 2025
- January and February 2025- VDH-ODW staff conducted site visits to determine whether areas of concern identified by EPA were addressed by COR.

VDH-ODW's follow-up observed some progress in addressing several areas of concern EPA identified, and long-term projects were either in planning or in process. COR did not appear to implement any significant changes to processes, procedures, and work culture at the time of the VDH-ODW visits. Most of the items addressed were immediate fixes, but more long-term areas of concern remain. Some of COR's immediate fixes discussed in their response did not appear to address the cause of the issues identified by EPA or put in place routine checks on the issues. VDH-ODW observed the issues again, including controlling free ammonia concentrations, various chemical leaks, leaking valves, and standing water (Example-Figure 11, Figure 12, Figure 13).

A general lack of housekeeping was observed with dust, trash, and standing areas of water throughout the water treatment plant and distribution system (Figure 59, Figure 79). As new equipment is installed and upgrades occur for infrastructure, COR must properly maintain new equipment to the end of its useful life.

COR lacks sufficient standard operating procedures (SOPs) and emergency preparedness documents and training. New executive leadership is addressing the lack of SOPs and emergency preparedness. COR leadership is evaluating structural and process changes to address concerns and improve emergency preparedness.

In response to the January 6, 2025, water crisis, COR is making progress on infrastructure improvement at the water treatment plant. COR must pay more attention to the distribution system infrastructure for understanding assets, identifying needs, and addressing deficiencies. Water storage tanks and piping in the distribution system and their condition are just as critical as the operation of the water treatment plant (Figure 30). As COR makes progress on improving processes and procedures, COR should maintain a whole waterworks approach to improvements.

Introduction

COR owns and operates the City of Richmond Waterworks (Waterworks) served by a Class 1 surface water treatment plant with a permitted capacity of 132 MGD. From July 26, 2022, through July 28, 2022, representatives from EPA conducted a Safe Drinking Water Act Compliance Inspection of the water treatment plant and the distribution system facilities. VDH-ODW staff attended each day of the inspection. The inspection evaluated the waterworks' compliance with the Safe Drinking Water Act (SDWA) and the National Primary Drinking Water Regulations (NPDWR). A timeline of activities related to this site visit is provided in the Executive Summary.

On January 6, 2025, a catastrophic failure occurred at the COR water treatment plant that caused customers, citizens, and businesses to be without an adequate water supply until January 11, 2025 (the water crisis). In response to the failure, VDH-ODW staff were present at the water treatment plant from January 7 through January 11, 2025.

VDH-ODW staff performed additional site visits in January and February 2025 to understand the causes of the water crisis and to conduct a sanitary survey of the waterworks' infrastructure. VDH-ODW also evaluated COR's responses to EPA dated January 3, 2025.

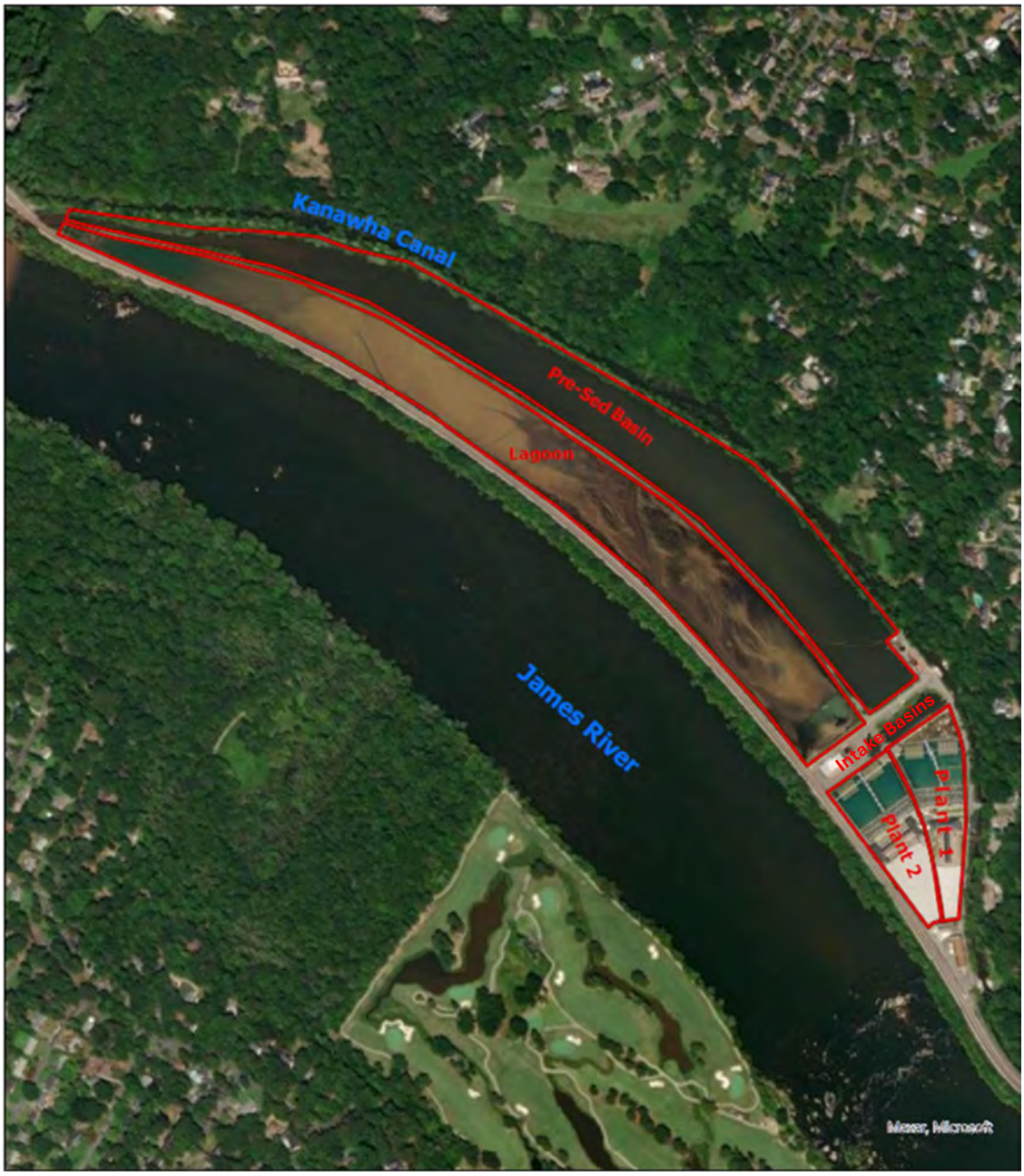
This document summarizes VDH-ODW staff's observations and findings as they relate to the EPA inspection report. VDH-ODW also conducted a state-led sanitary survey which is documented and presented in a separate report.

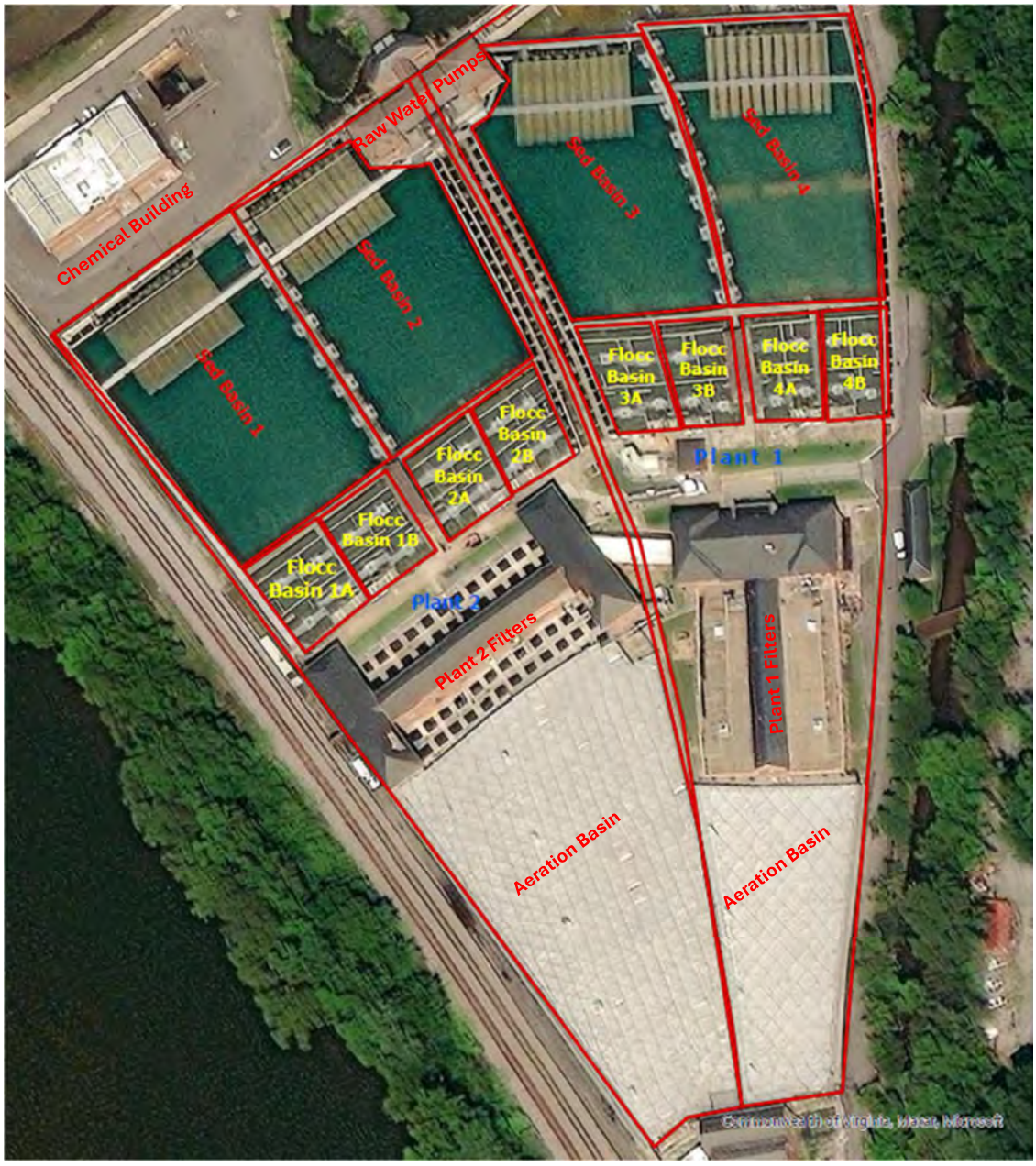
General System Description

The City of Richmond Water Treatment Plant (WTP) is a surface water treatment plant facility that is currently permitted for a maximum capacity of 132 MGD. The WTP provides water to the City of Richmond service area, and on a wholesale basis, meets water demand for Henrico County, Chesterfield County, and Hanover County. Henrico County wholesales water to Goochland County. Hanover and Goochland Counties wholesale water to smaller subdivision sized waterworks.

The WTP is located on the bank of the James River, which is the primary water source. A flood wall reduces risk of river flooding at the WTP. Supplemental raw water may be taken from the Kanawha Canal, which receives water from the James River and Tuckahoe Creek.

The WTP is essentially split into two treatment trains, the original water treatment plant built in 1924 (Plant No. 1), and an expansion of the water treatment plant built around 1950 (Plant No. 2). Plants No. 1 and No. 2 are capable of independent operation. When fully operational, Plant No. 1 has a capacity of 60 MGD and Plant No. 2 has a capacity of 72 MGD.


Kanawha Canal
Pre-Sed Basin
Lagoon
James River
Intake Basins
Plant 1
Plant 2
Maxar, Microsoft



Raw water through filtration process

Raw water flows from the James River to the raw water pre-sedimentation basin by gravity. The channel is about 5,100 feet long, 10 feet deep, and 300 feet wide.

Water flows by gravity from the pre-sedimentation basin into two raw water pump intake basins through manually operated sluice gates equipped with bar screens. Water can also be supplied to the intake basins through a sluice gate connected to the Kanawha Canal. Water flows by gravity from the two basins into the wet wells of three raw water pump station buildings through another set of bar screens. The wet wells provide water to the suction side of four raw water pumps (one

building houses two raw water pumps, the other two buildings house one raw water pump each). A traveling screen is provided on one inlet bar screen to reduce debris flowing to the wet wells. The raw water pumps discharge water to two separate concrete channels, one that typically serves Plant No. 1 and one that typically serves Plant No. 2.

During VDH-ODW's site visits in January and February 2025, one portion of the intake basin and associated bar screen was offline due to construction activities. The construction project will replace the bar screen and install a traveling screen. One concrete channel was offline because of the raw water construction activities.

Once the raw water enters the concrete channels, the water flows by gravity through the coagulation, flocculation, sedimentation, and filtration treatment processes of Plant No. 1 and Plant No. 2 and into the clearwell basins located underneath the filtration gallery of each plant.

The concrete raw water channels flow water about 400 feet to the head of the WTP through two inline rapid mixers and to its eight flocculation basins. Gravity moves the water flow to the flocculation basins through manually operated sluice gates. At the time of the January and February 2025 site visits, chemical feeds, such as alum that are typically fed in the offline raw water channel, appeared to be routed to the online raw water channel via temporary hoses running along and across the central concrete walkway. VDH-ODW observed plastic heavy duty pedestrian piping cover ramps over the hoses.

Filtration

There are 22 multi-media filters on site; 10 filters serve Plant No. 1, and 12 filters serve Plant No. 2. The filters consist of anthracite, sand, and garnet. At Plant No. 1, the filter valves that control filter flow and backwashes are electrically actuated. At Plant No. 2, the 60 filter valves that control filter flow and backwashes are hydraulically actuated using house pressure from the Korah 3 pump station discharge pipe, except for 12 filter effluent valves which are electrically actuated.

The filter gallery is located between the odd and even rows of filters, at an elevation below the filters and where associated filter piping, filter valve controls, filter instrumentation and filtered water pumps are located. Beneath a portion of the filter gallery are the clearwells where water from the filters is transferred to the aeration basins by filtered water pumps.

Clearwells and Aeration Basins

The Plant No. 1 and Plant No. 2 clearwells are interconnected. Four filtered water pumps at each plant (eight total pumps) pump water from the clearwells to two aeration basins. The aeration basins are identified as North, usually served by water from Plant No. 1, and South, typically served by water from Plant No. 2. No aeration occurs in the aeration basins, but the historical aeration name is used by some staff in the plant.

Finished water pumps deliver finished water from the aeration basins to the distribution system. Water flows by gravity through another concrete channel to the Byrd Park Reservoir from the aeration basins. Korah Pump Stations Nos. 1, 2, and 3 are located on-site at the water treatment plant adjacent to the aeration basins. Two pump stations located at Byrd Park provide water via gravity from the aeration basins and transfer water to the Byrd Park Reservoir.

Finished pump general information

Korah No. 1 - Sends water to Byrd Park Reservoir.

Korah No. 2 - Sends water to Cofer Road storage tanks (Zone 1 South pressure zone) and can send additional supply capacity to Byrd Park Reservoir through a 36-inch tie-in to the Korah No. 1 discharge line.

Korah No. 3 - Sends water to Henrico County and if needed to Zone 4 pressure zone in COR.

Emergency Power and Resiliency

1. Dominion Power Feeds

The WTP and Korah Nos. 1, 2, and 3 are provided with two separate electrical feeds from Dominion Power to the main substation at the WTP. One electrical feed is located underground, and the other is located above ground. Feeder lines from this substation supply power to Plant No. 1, Plant No. 2, Korah Pump Stations Nos. 1-3, and Douglasdale sewage pump station.

Staff can disconnect each electrical feed and power the WTP with just one of the feeds. Historically, COR used one above-ground electrical feed in the winter due to lower demand and cost-savings. Typically, COR disconnected the underground feed from the WTP in winter months.. An automatic bus tie allows for continued operation if the above-ground feed being used goes down. By the time of the 2025 site visits, and following the water crisis in January, COR discontinued the historical practice of isolating electrical feeds and using only one feed during the winter. COR staff reported that the WTP will keep both feeds online going forward. COR is considering whether to make the underground feed its primary source of power since it is a more reliable source of power.

