James River Watershed, Virginia

City of Richmond Integrated Municipal Permit

Overview

The City of Richmond provides drinking water, stormwater, and wastewater services to about 227,000 customers within the James River watershed. The City owns and operates a wastewater treatment plant (WWTP), a combined sewer system (CSS), and a municipal separate storm sewer system (MS4), which all discharge to the watershed. The WWTP provides advanced treatment, including denitrification, filtration, and ultraviolet (UV) light disinfection, for up to 45 million gallons per day (dry weather flow) and 75 million gallons per day (wet weather flow). The WWTP also provides primary treatment and UV disinfection for additional wet weather flows of up to 65 million gallons per day. More than 12,000 acres of the City drain to the CSS, while the remaining 26,000 acres drain to the MS4.

Historically, the City's Department of Public Utilities (DPU) managed its three water utilities separately to comply with the applicable regulatory requirements for each. In 2014, DPU recommended an integrated planning approach for the City's water services to the Virginia Department of Environmental Quality (DEQ), based on EPA's Integrated Planning Framework. DPU hoped that this coordinated approach would allow the City to meet its water quality requirements while also increasing efficiency and prioritizing actions necessary to improve and protect water resources in the watershed.

Watershed

James River watershed, Virginia

Key Water Quality Concerns

Nutrients, bacteria, pH, dissolved oxygen, biochemical oxygen demand, and total suspended solids

Stakeholder Involvement Techniques

- Technical stakeholder involvement from beginning of permit development process
- Meetings for technical and non-technical audiences every two to three months
- Shared knowledge, data, and resources
- Scoring and metrics to establish and prioritize potential projects

Case Study Issues of Interest

Type of Point Sources

- Publicly Owned Treatment Works Discharges
- Municipal Separate Storm Sewer System Discharges
- Combined Sewer Overflows

Type of Watershed-Based Permit or Approach

- Integrated Municipal Permit

Highlighted Approach(es)

- Implementation of Total Maximum Daily Loads or Other Watershed Pollutant Reduction Goals
- Integrated Planning

Following extensive stakeholder involvement, DPU released the 2017 Richmond, Virginia (RVA) Clean Water Plan, an integrated plan, to enable the City to efficiently evaluate, manage, and implement water quality programs; achieve its goals and objectives; and support development of a single integrated municipal permit for the City's WWTP, CSS, and MS4. In 2018, Virginia DEQ issued an integrated municipal permit requiring implementation of the City's integrated plan.

This case study provides an overview of the City's watershed-based permit and summarizes key components of the permit and the City's integrated plan.

Background

Prior to issuance of the integrated municipal permit, the City was subject to an individual Virginia Pollutant Discharge Elimination System (VPDES) permit for the WWTP and CSS and General Permit for Dischargers of Stormwater from Small MS4s (VPDES Permit No. VAR040005) for the MS4.

In 1988, the City signed the first in a series of special consent orders with Virginia DEQ to control combined sewer overflows (CSOs). The City's Long Term Control Plan, approved by Virginia DEQ in 2005, outlined specific actions the City would implement to control CSOs.

The James River watershed is impaired for bacteria, mercury, chlordane, DDE, DDT, polychlorinated biphenyls (PCBs), pH, dissolved oxygen, chlorophyll a, and submerged aquatic vegetation. In 2010, EPA approved the City of Richmond Bacterial Total Maximum Daily Load (TMDL) to address bacteria levels in the main stem of the James River, which includes wasteload allocations for the WWTP, CSS, and MS4. The City's WWTP, CSS, and MS4 are also subject to wasteload allocations for total nitrogen, total phosphorus, and total suspended solids in EPA's 2010 Chesapeake Bay TMDL, which addresses impairments for dissolved oxygen, chlorophyll a, and submerged aquatic vegetation in the bay and its tidal tributaries. The City's integrated municipal permit implements TMDLs to address impairments related to bacteria, nutrients, and sediment.

Permit Strategy

Despite the significant financial investment to comply with the terms of the Special Consent Orders, the City continued to experience compliance issues, primarily related to compliance with bacteria limits. The City also anticipated that compliance with the Chesapeake Bay TMDL would cost another several hundred million dollars. Therefore, the City sought a new approach to achieve compliance with their water quality requirements while also keeping water utilities affordable for ratepayers.