2. Generators

The WTP has two standby generators to provide the WTP with power to run the critical treatment systems and two treatment trains at a reduced capacity of about 50 MGD. COR indicates these generators are 2 megawatts (MW) each. The electrical connection must be manually transferred from the main power feed to the generator feed to use the generators. COR plans to install an automatic transfer switch by October 2025 to start the generators automatically when the two main power feeds are offline.

3. UPS Systems

COR staff use Uninterruptible Power Supply (UPS) systems at the WTP to provide temporary emergency battery power to critical equipment such as valve actuators, Supervisory Control and Data Acquisition (SCADA) systems, and associated Programmable Logic Controllers (PLCs) to allow for a controlled shutdown of the WTP if power is lost. During the water crisis, the UPS systems did not enable a controlled shutdown of the WTP. During the 2025 site visits, VDH-ODW observed that the UPS for Plant 2 was replaced with two new UPSs. On March 31, 2025, COR indicated that the new UPS systems were installed for both Plant 1 and Plant 2.

Distribution System

The Waterworks has 12 finished water pumping stations and 11 finished water storage facilities in the distribution system. These facilities serve 9 pressure zones.

The Trafford Pump Station is located adjacent to the Byrd Park Reservoir and pumps to the Zone 2 service area. The pump station is manned 24 hours a day and all pump stations and tanks send information such as water tank level, pump station flow, and operational status to it. Using this information, the operator at the pump station remotely operates distribution pumps to ensure all tanks have adequate water to meet demands and maintain pressure in each pressure zone and for each wholesale customer.

Byrd Park Reservoir consists of two separate, buried concrete basins and provides water for the Trafford and Columbus Pumping Stations, as well as Zone 1 North, Church Hill tank, and Henrico County. COR constructed the reservoir in 1874, at which time it was uncovered. COR first covered the basins in 1970 and re-roofed them in 1982. At the time of the 2025 site visits, a roof replacement project had taken one basin offline, which reduced the capacity at Byrd Park Reservoir by about half.

A summary of pumping and storage facilities in the distribution system is provided below.

Pumping Station Inventory

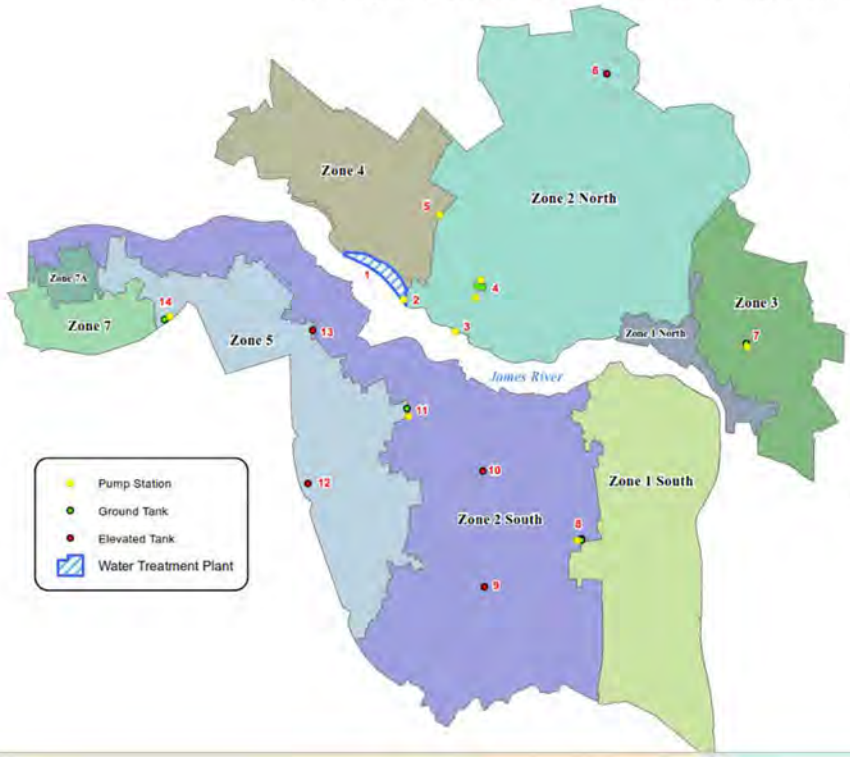
Station	Number of Pumps	Station Capacity	Firm Capacity (1)
Korah No. 1	2	34 mgd @ 181'	17 mgd @ 181'
Byrd Park Main	3	50 mgd @ 165'	30 mgd @ 165' (2)
Byrd Park Reserve- Zone 1	1	11.5 mgd @ 166'	11.5 mgd @ 166'
Korah No. 2	5	70 mgd @ 248'	56 mgd @ 248'
Korah No. 3	5	35 mgd @ 378'	28 mgd @ 378'
Byrd Park Reserve- Zone 2	3	24.9 mgd @ 110'	16.6 mgd @ 110'
Trafford	5	66.8 mgd @ 145'	51.3 mgd @ 145'
Columbus	4	60 mgd @ 145'	45 mgd @ 145'
Westhampton	4	24 mgd @ 132'	16 mgd @ 132'
Jahnke Road –City Zone 5	2	12 mgd @ 234'	6 mgd @ 234'
Jahnke Road- Chesterfield County	4	31.5 mgd @ 250'	21.5 mgd @ 250'
Huguenot Road	2	5.4 mgd @ 135'	2.7 mgd @ 135'
Church Hill	3	34.5 mgd @ 125'	21.5 mgd @ 125'
Cofer Road	4	35 mgd @ 185'	26.3 mgd @ 185'

(1) Firm capacity is calculated with the largest pump out of service
(2) With one 20 mgd Byrd Park main pump out of service

Distribution System Water Storage Facilities

Storage Facility	Pressure Zone	Total Storage Volume (MG)	Useable Volume (MG)	Notes
Byrd Park Reservoir	1N	54.8	41.8	Main Reservoir
Ginter Park	2N	1.00	1.0	
Church Hill	3	4.90	2.2	
Cofer Rd. No. 1	1S	2.00	1.2	
Cofer Rd. No. 2	1S	2.10	1.2	
Woodside	2S	1.00	1.0	
Warwick Rd.	2S	2.00	2.0	
Stratford Hills	2S	0.25	0.0	Not used for storage
Jahnke Rd.	5	2.40	1.4	
Hioaks	5	2.00	2.00	
Huguenot Rd.	7	0.75	0.38	
Total Storage		**73.2**	**54.18**	

Water System Service Area, Pressure Zones and Facilities



LOCATION	
1.	Water Treatment Plant
2.	Korah Pump Stations
3.	Byrd Park Reservoir, Trafford and Columbus Pump Stations
4.	Byrd Park Pump Station
5.	Westhampton Pump Station
6.	Ginter Park Elevated Tank
7.	Church Hill Pump Station and Ground Tank
8.	Cofer Road Pump Station and Ground Tanks
9.	Warwick Road Elevated Tank
10.	Woodside Elevated Tank
11.	Jahnke Road Pump Station and Ground Tank
12.	Hioaks Elevated Tank
13.	Stratford Hills Elevated Tank
14.	Huguenot Road Pump Station and Ground Tank

January 6, 2025, Water Crisis Event Summary

On January 6, 2025, a mix of sleet, freezing rain, and snow created conditions that caused a power outage on one of the main power feeds that supplies the WTP. At the time of the power outage, the WTP was only utilizing one power feed as a cost-saving measure. The automatic bus tie that should have automatically switched the power feed from the one power feed that was in use to the secondary feed failed, and COR staff did not switch on generator power, leaving the WTP without power for about 90 minutes. During the time the electrical power was off, the battery-powered UPS systems should have provided power for enough time to conduct a controlled shutdown of the plant filters. However, this did not occur, and the filter effluent control valves for the filters remained open. While the valves were open, gravity was still pushing water from the head of the plant through the filters into the clearwells. The clearwells quickly filled and water overflowed from the clearwells into the filter pipe galleries, causing catastrophic damage to filter controls, filtered water pumps, and all electrical and control equipment located within the flood zone.

Due to the extensive damage, the WTP could not produce water until January 8, 2025, which impacted wholesale water customers except for Chesterfield County. The distribution system was under a boil water advisory until January 11, 2025, while workers repaired the WTP, placed it back online, restored water service and pressure throughout the distribution system, and conducted water quality testing.

Summary of Follow-Up Site Visit Findings and Observations

VDH-ODW evaluated areas of concern and observations identified in the 2022 EPA inspection report and COR's responses to EPA's observations. This report provides VDH-ODW's observations with accompanying photographs to highlight changes that occurred between 2022 and 2025.

EPA identified several "areas of concern" in the 2022 report that should be addressed by COR.

The EPA inspection report also included several observations that did not necessarily rise to the classification of being an "area of concern" but are important to note and provide status updates observed by VDH-ODW. These observations may become areas of concern in the future.

The following pages are split into two tables: one for identified "areas of concern" and one for updates to general observations that did not rise to being classified as an "area of concern".

Identified Areas of Concern by EPA with Response from COR and Follow-up by VDH-ODW

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-1	Backwash Water Recycle Rule	There is a lack of flow control and monitoring of recycled water from lagoon to pre-sed. 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 (raw water channel) 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).	The City acknowledges this observation and confirms there is currently no flow monitoring infrastructure associated with the lagoon effluent. Flow is controlled from the lagoon with sluice gates. Backwash Wastewater flows are measured and reported on the Monthly Reports to the Virginia Department of Health (VDH). These flows represent the majority of recycled water. Attached is a copy of the July/August 2022 report, which defines the inspection period. The "recycled water" column in the report presents the majority of the flow into and subsequently out of the residual's basin.	No change. ODW did not observe any changes from 2022 observation, no flow measurement of recycled water, flows by gravity from the lagoon to the pre-sedimentation basin. The introduction of recycled water from the lagoon is approx. 4,500 feet upstream of the raw water pump stations to the plant. This is atypical of usual backwash recycle systems, which direct recycle water to the rapid mix or close vicinity to the start of the coagulation process and is closer to indirect potable water reuse than traditional backwash recycle.	Figure 1

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-2	Backwash Water Recycle Rule	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 Reps. 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 reintroduced back into the treatment plant." 12VAC5-590-550.16.a-f describes the recycle flow	The City acknowledges this observation and has since confirmed with the project engineer that flow from the dredging process is not introduced directly into the pre-sedimentation basin.	VDH-ODW will follow-up in summer 2025 No dredging activities were observed at the time of inspection by ODW. The discharge of dredging operations was not observed. See response to Item AOC-1 above for discussion on recycle flows.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				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).			
AOC-3	Pre-sed Basin	The basin cannot be bypassed for instances such as emergency or maintenance.	There is not a means for water to bypass the pre-sed 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 states, "Provisions for bypassing re-sedimentation basins shall be provided."	The Kanawha Canal provides source water to the WTP downstream of the pre-sedimentation basin in cases of emergency and/or Maintenance. This operational capacity was in place during the inspection and remains unchanged. We offer this response as a point of clarification.	Addressed. ODW understands that the Kanawha Canal, when the gate is open, would discharge into the intake basin downstream of the pre-sedimentation basin.	Figure 2
AOC-4	Pre-sed Basin	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."	The City acknowledges this observation and will review historical records to validate and, if needed revise, the maintenance schedule.	No change. The pre-sedimentation basin does not undergo maintenance and is not equipped with means to remove sludge. The basin should be evaluated for silting and dredging should be conducted as necessary to	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
						maintain capacity in the basin.	
AOC-5	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."	Water quality monitoring equipment is being incorporated into the pre-sedimentation basin dredging project. The City will seek approval from VDH as needed for equipment / design. Raw water is also monitored and reported with online instrumentation.	No change. Waterworks measures raw water for pH, turbidity, and alkalinity. Additional potential parameters include algal counts/HAB measurements, DO, turbidity, conductivity. Measurements would be recommended at the head of the feeder channel, near the dam intake and upstream of the WTP to give advanced warning of possible contamination. These parameters are not required in the current regulations at the locations described.	Figure 3
AOC-6	Kanawha Canal	There is a lack of flow monitoring of water from the Kanawha Canal, which could	Canal water flows by gravity without flow measurements. System Reps	"Recommended Standards for Water Works" (2018 Edition) Part 2.13 states, "All	There is currently no flow monitoring infrastructure associated with any of the canal crossover gates. Flow is controlled from the	No change. No means to monitor flow currently. Gates did not appear to be	Figure 4

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
		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.	stated that use of the Canal creates differences in water quality, and there is no prescribed procedure to adjust treatment for these instances.	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, "Real 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).	Canal with sluice gates. The long-term effort to address this observation has been described in observation #5 above.	open at time of observation. WTP staff reported the Kanawha Canal is very rarely used. The location of the raw water channel gates and the Kanawha Canal gates would not be conducive to complete mixing of both water sources in the intake basin prior to reaching the raw water pump screens. Measurement of flow and water quality would be needed at each gate and at the pump screens to get a better understanding of mixing and impacts to water quality when the Kanawha Canal is used.	
AOC-7	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, "Control should be sufficient to limit free ammonia leaving the chloramination facility to no more	The City acknowledges this observation and Operators are currently adjusting the dosage when free ammonia reaches 0.1 mg/L. Staff has been trained accordingly.	No change. ODW reviewed February 2025 data sheets and observed 3 instances out of 40	Figure 5

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				than 0.1 mg/L as nitrogen."		readings that were above 0.1 mg/L. ODW recommends the investigation of plant controls and flow pacing of chemical feeds to optimize chemical dosing feedback loops to reduce the need to manually operate chemical feed pump rates. In addition, recommend consideration for online measurement of free ammonia and chloramine for chloramine process control.	
AOC-8	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, "Where mechanical mixing devices are utilized, duplicate units or spare mixing equipment shall be provided." System risks exceeding turbidity standards described in 40	Redundancy exists in the system today. Spare mixers are available, and the PM schedule is monthly. To address potential failures, additional measures of redundancy are being considered. In the meantime, a hot swap method is the first method of choice for redundancy.	Addressed. Inline rapid mix in the raw water channel appeared operational. Four rapid mix units are still installed downstream of the inline mixer just upstream of the flocculators. Spare inline mixers observed.	Figure 6

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				CFR §141.173(a)(1).			
AOC-9	Raw water coagulation channel	Raw flow meters used for chemical dosage is 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, "The 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	The City acknowledges this observation and is addressing repairs through a CIP project, which is scheduled for completion in June 2025. In the meantime, all RW flowmeters are operating as designed with exception of the RW2 mag meter. Dosage is verified by chemical feed through a manual process. When flow is adjusted, the chemicals are adjusted manually.	No change. Operations staff indicate raw water flow meters are still unreliable and not trusted. The installation of reliable and trustworthy raw water meters is critical for the accurate dosage of raw water chemicals including coagulation chemicals. New raw water meters should be verified to function reliably when installed and routinely calibrated per manufacturer's recommendation.	Figure 7

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				shall be promptly implemented to protect public health." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).			
AOC-10	Raw water coagulation channel	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 instrumentation failure. Potassium permanganate residuals are not tested in treated water to confirm proper dosage.	12VAC5-590-360.A states, in part, "The 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." System risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).	The permanganate system was repaired by WTP Maintenance and is working as designed.	VDH-ODW will follow-up in summer 2025 Permanganate not being fed at the time of inspection due to seasonality of feed (not fed in winter). The WTP still does not have the ability to check permanganate residuals. To measure permanganate residuals, the WTP can use free chlorine DPD methods and 0.45-micron filters. This assumes no chlorine introduced to the raw water at the point of sample collection. 1. Filter raw water	Figure 8

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
						through a 0.45-micron filter and use the filtered water to zero a spectrophotometer. 2. Add a free chlorine DPD powder pillow to the sample and measure free chlorine residual. 3. Multiple the value by 0.893 to convert free chlorine readings to permanganate residual readings	
AOC-11	Chemical storage	Chemical leaks were observed.	The chemical line for caustic soda in the Korah 1 Pump Station had crystalized	12VAC5-590-470 states, "The waterworks shall be maintained in a clean and orderly condition."	Repairs have been addressed as follows: a. Hypo bulk storage tank #1 and day tank #2 were repaired (initiated 10/2023, repaired 4/2024) and returned to service.	No change. Evidence of chemical leaks were still observed in various areas of the	Figure 9 Figure 10 Figure 11 Figure 12 Figure 13

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			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.		b. The manway flanges on various tanks were tightened to alleviate and prevent any leaks. c. The tank #3 has been emptied and taken out of service to replace the manway gasket. (photo #120) d. A small hypo leak on tank offloading / fill line was repaired shortly following the inspection. (WO#C269333)	WTP including but not limited to: • Plant 2 filter console area roof appeared to be leaking a chemical with formation of mineral deposits observed • Sodium hypochlorite bulk tanks in West Chemical Building at the manway flanges • Polymer room for Plant 1 and Plant 2 • Various chemical feed pumps	
AOC-12	Chemical storage	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	12VAC5-590-860.D.1.a states, "Space shall be provided where at least 30 days of chemical supply can be stored..."	The remainder of 12VAC5-590-860.D.1.a states "Lesser storage capacity may be approved if the owner can demonstrate that the local suppliers or other conditions will provide an uninterrupted source of chemicals." The City acknowledges this observation but notes that contracts are in place for regular supply and recurring deliveries to	Addressed. ODW has historically accepted that COR can have an uninterrupted source of chemicals from local suppliers in a manner that reduces the need for 30-day supply. This has also been accepted at other	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			14,000 gallons/day of aluminum sulfate, providing an 11-day supply.		promote continuous operations without interruption. Sufficient storage is noted on the VDH plant inspections. Accordingly, the City does not believe there is any deviation from the Regulation with its chemical storage capacity.	water treatment plant facilities. The WTP receives chemical deliveries daily. Space constraints would not allow for storage of a 30-day supply of alum, for example. COR should incorporate contingency planning into emergency response plans related to chemical supply shortages and identify secondary suppliers.	
AOC-13	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.	12VAC5-590-360.A states, "The 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	The City acknowledge the observation and have initiated a plan to update all WTP SOPs by year end 2025.	No change. ODW conversations with operations staff indicate that current SOPs for chemical treatment processes are not available. Polymer verified still not flow-paced.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			Polymer is not flow paced and must be manually adjusted.	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."			
AOC-14	Chemical Treatment & Process Control	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	"Recommended Standards for Water Works" (2018 Edition) Part 4.4.5.5.b. states, "A monitoring program shall be established…throughout the distribution system to verify proper	Currently developing nitrification plan. Consulting with peer localities to aide in speedy adoption of plan. Regulation is followed for re-sampling.	No change. A nitrification control plan is not used currently. ODW has gathered nitrification control plans from surrounding waterworks to assist in developing a	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			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.	chloramine formation and for determination of nitrification occurrence." Part 4.4.5.6.b. states, "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."		template that COR can use. COR follows Bacteriological Site Sampling Plan requirements for repeat sampling after total coliform positives.	
AOC-15	Chemical Treatment & Process Control	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	12VAC5-590-960.A states, "The continuous 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	The City acknowledge the observation and has initiated a plan to update **all** WTP SOPs by year end 2025.	No change. Practice has not changed. WTP staff should incorporate testing of copper levels in raw water and finished water. Raw water levels should be tested prior to application to determine dosage needs. WTP staff should also	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			measured application.	finished water leaving the treatment plant."		consider coordinating with wastewater treatment plant staff to determine if more stringent copper residual levels are required.	
AOC-16	Chemical Treatment & Process Control	PAC [powdered activated carbon] 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, "The 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 40 mg/L."	The City acknowledge the observation and have initiated a plan to update **all** WTP SOPs by year end 2025.	No change. Practice has not changed currently. WTP staff should establish benchmarks for when powdered activated carbon is added, dosage to add, and how to apply the dosage to the water. Scenarios for feeding PAC to address taste and odor events, algal bloom events, and removing organic compounds should be developed. PAC addition equipment should be tested on a routine basis to verify it will be functional if needed.	None
AOC-17	Plant 2 Filters	The exposed concrete filter beds and surface	Concrete structures	12VAC5-590-360.A states, "The owner shall provide and	Debris has been removed. The overall solution is being evaluated	Not substantially addressed.	Figure 14 Figure 15 Figure 16

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
		structures appeared deteriorated due to weathering and age, and failure of additional filers could impact overall filter performance.	above filter beds had hairline cracks throughout. Structural debris was observed on the center wall inside of Filter 16.	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	through a larger CIP project.	ODW observed some surface level skim coating of previous hairline cracks on the walkways around the Plant 2 filters. Some structural issues and cracking still observed beneath the walkways. Concrete structure cracking and separation also observed on walkway between raw water pumps and head of sedimentation basins. Conversations with consulting engineer indicate that some money anticipated to be used to address concrete concerns may be diverted to move critical electrical equipment away from flood prone areas in response to the January 6, 2025, event.	Figure 17 Figure 18

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				risks exceeding turbidity standards described in 40 CFR §141.173(a)(1).			
AOC-18	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.		The overall solution is being evaluated through a larger CIP project, which has been highlighted above in observation #17.	No change. Air scour pipes still showing significant signs of corrosion. As VDH-ODW observed a backwash inside the enclosed structure, chlorine levels in the air were noticeable along with a humid environment. Stainless steel may need to be replaced with another material in the future.	Figure 19
AOC-19	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		The City acknowledges this observation, and the solution has been addressed through the organizational changes made effective June 2023.	VDH-ODW will follow-up in summer 2025 Routine filter drop tests, rise tests, and expansion tests did not appear to be occurring at this time.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			to identify and address maintenance preventatively are not completed.				
AOC-20	Filter Operation and Maintenance	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.		Provided water quality supervisory notification screenshot which includes parameters that on duty supervisor needs to be informed of if not met. One of the parameters is filter turbidity greater than 0.10 NTU.	VDH-ODW will follow-up in summer 2025 The automated filter to waste cycle can be extended by operators, however, typically appear to be below 0.1 NTU within 9-minute cycle. Rising above 0.1 NTU in the minutes following return to service may indicate the filter has not fully ripened prior to placing back into service. One recommendation to reduce exceedances mentioned is to allow filter to sit and ripen after backwash and prior to initiating filter to waste cycle.	None
AOC-21	Filter Operation		There are several instances in the MORs that		Provided water quality supervisory notification screenshot which includes	No change.	Figure 20

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
	and Maintenance		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.		parameters that on duty supervisor needs to be informed of if not met. One of the parameters is filter turbidity greater than 0.10 NTU.	Around 3 non-consecutive, non-combined filter effluent, instances found in MORs submitted in 2024 where the maximum recorded turbidity is 2.00 NTU, no instances of going above 2.00 NTU. Waterworks Regulations require comprehensive performance evaluation following the exceedance of two consecutive measurements for individual filter turbidity. WTP staff should evaluate the signal span for the filter turbidimeters and related data recording system, and verify that the span exceeds 2.0 NTU, with a recommended span of 0-5.0 NTU. If the span is correct, the WTP staff should evaluate data logging equipment	

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
						and MOR data completion software to ensure they are able to report above 2.0 NTU turbidities.	
AOC-22	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, "The 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	The City acknowledges this observation and is addressing this through an O&M project. Pump N-2 refurbishment is nearing completion (see pics 115 and 116). Pumps N-1 and N-3 refurbishment will follow accordingly.	Partially addressed. Corrosion still observed at time of site visit on several pumps in the pipe gallery area. Some pumps appear to have relatively new bolts attached to still corroded bracketing and/or base pedestals. New bolts appear to be uncoated, may accelerate rusting.	Figure 21 Figure 22 Figure 23

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				delivered to the consumers. Preventative control measures identified in Part II of this chapter shall be promptly implemented to protect public health."			
AOC-23	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 states, "The waterworks shall be maintained in a clean and orderly condition. 12VAC5-590-1081.J states, "Every 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."	The City acknowledges this observation and has included photos 32 and 33 for confirmation.	Partially addressed. Baseboard appeared to be in place around the aeration basins except for at the ladder entrance point. Some debris observed near the door as people enter and leave the facility but not to extent shown in EPA photos. One walkway in aeration basin 1 appeared to have no solid material underneath the walkway. Debris could land in finished water when walking.	Figure 24 Figure 25 Figure 26

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-24	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 and did not know the cause, indicating the valve pit is not inspected on a regular basis.	12VAC5-590-1081.H states, "The roof and sidewalls of all structures shall be watertight with no openings..."	The deficiencies observed during the inspection were corrected shortly following the inspection. Long term solutions will be altered due to the CIP project that is currently underway and scheduled for completion in 2028.	Follow-up needed Byrd Park Reservoir is in active construction of roof replacement. One cell of the reservoir is offline.	Figure 27 Figure 28
AOC-25	Byrd Park Reservoir	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.	Enhanced overflow features for East and West Reservoir tanks are incorporated into the CIP project that is currently underway and scheduled for completion in Nov 2027. West side overflows are complete and East side overflows are scheduled for completion by end of 2027.	In progress. Construction permit issued in 2021 for roof replacement includes overflow vent structures for each cell. Currently in process.	Figure 29
AOC-26	Warwick Road Tank	Overflow discharge location was not able to be located,	System Representatives	12VAC5-590-1081.D describes	The City acknowledges this observation. All	VDH-ODW will follow-up in summer 2025	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
		unknown contamination risks.	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.	overflow requirement for finished water storage structures.	vegetation has been removed and the Building & Grounds Team has kicked off an effort to perform grounds maintenance around the tank via PM ID 1215. WTP working with Water Distribution to locate overflow to verify air gap is in place via WO#C277117.	. COR representative stated the overflow discharge goes into the sanitary sewer per COR's geographic information system. COR should confirm this is valid in the field and that sufficient cross-connection control is provided.	
AOC-27	Warwick Road Tank	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	12VAC5-590-360.A states, in part, "The owner shall provide and maintain conditions throughout the entirety of the waterworks in a manner that will assure a high degree of capability and	The City acknowledges this observation and will determine a path forward using the framework of the June 2023 organizational changes. The Water Distribution team intends to investigate and strategize immediately following the holidays.	No change. Wood blocks continue to be used as support.	Figure 30

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			support structure; it did not appear to be functional.	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."			
AOC-28	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.	Project manager indicates overflow was installed to satisfy code. The City acknowledges this observation and WOs# C277113 & C277114 has been generated to track resolution.	Addressed. Weighted flapper appeared to be functional. Along with weighted flapper cover, a large air gap separates discharge from the ground and drain. Fine screen mesh installed.	Figure 31
AOC-29	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	12VAC5-590-1081.A.2 states, "All finished water storage structures shall be designed	The City acknowledges this observation and WO #C276853 has been created to track the effort.	No change. ODW observed fine mesh had not been installed.	Figure 32

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
			was large enough to allow pests into the finished water storage.	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..."			
AOC-30	Huguenot Road Tank	The overflow pipe was not able to be identified, and the pipes were below grade in a low-lying area that was 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..."	Immediate removal of the debris was completed via WO# C275217 (See photos #: 89 & 90). These photos also show that two of the pipes had screens at the time of inspection. Additionally, the Building & Grounds Team has kicked off an effort to perform grounds maintenance around the tank out to the fence line via PM ID 1215. WTP working with Water Distribution to confirm identity of all 3 pipes and replace existing pipe screens via WO# C277116 & C276953 respectively.	Addressed. Overflow pipe clear of debris and screened.	Figure 33 Figure 34 Figure 35

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-31	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.	WTP working with Water Distribution to locate overflow to verify backflow prevention is in place. Effort being tracked via WO# C277111. Organizational changes implemented in June 2023 are helping to fast track the long-term strategy of this issue.	VDH-ODW will follow-up in summer 2025 VDH-ODW could not confirm if an air gap or screen were provided in the manhole that receives the overflow pipe.	None
AOC-32	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 contamination during pressure loss.	12VAC5-590-600 describes the cross-connection control program responsibilities for public water system owners.	Immediate repairs were made to valves (replaced glands and packing), hose was removed, vacuum breakers installed on discharge header taps / spigots and floor drain was cleared. Flow / pressure transmitter functionality was restored. 100+ year old equipment. WO #C271037 The ceiling coating will be addressed in the ongoing CIP project to significantly upgrade the pumping station. See CIP Project Name Below. Project Name; Byrd Park Main Pumping Stations Renovations (suspected end date April 2027).	Not substantially addressed. VDH-ODW did not observe as much debris as in the EPA inspection report, but did observe areas of standing water and leaks. Significant corrosion observed on pumps. COR indicated that pumps were due to be replaced.	Figure 36 Figure 37 Figure 38

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-33	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, "The 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."	Organizational changes in June 2023 have elevated the ownership and maintenance of these structures to reflect business needs and compliance concerns. A schedule is being developed to manage ongoing required maintenance and PMs will be generated from the CMMS system.	COR staff indicated that tanks are on five-year inspection program. Last tank inspections conducted in 2023. COR should evaluate tank project prioritization matrix and perform recommendations for highest priority items.	None
AOC-34	Finished Water Storage Facilities	Several tanks had overgrown vegetation within 6' and/or overhanging the	Overgrown vegetation was observed at the Jahnke Road Tank	12VAC5-590-360.A states, in part, "The owner shall identify and	Vegetation was removed shortly following the inspection. Additionally, the Building & Grounds Team has kicked off an	Addressed. Limbs that may have been overhanging the	Figure 39 Figure 40 Figure 41