After reviewing EPA's Integrated Municipal Stormwater and Wastewater Planning Approach Framework, DPU expressed interest in using the integrated planning approach to more efficiently and effectively address their municipal wastewater and stormwater management needs. The City determined that an integrated municipal permit would address multiple permitting requirements while simultaneously increasing operating efficiency and reducing associated costs.

Beginning in November 2014, the City conducted multiple public stakeholder meetings to both inform and collect input from federal and state agencies, local governments, special interest groups, and the general public about its integrated planning efforts. The City also developed various community outreach and education initiatives to inform and involve the local community.

Working with the key technical stakeholders, the City developed a list of watershed goals and strategies, and then prioritized strategies and projects for implementation. The final list of goals and strategies are presented in the table below.

Goals	Strategies
• Improve water quality and quantity • Protect and restore aquatic and terrestrial habitat • Engage and educate the public • Implement land conservation and restoration practices • Create partnerships • Maximize water availability • Provide water-related recreational opportunities • Gather high-quality data	• Replace or restore riparian areas • Install or retrofit green infrastructure in the MS4 and CSS • Restore streams • Use native plants in new landscaping • Increase tree canopy and protect existing canopy • Place land in conservation easement and conserve land creating green corridors • Reduce water consumption • Reduce contribution of pollutants to the MS4 • Implement long-term control projects for the CSS

These efforts culminated in the 2017 Clean Water Plan, which informed Virginia DEQ's development of the integrated municipal permit. Major elements of the Clean Water Plan included:

- Stakeholder involvement.
- Watershed characterization.
- Strategy identification, evaluation, and selection.
- Program implementation.
- Progress measurement.
- Adaptive management.

A multi-media campaign developed by the City of Richmond to encourage environmental awareness and active community participation to achieve water quality goals. Learn more at https://rvah2o.org/.

For an overview of the 2017 Clean Water Plan, see https://www.epa.gov/system/files/documents/2021-07/rtc-profile-richmond.pdf.

In 2012, EPA published the "Integrated Municipal Stormwater and Wastewater Planning Approach Framework," providing guidance for municipalities to manage stormwater and wastewater overflows and other Clean Water Act obligations using an integrated approach. In 2019, Congress enacted the Water Infrastructure Improvement Act, which amended the Clean Water Act to include the 2012 framework. For more information, see EPA's Integrated Planning Website at https://www.epa.gov/npdes/integrated-planning-municipal-stormwater-and-wastewater.

Permit Highlights

Aggregated Load Allocations

The permit establishes aggregated load allocations based on applicable wasteload allocations for the WWTP, CSS, and MS4 in the Chesapeake Bay TMDL. The annual load allocations are expressed in pounds per year (lbs/yr) for total nitrogen, total phosphorus, and total suspended solids. The WWTP is also subject to calendar year load limits under the General VPDES Permit Regulation for Total Nitrogen and Total Phosphorus Dischargers and Nutrient Trading in the Chesapeake Watershed in Virginia. (See this case study for an overview of the general permit, a multisource watershed-based permit.)

Parameter	MS4 Annual WLA (lbs/yr)	WWTP Annual WLA (lbs/yr)	CSS Annual WLA (lbs/yr)	Total Aggregated Annual Load (lbs/yr)
Total nitrogen	154,901	1,093,652	409,557	1,658,110
Total phosphorus	17,262	55,754	31,642	104,658
Total suspended solids	5,223,204	847,754	3,396,550	9,267,508

Permit Components

WWTP Effluent Limits

The permit includes effluent limits and monitoring requirements at three points of compliance to address dry weather and CSO-related bypass discharges:

- Outfall 101 applies to fully treated effluent and is located after full treatment and disinfection and prior to comingling with discharges from Outfall 102.
- Outfall 102 applies to CSO-related bypass discharges and is located after primary treatment and disinfection and prior to commingling with discharges from Outfall 101.
- Outfall 001 applies to the combined discharge from Outfalls 101 and 102 to the James River.

The permit includes limits for bacteria, pH, dissolved oxygen, carbonaceous biochemical oxygen demand, total suspended solids, ammonia, total nitrogen, and total phosphorus for discharges of fully treated effluent at Outfall 101 when flows are less than or equal to 75 million gallons per day.