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
		structures.	and Huguenot Tank within proximity and/or overhanging. There is potential for damage to the structure in storm conditions.	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."	effort to remove vegetation and debris from around the tank structures on a recurring basis (Jahnke, Huguenot and Ginter Park) via PM ID 1215. The CMMS system will serve as the host location for PMs.	tanks, such as at Jahnke Road, appeared to have been cut back. Routine attention will be needed due to the proximity of vegetation to the tanks.	
AOC-35	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, "The waterworks shall be maintained in a clean and orderly condition."	The City acknowledges this observation and has increased its focus on the "Weekly Checklist at Station" via PM ID 1948. Operators record pump operations daily, which are maintained digitally. SCADA to be installed with upgrade currently in design via Byrd Park Main Pumping Stations Renovations CIP Project. The WTP Operation and associated assets are 100+ years old. Ongoing maintenance, preventative repairs and overall replacement schedules are managed through CMMS, Condition Assessments and CIP projects. Deficiencies pointed out	In progress. WTP staff indicated that upgrades are in planning to bring fiber to Byrd Park and the main station planned to be put on SCADA. Pump replacement project in process, per WTP staff.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
					during the inspection have been resolved - Pressure / flow transmitters, leaking valve packing / glands, water on the floor, hoses removed / vacuum breakers installed, etc.		
AOC-36	Pump Station Maintenance	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, "A suitable outlet for drainage from pump glands shall be provided Without discharging onto the floor."	The City acknowledges this observation, and the exposed wiring was remedied through WO #C270729. The active water drainage is being managed through a short-term solution (see photo #43) (i.e., temporary PVC line). A longer-term solution is under review through WO #C276963, which is anticipated to be complete January 4, 2025.	Partially addressed. Standing water still observed in some locations. Exposed wiring not observed.	Figure 42 Figure 43 Figure 44
AOC-37	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.	The new Lead and Copper Rule Revisions addresses this through the required inventory system. A new list of sample sites will be developed to meet the regulation. The City's interactive map was submitted to EPA by the deadline of October 16, 2024.	In progress. COR has submitted lead service line inventory to meet LCRR requirements which evaluated service line material. VDH-ODW and COR in process of developing updated LCR inventory and sample site list.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-38	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.	The City's Laboratory has been collecting 150 samples each month since June 2023.	Addressed. BSSP updated in June 2023 and increased sampling to 150 samples per month. Procedure to evaluate population annually should be developed.	None
AOC-39	Revised Total Coliform Rule	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, "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."	Any distribution sample that is positive for coliform bacteria is also checked for E. coli. To date the City has never had a sample that was also positive for E. coli. The sample that was positive for coliforms is resampled within 24 hours as well as a sample that is upstream and one that is downstream from the site. All 3 are tested and reported to VDH. It is normal for positive samples to come back as negative for bacteria in the resamples	Addressed. Appropriate repeat sampling collected following routine total coliform positives. COR should implement nitrification plan which includes additional investigation of sites with total coliform positives for potential nitrification.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
AOC-40	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.	The City acknowledges this observation and inspections are in process. PMs 2292 & 845 are generated to initiate inspections. (See file WTP Backflow PMs.pdf) WOs# C275650, C275652, C275646, C275647, C275653, C275649, C275648, C275645, C275654, C275651, issued to repair backflows. WOs# C275645, C275648, C275649, C275650, C275652, issued to replace backflows.	Partially addressed. Backflow prevention devices at the WTP appear to have inspection dates of March 2024, will need to be tested again in 2025. Some devices missing updated tags. Some devices had observed leaking at relief ports, possibly due to debris in the valves or improper seal of the valves.	Figure 45
AOC-41	Cross Connection Control	Threaded taps were located on finished water lines without vacuum breakers, presenting cross contamination risk during pressure loss.	EPA observed several hoses without vacuum breakers that were tied to a finished water line throughout the plant and the distribution system.		Repairs of deficiencies noted during the inspection are complete. See photos: 92, 93, 105, & 109.	Follow-up needed summer 2025. VDH-ODW did not observe hoses without vacuum breakers. An inventory of water outlets at the WTP should be developed and appropriate backflow prevention device provided according to hazard determination, if not already conducted.	Figure 46 Figure 47
AOC-42	CMMS [Computerized	Calibration of critical instrumentation and chemical	System Representatives stated that flow	12VAC5-590-480.E states, "Process control	Staff performs cleaning / verification of online water quality instrumentation via	No change.	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
	Maintenance Management System] Work Orders	feed pumps is irregular or as needed.	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.	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."	a weekly PM generated by the CMMS. Attached is an uploaded file of PM Completion Reports for PM ID's 677, 702, 703, 737, 865, 1370, & 1416 and includes the respective work orders.	WTP staff indicate calibration of chemical feed pumps not typically conducted on a routine basis. Some items such as chemical feed pump calibration fall to operation staff, who do not use the computerized maintenance management system (CMMS), while other calibrations fall to maintenance staff, who use the CMMS.	
AOC-43	CMMS Work Orders	Preventative maintenance documentation appears to be limited and corrective maintenance does not appear to be documented, and	Work orders from 2022 only reflect some preventative maintenance activities, and they are not used to track all maintenance activities or	"Recommended Standards for Water Works" (2018 Edition) Part 2.19(c) states, in part, that "…provisions should be made for maintaining an inventory of	Preventative/Corrective Maintenance Documentation – Preventative and corrective maintenance logs are documented in the Computerized Maintenance Management System "CMMS". See Work Order Complete Report	Partially addressed. Not all operators have training or authorized access to CMMS to submit work orders and WTP staff indicated some work orders were not addressed	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
		there is no tracking for out of service assets. Loss of critical assets creates risk for meeting production demands.	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.	critical parts."	example. (1 of 2,824 WOs closed in 2022 compared to another 2,041 closed in 2021). Total open at the time of this response equals 413. **Out of Service Assets** – The CMMS does can track assets status for Out of Service Assets. Asset status changes are made manually when WOs are generated and closed. **Critical Parts –** Critical assets are monitored for repair and replacement through its asset management / condition assessment process.	in a timely manner r by maintenance or procurement. Recommend training operators as part of onboarding and providing access to submit work orders to all trained operators and to provide routine updates on the status of work orders and estimated timelines for completion.	
AOC-44	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	The City acknowledges this observation and has implemented steps for completion in early 2025.	In progress. An Emergency Response Plan developed by a contract engineer in 2021; however, it is not widely distributed, and plant staff are unaware of emergency response procedures. The plan should be reviewed, revised,	None

Obs. #	Category	Area of Concern	Supporting Observation	Relevant Citation	Richmond DPU Response 2025	VDH-ODW Observation 2025	Photograph (Appendix A)
				Planning, and Emergency Preparedness.		and distributed. Tabletop exercises related to emergency response planning should be conducted on a routine basis.	

VDH-ODW 2025 Updates to EPA General Inspection Observations

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
O-1	The plant is staffed with three operators per shift and two shifts/day	No change. Still the current practice in February 2025; COR is re-evaluating and updating staffing levels and attendance needs. At the time of the power outage, three operators were on shift. However, there were no maintenance staff with the ability to operate the secondary power feed from Dominion or the generators on site during the power outage. This created an extended delay in getting power restored at the WTP as appropriate staff needed to travel to the WTP. In making staffing decisions, COR should consider sufficient ability to always operate emergency equipment and who can activate emergency equipment as soon as UPS and main power feeds go offline. COR expects to place the backup generators into automation without the need for manual starting by October 2025. COR should also identify a list of emergencies and events that may occur, and the personnel and timeframe needed to address them to get a comprehensive evaluation of staffing needs.	None
O-2	The Engineering Supervisor stated the most recent distribution storage tank inspections were in 2017 and the system was	Addressed.	None

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
	moving toward a five-year inspection schedule. Reports provided during the inspection indicate tank inspections were last performed in May and December 2015.	COR staff indicated that tanks are on five-year inspection program. Tank reports indicate the last tank inspections were conducted in 2023. COR should evaluate the tank prioritization matrix and address items identified by tank inspections for rehabilitation and repair.	
O-3	EPA observed an earthen berm between the waste lagoon and 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.	No change. Earthen berm observed with vegetation including shrubs and trees. The root systems of the trees and shrubs can compromise the berm which may result in inundation of the pre-sedimentation basin with waste lagoon water that may be a challenge to treat and impact raw water capacity.	Figure 48
O-4	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	Addressed. Significant vegetation not observed around screen.	Figure 49
O-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. The Superintendent explained the polymer is used in the dewatering process for the lagoon dredge material.	No change. Three to four chemical totes observed in same area noted. No secondary containment observed.	Figure 50
O-6	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. These screens were permanently out of service per comments by System Representatives.	In progress. Raw water screens appeared to be replaced on one side of the intake basin. The other side is under construction. Traveling screens were also installed at the intake screen discussed by EPA.	Figure 51
O-7	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	In progress. Traveling screens were removed from previous location. Traveling screens installed or in the process of being installed near intake basins and screens are also located in raw pump station rooms for raw pumps 3 and 4. Work should be completed by summer 2025.	Figure 52
O-8	EPA observed vegetation growth near the entry of the concrete raw water coagulation channel at the water line	VDH-ODW will follow-up in summer 2025 Vegetation not observed, possibly due to temperature/season. Some debris observed in the channel including cardboard and plastic most likely from the construction activities. COR	Figure 53

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
		should develop a procedure to routinely inspect and remove debris.	
O-9	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	No concerns. Operations still the same. Did not observe much difference in solids collected between Plant 1 and Plant 2 plate settlers. COR should have a process to ensure appropriate maintenance is performed and documented.	Figure 54
O-10	Flocculator 4-2A had exposed wiring to the motor on the platform above the basin; this flocculator is one of the three that was out of service during the inspection.	Addressed. No exposed wiring observed at time of inspection.	Figure 55
O-11	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. No date was provided for their return to service.	Filters 2, 14, 15, and 19 were addressed. Filters 7, 9, 11, and 21 were out of service at time of inspection. Filter effluent valve replacement projects as well as other filter related projects were ongoing during inspection.	Figure 56
O-12	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.	In progress. Filter media replacement included in filter upgrade project that also includes upgrade of filter effluent valves. Project is in progress, started in late February 2025.	Figure 57
O-13	The Sr. Plant Operations Supervisor stated that maintenance for the filters includes periodic expansion and drop tests.	VDH-ODW will follow-up in summer 2025 These tests were historically done monthly; but have not been conducted routinely between the EPA visit and January 2025. Filter drop tests should be conducted monthly. Filter expansion tests should be conducted quarterly.	None
O-14	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.	VDH-ODW will follow-up in summer 2025 Power bumps are not unusual occurrences per WTP staff. A power bump occurred during the January 6, 2025, event. During site visits, there were several instances of alarms on SCADA popping up and instantly acknowledged. It is unclear if	None

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
		WTP staff conducted investigations after acknowledging the alarms or if the alarms occur frequently enough that their significance has been diminished. The WTP had various construction projects occurring during the site visits in 2025 that may have contributed to increased alarms.	
O-15	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.	VDH-ODW will follow-up in summer 2025 The automated filter to waste cycle can be extended by operators, however, typically appear to be below 0.1 NTU within the 9-minute cycle. One recommendation to reduce exceedances is to allow filter to sit and "ripen" prior to initiating filter to waste cycle.	None
O-16	EPA observed pH meters reading 8.16 and 7.62; System Representatives explained they are used to control caustic soda dosing. EPA observed dust and dirt built up on the analyzers and the screen.	VDH-ODW will follow-up in summer 2025 Dust and dirt build up observed in various locations throughout the waterworks. Bird droppings observed in a pump room at the plant. COR must improve pride and care of its plant by cleaning, repairing, and storing equipment appropriately.	Figure 58 Figure 59
O-17	EPA observed exposed wiring at the K1-2 pump	Addressed. Exposed wiring appeared to be corrected.	Figure 60
O-18	None of the instrumentation in Korah 2 and 3 Pump Station appeared to have calibration stickers.	No change. Calibration stickers were not observed at the instrumentation units.	Figure 61
O-19	EPA observed a corroded fitting leaking from a pipe with water accumulating on the ground below it	Addressed. No leakage apparent at time of inspection.	Figure 62
O-20	EPA observed security fencing around the Trafford 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. The new transmission mains will increase redundancy and reliability of power.	Addressed. Trafford pumphouse observed to have a gate and fencing, pump station operator can open the gate from within the pump station.	Figure 63
O-21	System Representatives explained that the roof of the Byrd Park 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	In progress. The roof replacement project is underway, and one side/cell is currently under construction. This leaves the waterworks with	Figure 64 Figure 65

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
	completed at a time. System Representatives discussed the need to increase pumping rates so that supply and capacity is maintained throughout the system.	reduced water storage capacity, leaves less room for error. WTP staff is required to carefully balance water plant flows and reservoir levels through the manual operation of raw water pumps, filters, filtered water pumps, finished water pumps, and coordination with Trafford PS operator.	
O-22	EPA observed security fencing with barbed wire around the perimeter of the Byrd Park reservoir. EPA observed significant vegetation in some areas of the fencing. Several areas of the roof had vegetation growing in between the stones.	VDH-ODW will follow-up as part of the final inspection of construction once construction has been completed. The reservoir is currently a construction zone.	Figure 64 Figure 65
O-23	EPA observed a Modular Automatic Cathodic Protection Unit (MACPU) digital unit on each tank at Cofer Road, 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.	Addressed. Unit appeared functional at time of inspection.	Figure 66
O-24	EPA observed security fencing without barbed wire around the perimeter of the tank at Jahnke Road.	Addressed. Chain link fence does not have barbed wire. Fence appears to be in good condition; limbs were removed and sections repaired.	Figure 67
O-25	EPA observed a significant amount of rust on the outside of the Jahnke Road tank. 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.	No change. Condition has not changed; tank appears to need recoating. 2023 tank inspection report recommends exterior and interior tank recoating and adjustment to cathodic protection.	Figure 68
O-26	EPA observed some corrosion and degraded sealant at the base of the tank at Jahnke Road.	No change. Condition has not changed; tank appears to need recoating.	Figure 69
O-27	EPA observed corrugated steel around the base of the elevated tank; there was some algal growth visible where the base of the Warick Road tank met the corrugated steel siding	No change. Condition has not changed, algal growth and some rusting observed. There are some bars that appear welded to the exterior of the tank that can act as a ladder to the top of the tank, there is no fence at the tank. 2023 tank inspection report recommends full rehabilitation of tank including exterior and interior recoating.	Figure 70 Figure 71
O-28	EPA and System Representatives were not able to locate a visible overflow for the Warwick Road tank. System Representatives	VDH-ODW will follow-up in summer 2025	None

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
	suspected that the overflow could be connected to a storm or sanitary sewer.	Overflow located in a vault that also contains the drain and riser pipe. The overflow and tank drain go to the storm sewer. It is unknown if there is an air gap or screen and is a potential cross connection. COR representatives that are tasked with escorting personnel to distribution facilities should be trained and familiarized with the facilities including locations of drains, overflows, inlet/outlet piping and their discharges. Discharges of overflows and drains should be identified and determined if they pose cross connection hazards.	
O-29	EPA observed significant corrosion on top of the control valve at Warwick Road	No change. Corrosion still observed at time of inspection.	Figure 72
O-30	EPA observed temporary fencing around the front of the tank and permanent security fencing without barbed wire at the rear of the tank at Huguenot Road. 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	No change. No security fencing observed, temporary fencing removed, and no permanent fencing put in place. Tank staining observed at time of inspection. 2023 tank inspection recommends exterior power wash, and immediate repairs to roof support beams.	Figure 73
O-31	EPA observed that the programmable logic controller (PLC) display screen in the main pump station building was not operational at Columbus Pump Station	Addressed. PLC display screen functional at time of inspection.	Figure 74
O-32	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	No change. Setpoint is still at 0.00 psi, however discharge pressure showing as 40.39 psi. Standard operating procedures not available to describe pressure setpoint reasoning.	Figure 75
O-33	The Program & Operations Supervisor stated the Byrd Park Reserve pump station does not have a generator or quick connect but relies on two feeds from Dominion Power for electricity.	VDH-ODW will follow-up in summer 2025 COR should verify how pump stations with two electrical feeds are operated and if they always provide sufficient reliability.	None
O-34	EPA observed graffiti on the door of the building, indicating security issues at Byrd Park Main Pump Station	Partially addressed. Graffiti not observed on door of the building, however some graffiti observed elsewhere on the exterior of the building.	Figure 76

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
		COR should improve security and maintenance to prevent graffiti.	
O-35	EPA observed the System had recently installed an overhead crane in the Byrd Park Main 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	Partially addressed. Ceiling debris not observed; however, a buildup of dust observed on piping. COR needs to take pride in its operations and ensure dust is routinely addressed.	Figure 77
O-36	EPA observed seals leaking on two gate valves and observed corrosion on the bolts of the gate valves at Byrd Park Main Pump Station	No change. Evidence of leaking still observed. Corrosion observed on various equipment in station. COR needs to improve pride and care of plant operations.	Figure 78
O-37	EPA observed poor housekeeping conditions throughout the Byrd Park main pump station, including debris, standing water on the ground, and lubrication leaking from the pumps. EPA also observed a nearly full and uncovered five-gallon bucket of oil/water mix.	No change. General housekeeping issues at WTP and distribution system facilities including used latex/nitrile gloves on the ground in various locations, debris, furniture and other general storage in the pipe gallery area, soda bottles, food wrappers, homemade mouse trap, etc. COR needs to improve pride and care of operations.	Figure 79
O-38	The System Representatives experienced difficulty locating the Ginter Park 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	VDH-ODW will follow-up in summer 2025 Overflow is directed into a manhole. Airgap or screen could not be observed (not photographed).	Figure 80
O-39	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.	No change. Flow pacing of chemicals is not practiced for many chemical feeds due to the unreliability of raw water flow meters and other flow meters in the WTP. Operators are manually adjusting chemical feed rates. Addressing the reliability of flow meters and resuming flow pacing of chemicals is recommended. COR should improve automation of plant operations.	None
O-40	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	Addressed.	Figure 81

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
	system actively dripping sodium hypochlorite down into the room.	VDH-ODW observed a truck delivering and offloading sodium hypochlorite at the time of the inspection. No active dripping of sodium hypochlorite into the room observed.	
O-41	EPA observed crystalized chemical on the exterior of one of the day-tank supply lines for aluminum sulfate	Addressed. No crystalized chemical observed on exterior of day-tank supply line (not photographed).	Figure 82
O-42	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.	Permanganate not being fed at the time of inspection due to seasonality of feed (not fed in winter). Not addressed. The WTP still does not have the ability to check permanganate residuals. To measure permanganate residuals, the WTP can use free chlorine N,N-diethyl-p-phenylenediamine (DPD) methods and 0.45-micron filters. This assumes no chlorine introduced to the raw water at the point of sample collection. 1. Filter raw water through a 0.45-micron filter and use the filtered water to zero a spectrophotometer. 2. Add a free chlorine DPD powder pillow to the sample and measure free chlorine residual. 3. Multiply the value by 0.893 to convert free chlorine readings to permanganate residual readings	None
O-43	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.	Not addressed. The flow meters for both Plant No. 1 and Plant No. 2 were reported as unreliable to use for flow pacing. COR should investigate how to replace unreliable flow meters with more reliable flow meters that can be trusted by operations staff. This will then allow for flow pacing of chemicals.	None
O-44	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.	Partially Addressed. Observed whiteboard in the Plant 2 operations room with target ranges for clearwell level, finished water flow, Byrd Park	Figure 83

Observation Number	EPA Observations from July 26-27, 2022	ODW Follow-Up Observation from January to March 2025	Accompanying Photograph (Appendix A)
		reservoir level, streaming current readings, finished turbidity, pH, fluoride, chlorine, and orthophosphate. This practice should be made permanent by hanging the whiteboard up in the operations room and expanded to include filter performance targets, raw water and applied water targets.	
O-45	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.	In progress. COR submitted their initial lead service line inventory to meet Lead and Copper Rule Revisions requirements on October 16, 2024. Richmond Field Office approved the inventory on October 22, 2024. The Lead and Copper Materials Survey/Sample Site List should be updated to include an adequate number of lead service lines and internal lead pipe or copper pipe with lead solder lines. It is recommended that COR identify more than the minimum 50 sample sites required for triennial reduced monitoring and ideally more than 100 sample sites if 6-month monitoring is required in the future. COR should conduct triennial reduced compliance sampling between June and September 2025 at 50 minimum sample sites with 50% of the sample sites consisting of lead service lines and 50% consisting of internal lead pipe or copper pipe with lead solder lines. The Lead and Copper Material Survey and sample site list should be updated to include 50% lead service lines and 50% copper with lead solder lines. Samples collected in 2025 should reflect this update.	None
O-46	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.	No change. COR has not implemented a nitrification control plan. Richmond Field Office is compiling nitrification control plans of neighboring utilities to develop a template for COR to use.	None

Appendix A- Photographs

Figure 1. Distance of recycle discharge point and head of raw water pump stations (VDH)

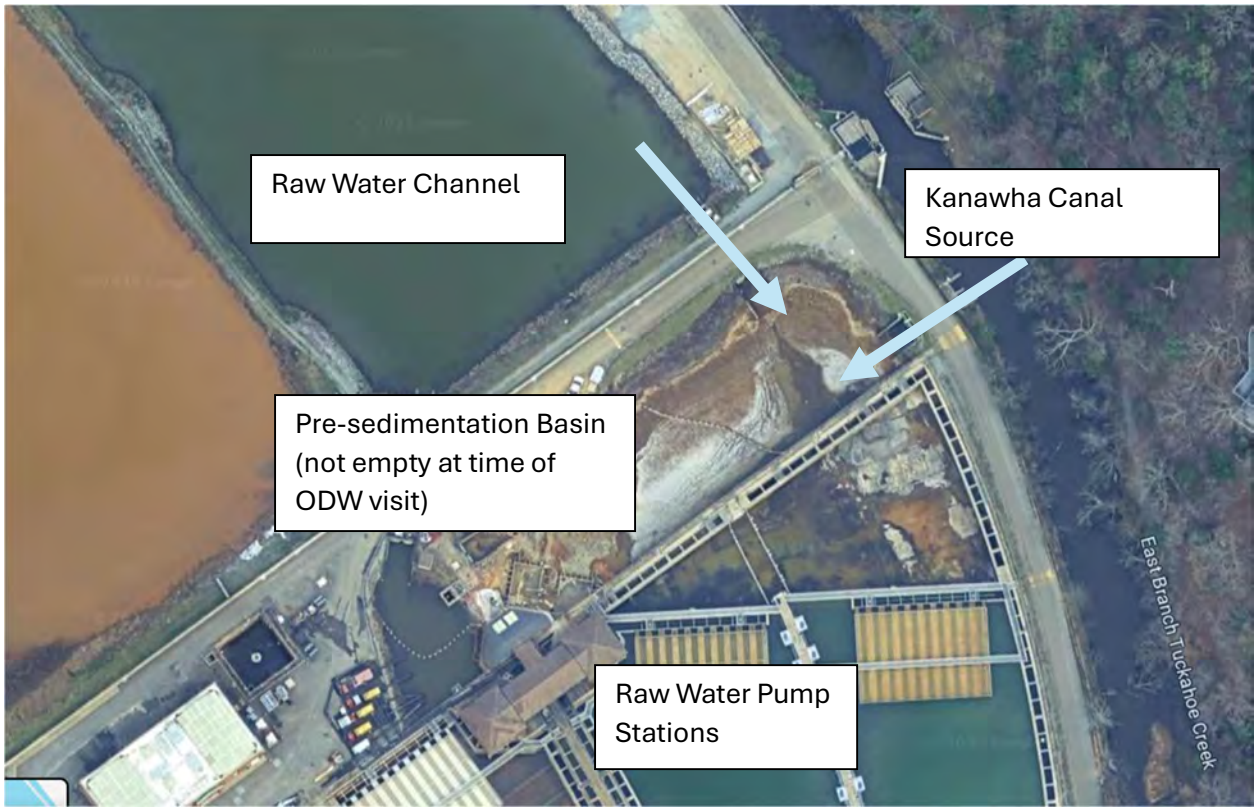


Figure 2. Location of Kanawha Canal discharge in relation to raw water channel (VDH)

Figure 3. Advance detection testing location (VDH)

Figure 4. Kanawha Canal gate closed, no flow observed (Top-EPA, Lower Left- COR, Lower Right- VDH)

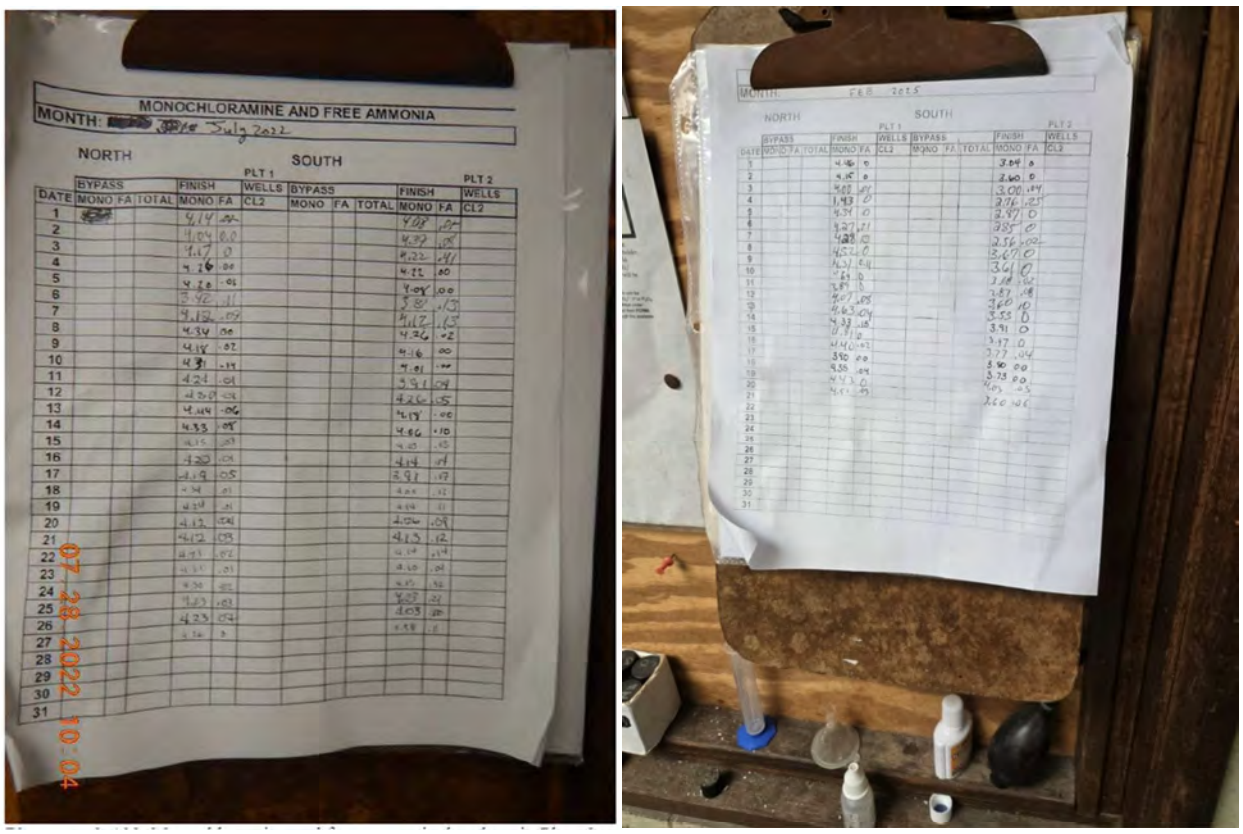


Figure 5. Free ammonia readings (Left-EPA, Right- VDH)

Figure 6. Rapid mix units that can be used as backup for inline mixers (VDH)

Figure 7. Plant 2 flow meter (Top- EPA, Bottom- COR)

Figure 8. Potassium permanganate feed (Top left- EPA, Top right- COR, Bottom- VDH (not used in winter))

Figure 9. Caustic leak in Korah 1 Pump Station (Top left- EPA, Top right-COR, Bottom- VDH)

Figure 10. Chemical leaks observed (VDH)

Figure 11. Leaks observed in sodium hypochlorite tanks (EPA)

Figure 12. Leaks in sodium hypochlorite tanks (COR)

Figure 13. Leaks observed in sodium hypochlorite tanks (VDH)

Figure 14. Filter 2 concrete (EPA)

Figure 15. Plant 2 concrete (COR)

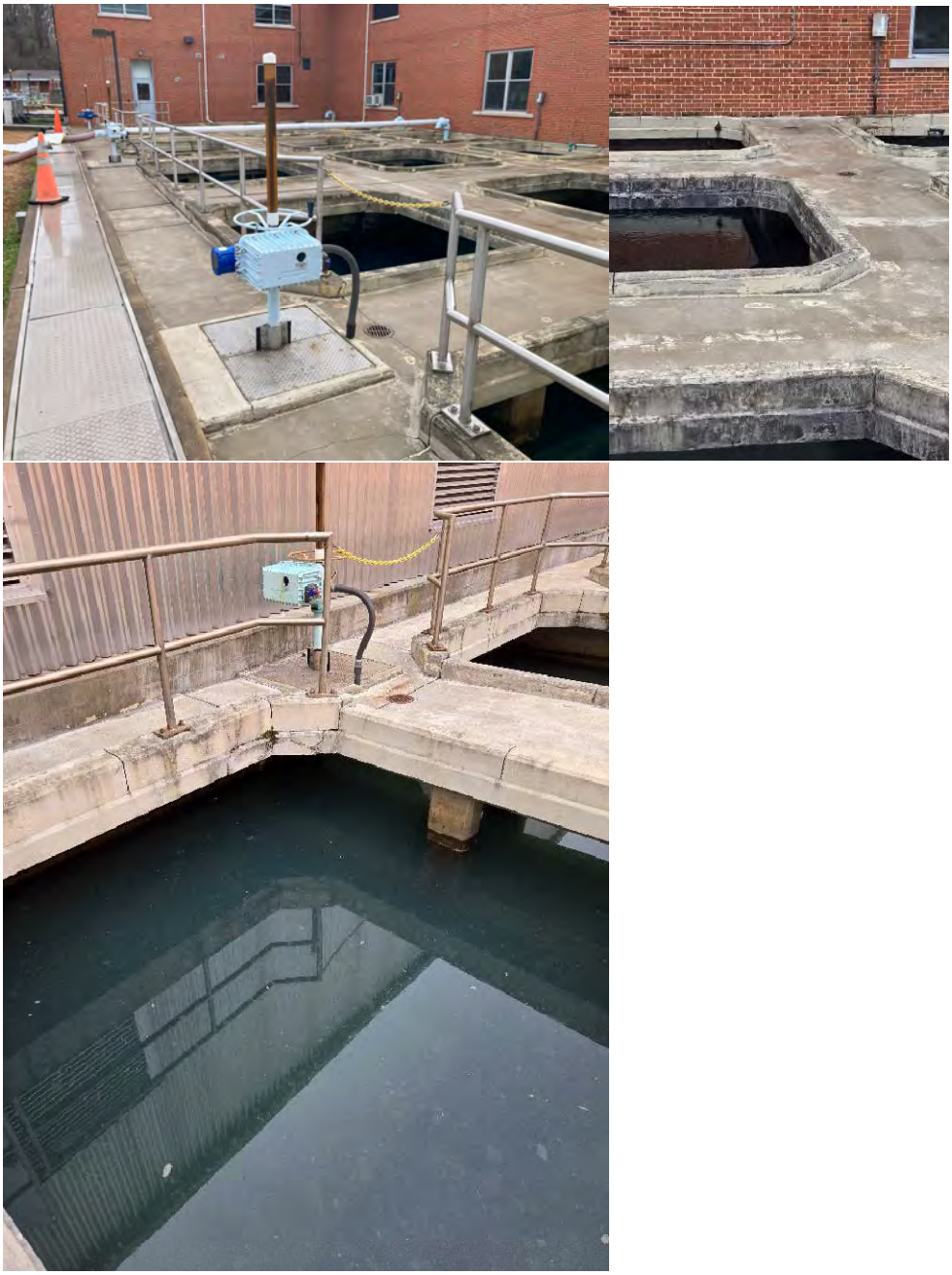


Figure 16. Plant 2 filters concrete (VDH)

Figure 17. Plant 2 filter structure/debris (Top-EPA, Bottom- VDH)

Figure 18. Walkway between sed basins (VDH)

Figure 19. Plant 1 air scour piping (Top- EPA, Bottom-VDH)

City of Richmond Water Treatment Plant, PWSID # 4760100
Page 4b of 30, Filter Turbidities 5-8
October 2024 Monthly Operating Report

Date	FILTER #5 SUMMARY				FILTER #6 SUMMARY				FILTER #7 SUMMARY				FILTER #8 SUMMARY			
	Max NTU	No. Read	No. ≤ 0.3	No. ≤ 0.1	Max NTU	No. Read	No. ≤ 0.3	No. ≤ 0.1	Max NTU	No. Read	No. ≤ 0.3	No. ≤ 0.1	Max NTU	No. Read	No. ≤ 0.3	No. ≤ 0.1
1	0.03	96	96	96	0.07	93	93	93					0.12	93	93	92
2	0.03	95	95	95	0.04	95	95	95					0.05	95	95	95
3	0.02	96	96	96	0.01	96	96	96					0.02	96	96	96
4	0.05	93	93	93	0.02	83	83	83					0.10	93	93	93
5	0.02	96	96	96	0.06	89	89	89					0.04	96	96	96
6	0.06	96	96	96	0.02	71	71	71					0.03	96	96	96
7	0.07	93	93	93	0.02	56	56	56					0.10	93	93	93
8	0.15	94	94	91	0.05	96	96	96					0.02	96	96	96
9	0.11	95	95	94	0.03	93	93	93					0.04	96	96	96
10	0.14	89	89	88	0.01	96	96	96					2.00	89	88	88
11	0.02	96	96	96	0.03	93	93	93					0.02	96	96	96
12	0.03	96	96	96	0.02	96	96	96					0.02	96	96	96
13	0.03	93	93	93	0.02	96	96	96					0.03	93	93	93
14	0.01	96	96	96	0.04	93	93	93					0.02	96	96	96
15	0.01	96	96	96	0.02	96	96	96					0.02	96	96	96
16	0.03	93	93	93	0.02	96	96	96					0.05	93	93	93
17	0.03	96	96	96	0.04	93	93	93					0.02	96	96	96
18	0.08	93	93	93	0.02	96	96	96					0.07	93	93	93
19	0.06	96	96	96	0.05	96	96	96					0.03	96	96	96
20	0.12	88	88	87	0.10	96	96	96					0.03	96	96	96
21	0.05	83	83	83	0.29	83	83	82					0.14	81	81	80
22	0.02	96	96	96	0.04	96	96	96					0.03	96	96	96
23	0.05	94	94	94	0.08	94	94	94					0.04	94	94	94
24	0.11	94	94	93	0.12	93	93	92					0.07	93	93	93
25	0.03	96	96	96	0.05	96	96	96					0.04	96	96	96
26	0.04	96	96	96	0.06	96	96	96					0.05	93	93	93
27	0.13	94	94	93	0.11	93	93	92					0.06	96	96	96
28	0.25	77	77	76	0.27	83	83	82					0.28	82	82	81
29	0.30	86	86	84	0.05	96	96	96					0.05	93	93	93
30	0.09	88	88	88	0.16	89	89	88					0.25	86	86	80
31	0.32	73	72	59	0.31	57	56	50					0.55	79	78	76
TOTAL		2863	2862	2838		2795	2794	2783		0	0	0		2883	2881	2870
MAX.	0.3202				0.3076				0				1.997			

Figure 20. Monthly Operation Report with 2.0 NTU reading (VDH)

Figure 21. Corrosion at filtered water pumps (EPA)

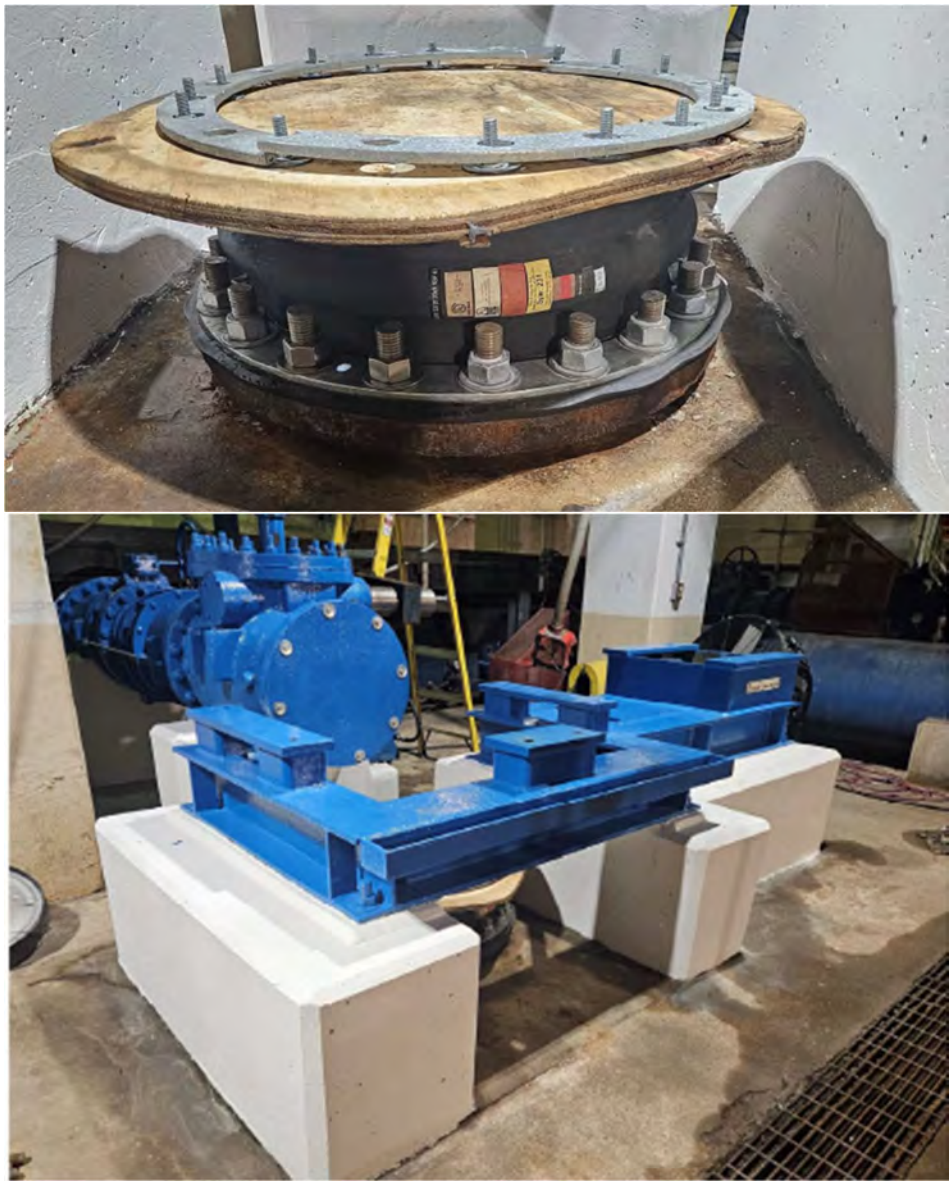


Figure 22. Filtered water pumps upgrades (COR)

Figure 23. Filtered water pumps mix of upgrades and old corrosion observed (VDH)

Figure 24. Finish water basins (aeration basins) (EPA)

Figure 25. Finished water basins (aeration basins) (COR)

Figure 26. Finished water basins (aeration basins) (VDH)

Figure 27. Byrd Park Reservoir valve pit (EPA)

Figure 28. Byrd Park Reservoir roof construction (VDH)

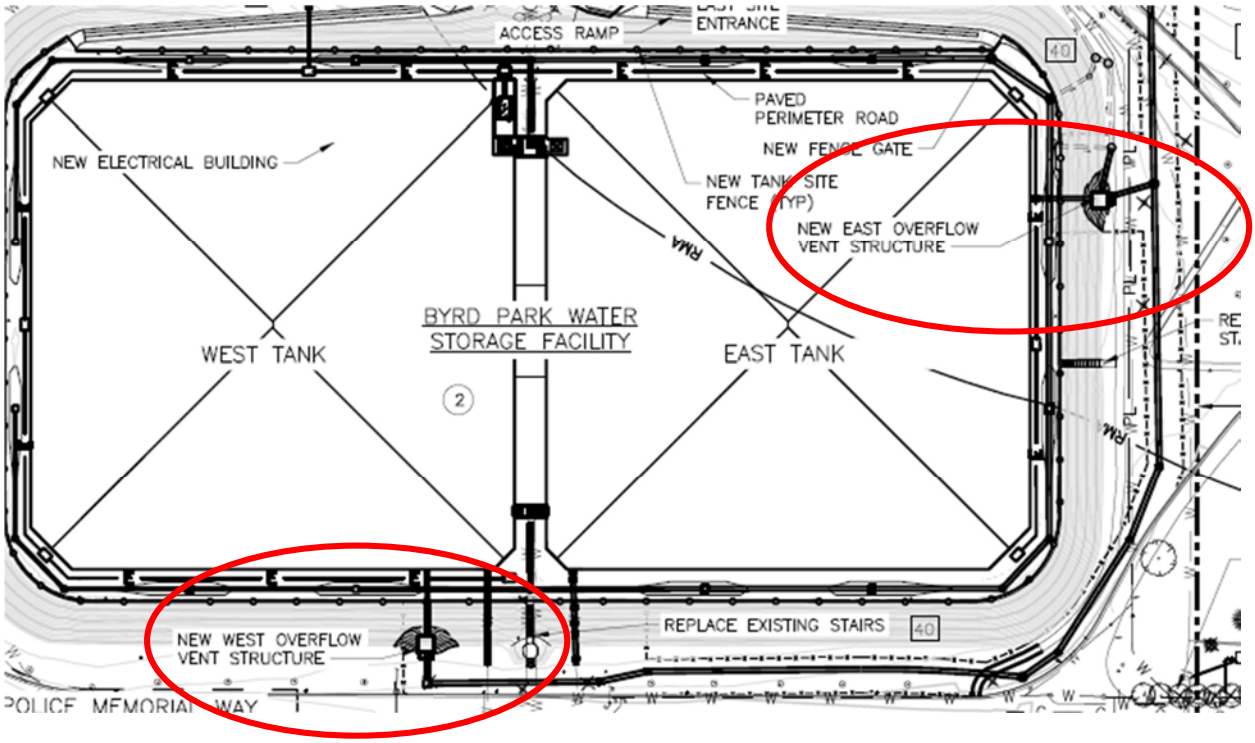


Figure 29. Byrd Park Reservoir roof replacement plans showing overflow

Figure 30. Warwick Road Tank gate valve (Left-EPA, Right- VDH)

Figure 31. Cofer Road overflow screen (Top left-EPA, Top right-COR, Bottom-VDH, Fine Mesh (also has air gap of ~3 feet))

Figure 32. Jahnke Road overflow screen (Top-EPA, Bottom-VDH)

Figure 33. Huguenot Road Tank overflow (EPA)

Figure 34. Huguenot Road Tank overflow (COR)

Figure 35. Huguenot Road Tank overflow (VDH)

Figure 36. Byrd Park Main Pump Station debris, leaks, housekeeping, backflow prevention (EPA)

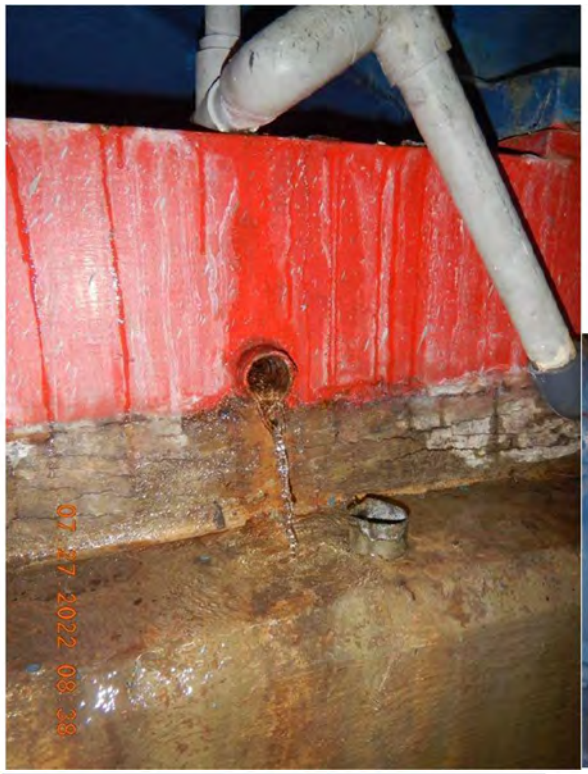
Figure 37. Byrd Park Main Pump Station (COR)

Figure 38. Byrd Park Main Pump Station (VDH)

Figure 39. Storage tank vegetation and overgrowth (EPA)

Figure 40. Storage tank vegetation and overgrowth (COR)

Figure 41. Storage tank vegetation and overgrowth. Cut limbs visible (VDH)



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.

Figure 42. Korah Pump Station observations (EPA)

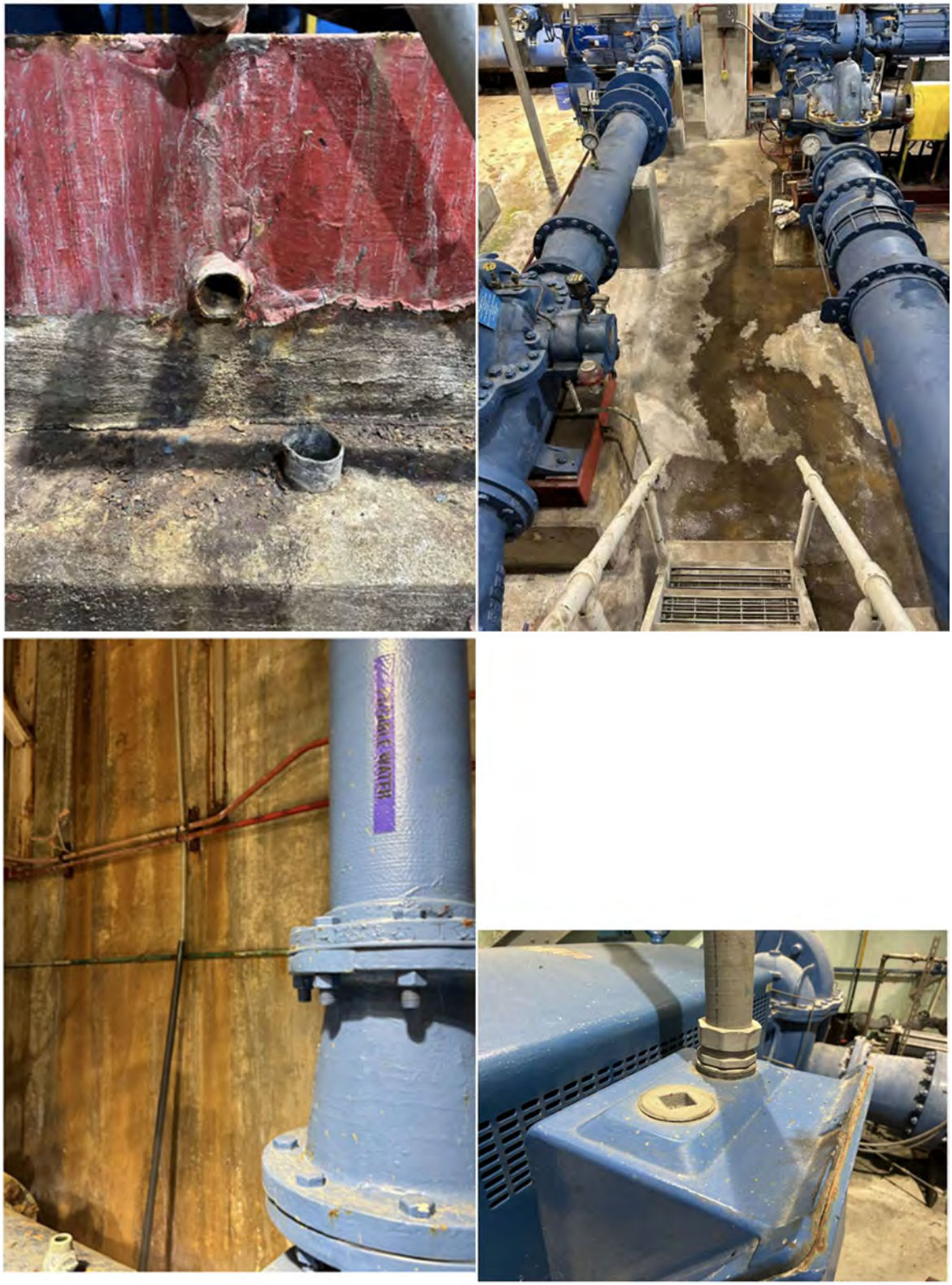


Figure 43. Korah Pump Stations observations (COR)

Figure 44. Korah Pump Station observation (VDH)

Figure 45. Backflow testing tags (Top left-EPA, Top right-COR, Bottom-VDH)

Figure 46. Threaded taps on lines without vacuum breaker (EPA)

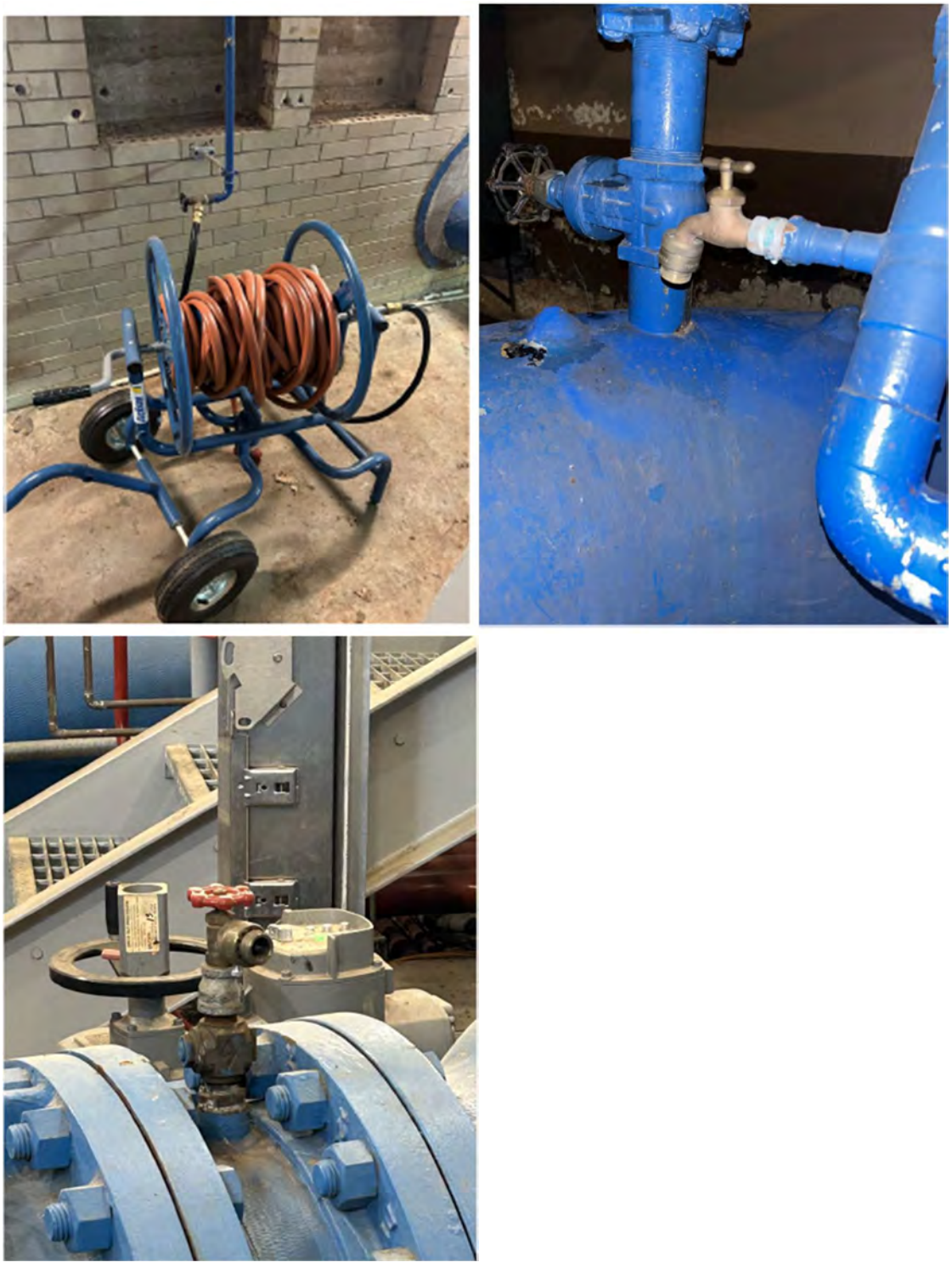


Figure 47. Threaded taps on lines with vacuum breaker installed (COR)

Figure 48. Earthen berm between lagoon and raw water intake channel (VDH)

Figure 49. Raw water screens (Left-EPA, Middle- COR, Bottom-VDH)

Figure 50. Dewatering operation near raw water intake channel (Left- EPA, Middle- COR, Bottom- VDH)

Figure 51. Pre-sed basin screens (Top-EPA, Lower Left- COR, Lower Middle and Right-VDH)

Figure 52. Traveling screens (Left-EPA, Middle-COR, Bottom-VDH)

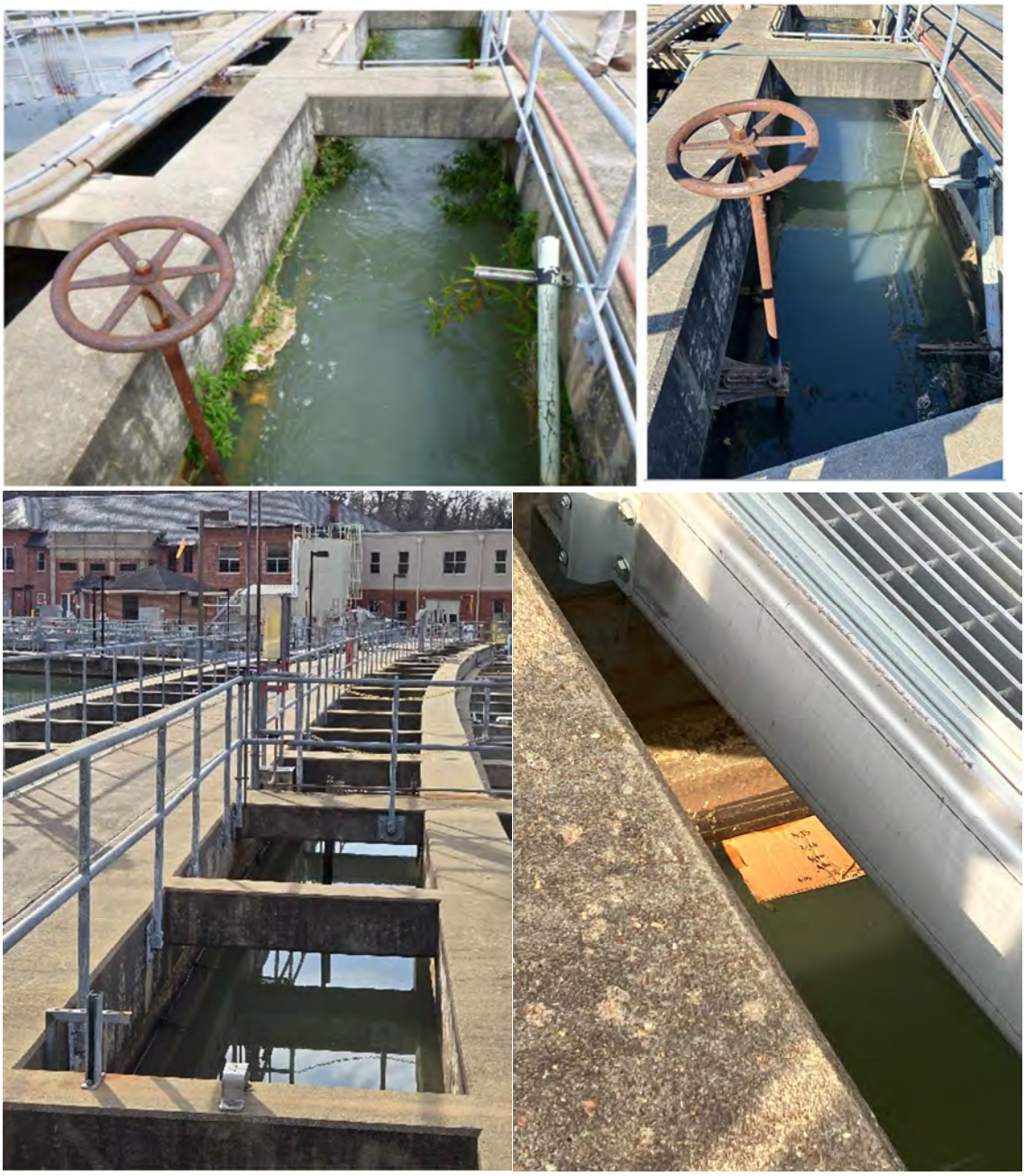


Figure 53. Vegetation and debris raw water coagulation channel (Top Left-EPA, Top Right-COR, Bottom-VDH)

Figure 54. Plate settlers (Top- EPA, Bottom- VDH)

Figure 55. Exposed wiring flocculator motor (Top Left-EPA, Top Right-COR, Bottom Left- VDH)

Figure 56. Filters in service/out of service (VDH)

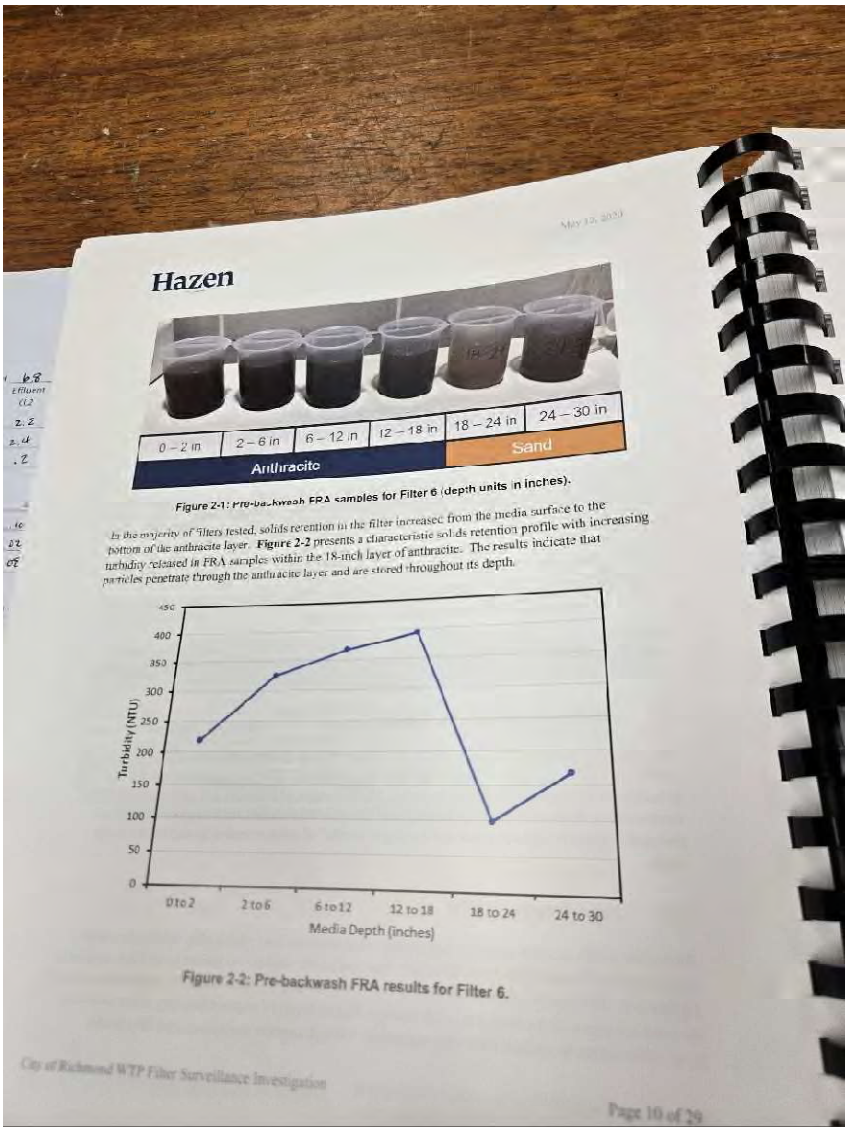


Figure 57. 2020 Filter media evaluation (VDH)

Figure 58. Korah 1 Pump Station pH analyzers (EPA)

Figure 59. Observations of dust, general housekeeping (VDH)

Figure 60. Exposed wiring Korah 1 pump station (Top-EPA, Bottom-COR)

Figure 61. Instrumentation in Korah 2 and 3 pump station, no calibration stickers observed (Top-EPA, Bottom-VDH)

Figure 62. Corroded fitting from pipe in Korah 2 and 3 pump station (Top left- EPA, Top right- COR, Bottom- VDH)

Figure 63. Fencing at Trafford Pump Station (EPA)

Figure 64. Byrd Park Reservoir fencing (EPA)

Figure 65. Byrd Park Reservoir Construction (VDH)

Figure 66. Cathodic Protection Unit at Cofer Road tank (Top left-EPA, Top right- COR, Bottom- VDH)

Figure 67. Fencing at Jahnke Road Tank (Left- EPA, Middle- COR)

Figure 68. Rust observed on Jahnke Road Tank (Top-EPA, Bottom-VDH)

Figure 69. Corrosion and degraded seal at Jahnke Road Tank (EPA)

Figure 70. Algal growth at bottom of bowl Warwick Road Tank (EPA)

Figure 71. Warwick Tank unprotected access to top of tank (VDH)

Figure 72. Corrosion on control valve in Warwick Road Tank (EPA)

Figure 73. Huguenot Road Tank (Top- EPA, Bottom left- COR, Bottom right- VDH)

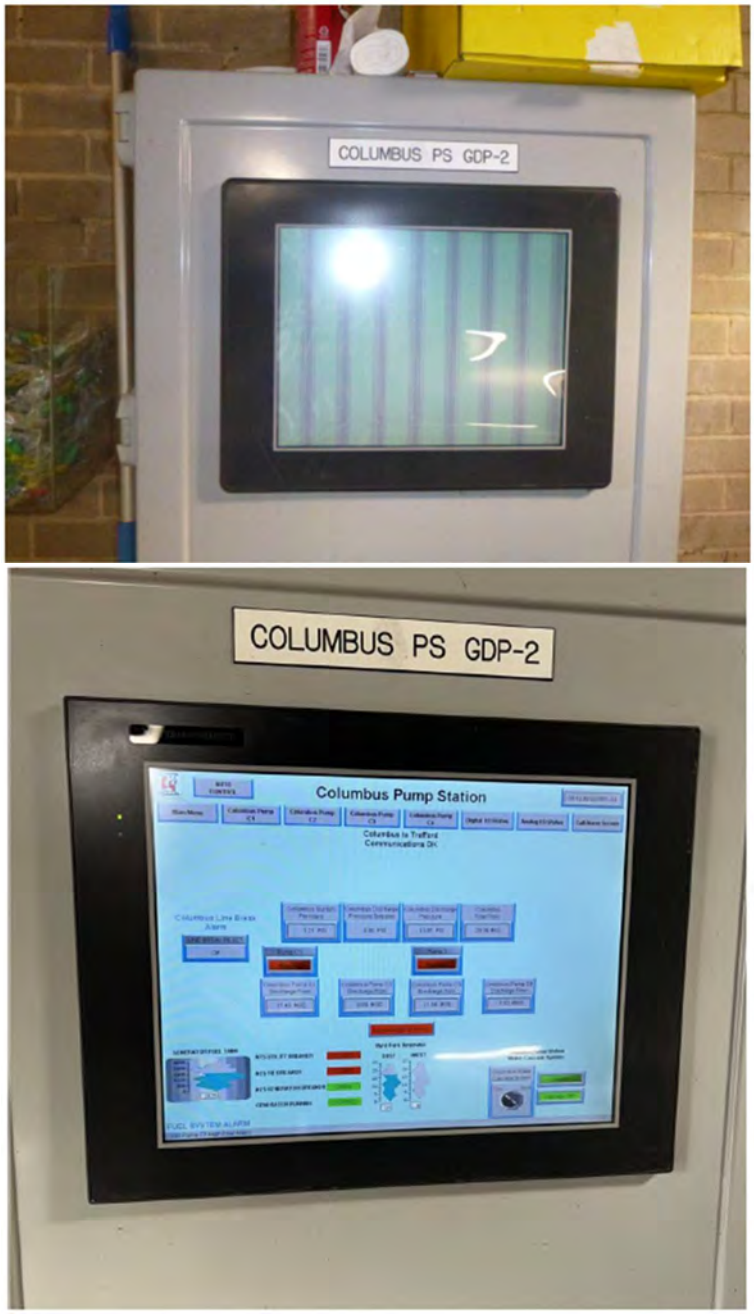


Figure 74. PLC at Columbus Pump Station (Left- EPA, Right- VDH)

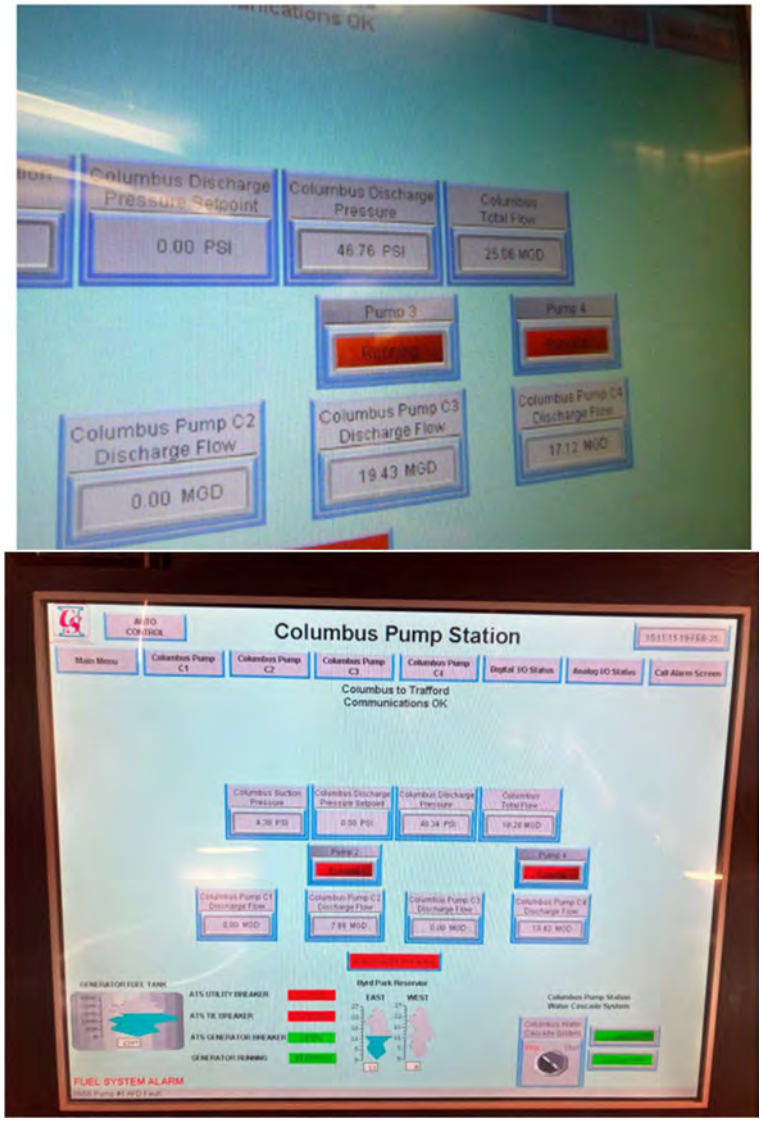


Figure 75. PLC in electrical room Columbus Pump Station, discharge setpoint at 0.00 psi (Left-EPA, Right-VDH)

Figure 76. Byrd Park Main Pump Station entrance (Top left- EPA, Top right- COR, Bottom- VDH)

Figure 77. Debris on ground from ceiling at Byrd Park Main pump station (Top- EPA, Bottom- VDH)

Figure 78. Leaking seals on gate valves at Byrd Park Main pump station (Top left- EPA, Top right- COR, Bottom- VDH)

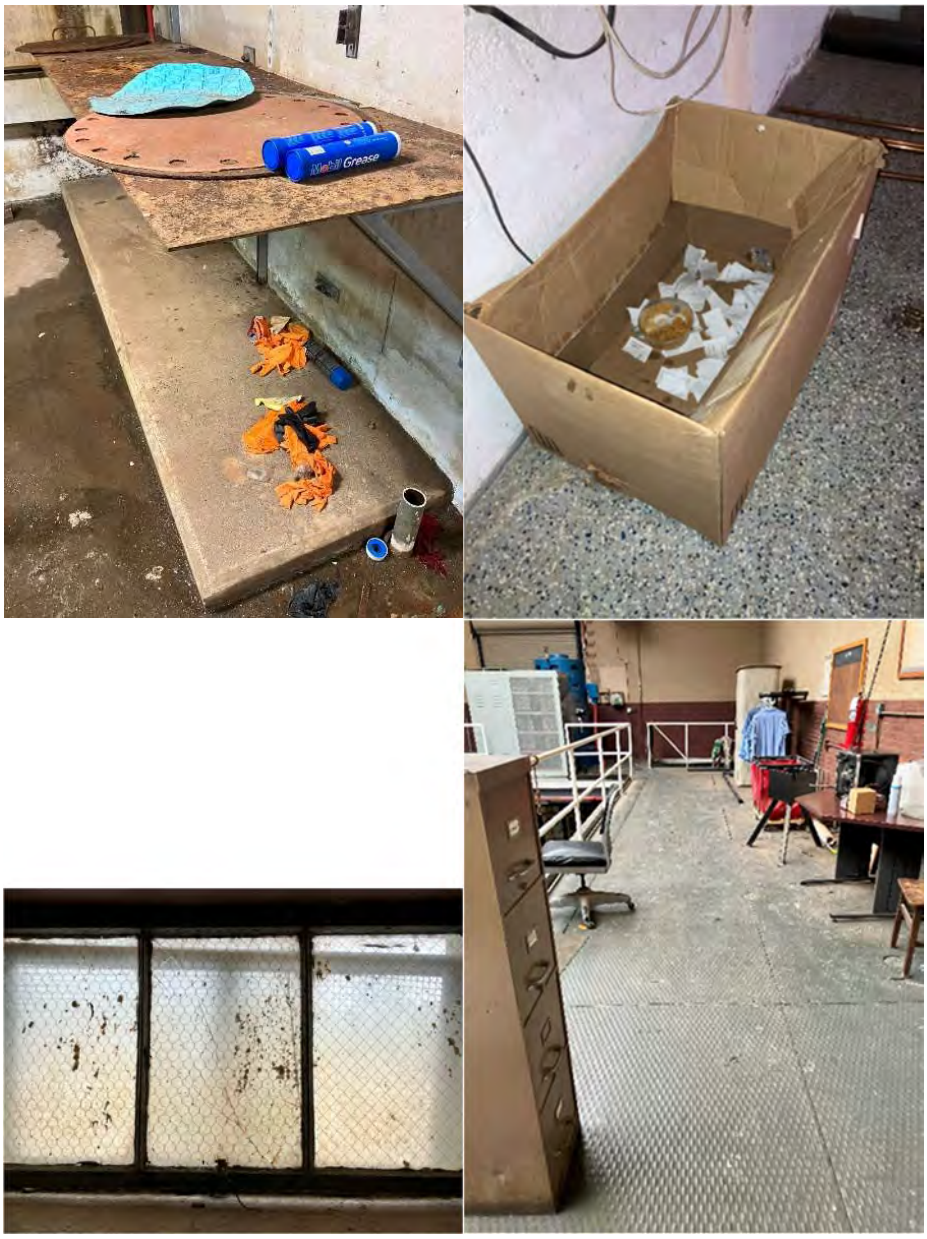


Figure 79. General Housekeeping Observation (VDH)

Figure 80. Ginter Park tank overflow pipe (EPA)

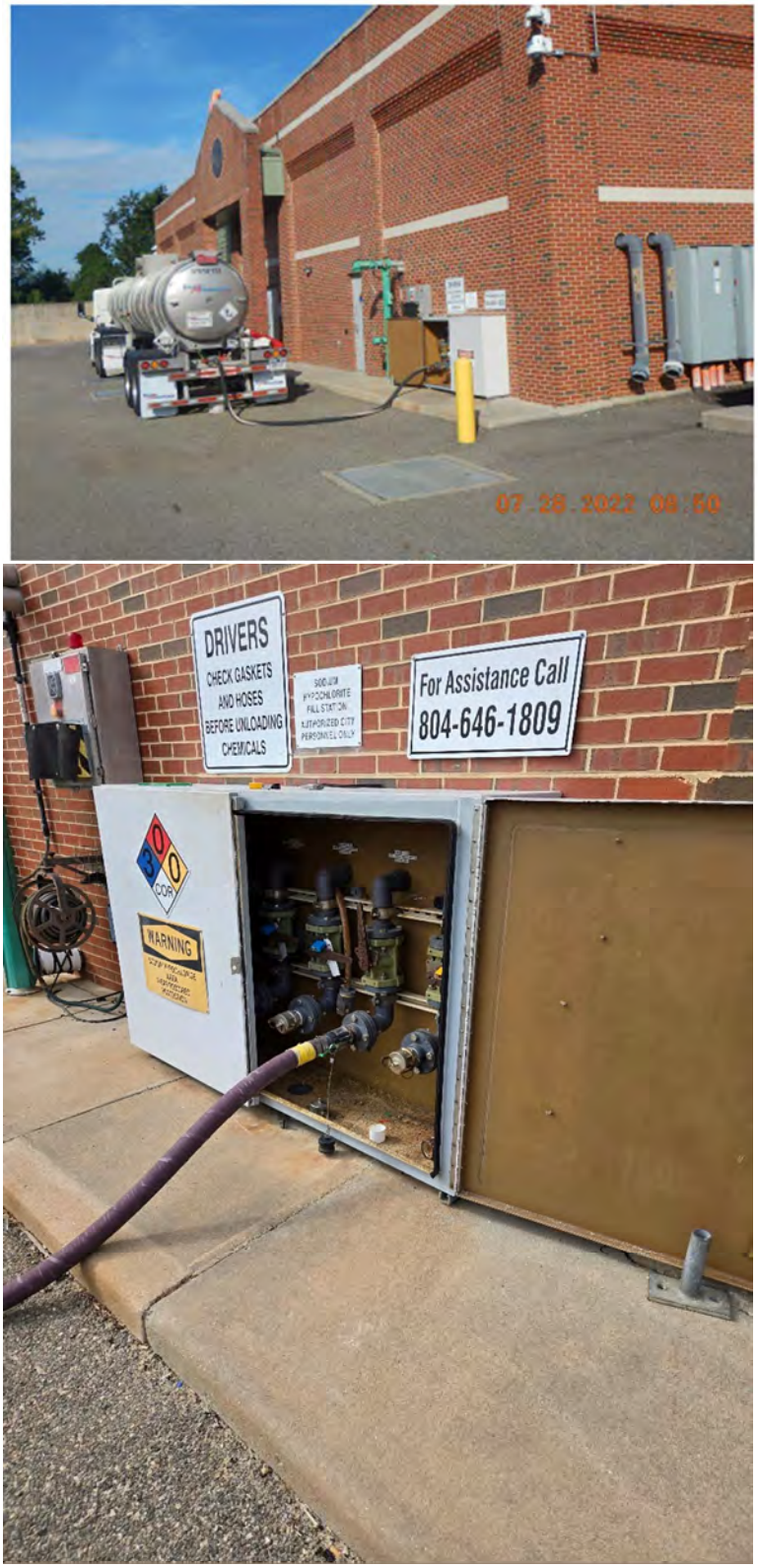


Figure 81. Truck delivering sodium hypochlorite (Top- EPA, Bottom- VDH)

Figure 82. Aluminum sulfate day tank supply line (EPA)

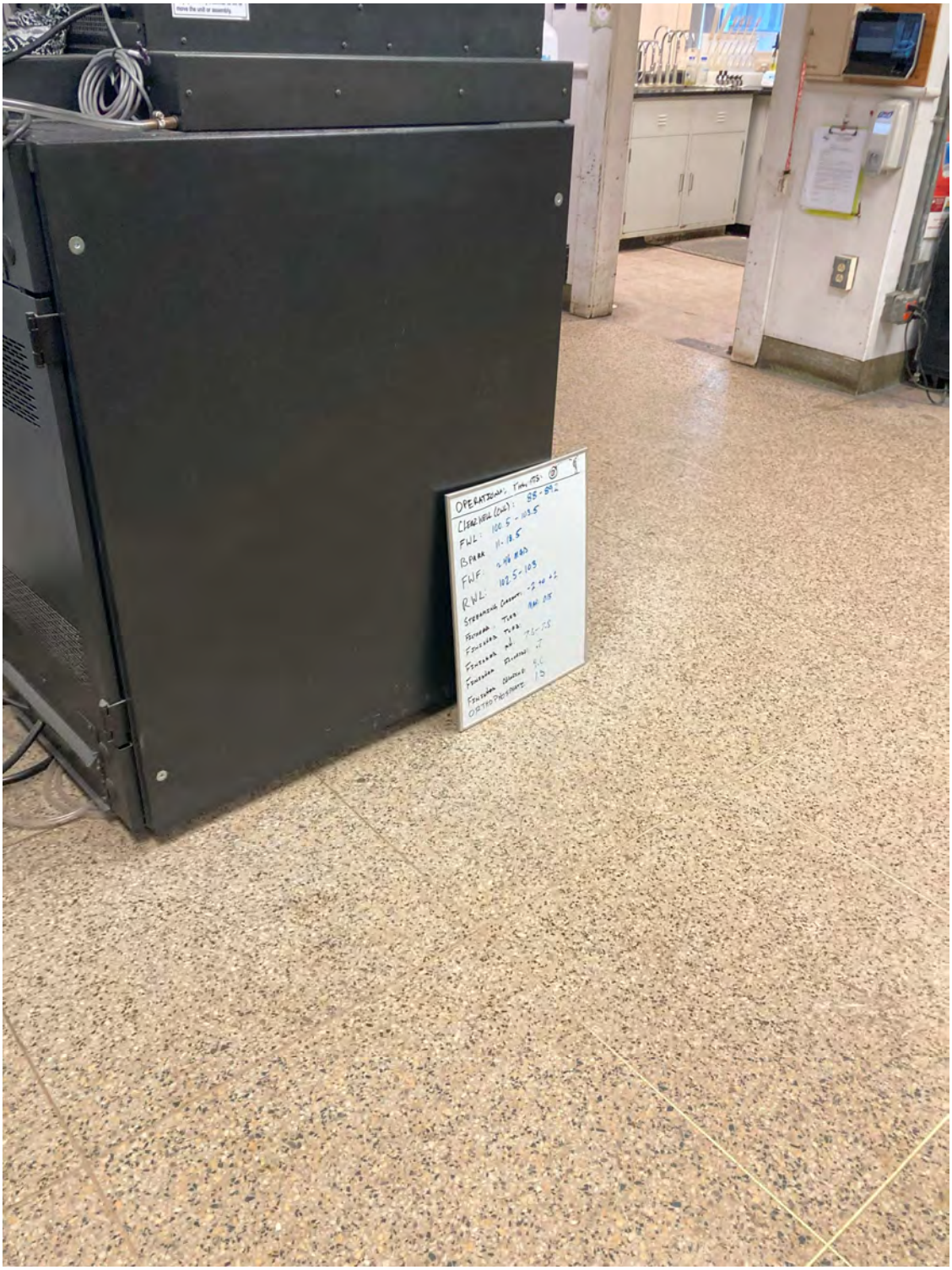


Figure 83. Treatment targets whiteboard (VDH)

Appendix B. Miscellaneous Photographs

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

Figure 84. Flood Wall (Top Left- EPA, Bottom Left- COR, Right-VDH)

Figure 85. Kanawha Canal (Left- EPA, Right- VDH)

Figure 86. Inactive basin (Left- EPA, Right- VDH)

Figure 87. Water Champ flash mixer controls (Left- EPA, Right- VDH)

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

Figure 88. Caustic soda bulk storage area (Top Left- EPA, Bottom Left- COR, Right- VDH)

Figure 89. Process Drain (Left-EPA, Right-VDH)

Figure 90. Korah 1 Pump Station pH analyzers (Left- EPA, Right- VDH)

Figure 91. Gauges and flow meters in Byrd Park main pump station not operational (Left-EPA, Middle- COR)