During wet weather events when influent flows are greater than 75 million gallons per day, discharge of up to 65 million gallons per day of primary treated effluent from Outfall 102 is approved provided the permittee is in compliance with its Long Term Control Plan. Discharges from Outfall 102 are not subject to effluent limits; however, the permit requires monitoring and performance evaluations when discharges from Outfall 102 occur.

The permit also includes effluent limitations for bacteria, pH, and dissolved oxygen applicable to the combined WWTP discharge at Outfall 001 to the James River.

Industrial Stormwater Requirements for WWTP

The permit includes controls and limitations for industrial stormwater discharges from the WWTP and requires the City to develop/update and implement their Stormwater Pollution Prevention Plan (SWPPP) for the WWTP. In addition, the City must review the effectiveness of their SWPPP and related best management practices (BMPs) if bacteria levels rise above a certain threshold.

CSS Requirements

The permit requires the City to implement nine minimum controls, consistent with EPA's CSO Control Policy. The permit also requires continued implementation of the City's January 2002 Long Term Control Plan. Implementation of the plan is designed to provide capture of approximately 87 percent volume and achieve greater than 85 percent removal of biochemical oxygen demand and total suspended solids in the average year.

MS4 Requirements

The permit includes requirements to reduce pollutants in MS4 discharges to the maximum extent practicable (MEP), consistent with the federal regulations at 40 CFR 122.34(a), to protect water quality and satisfy the requirements of the Clean Water Act Section 402(p)(3)(B) standard for large and medium-sized MS4s. To optimize the City's CSS and MS4 stormwater pollutant reductions, the permit specifies factors the City should consider when determining appropriate BMPs, including:

- Adequate funding from the City of Richmond Stormwater Utility.
- Other stormwater funding allocated to the City (e.g., funding from the City of Richmond Wastewater Utility for the CSS, funding from the Virginia Stormwater Local Assistance Fund).
- The benefit-cost ratio of CSS projects compared to the benefit-cost ratio of MS4 projects.
- The relative spatial and pollutant reduction benefit of CSS projects compared to MS4 projects based on the outfall locations affected.

The permit also requires the City to develop, implement, and enforce an MS4 program plan describing how the City will comply with the permit's six minimum control measures and the applicable Chesapeake Bay TMDL special conditions. The City is allowed to modify the MS4 Program Plan through an adaptive, iterative approach that provides flexibility to deal with unique circumstances specific to the MS4.

The Virginia Stormwater Local Assistance Fund provides matching grants to local governments to plan, design, and implement stormwater BMPs that address cost efficiency and commitments related to reducing water quality pollutant loads.

Monitoring and Reporting Requirements

Compliance with the aggregate annual load limits is based on sampling and analyzing the WWTP discharge, modeling results for the CSS, and modeling for BMP reductions associated with the MS4. The permit establishes monitoring requirements to determine compliance with the effluent limits for Outfalls 001 and 101. In addition, the permit includes monitoring requirements for Outfall 102 for CSO-related bypass discharges when discharge flow equals or exceeds 75 million gallons per day.

The City is required to submit an Integrated CSS and MS4 Annual Report, which includes information on any CSOs that occurred during the reporting period, the implementation status of the nine minimum controls for the CSS and six minimum control measures for the MS4, and the implementation status of Chesapeake Bay TMDL and local TMDL action plans. The integrated annual report requirement enables more efficient reporting and allows the City to holistically address overlapping control measures (e.g., public education and outreach, public involvement and participation, pollution prevention, and good housekeeping).

Permit Effectiveness

Implementing an integrated planning approach has allowed the City to combine resources for its wastewater and stormwater utilities, resulting in an integrated municipal permit that acknowledges the relationship between the CSS and MS4, reduces redundancy in sampling and reporting requirements, and enhances communication. The integrated municipal permit approach has also provided the City with flexibility in selecting and prioritizing projects to meet pollutant-reduction goals.

The integrated municipal permit has benefited the City by increasing internal communication and coordination among the City's water programs. The Clean Water Plan has allowed the City to efficiently evaluate, manage, and implement water quality programs and work toward its goals and

objectives, while financially benefitting from the integrated planning approach.

The City expects that the approach used to develop the Clean Water Plan and implement the integrated municipal permit will provide a model for other municipalities that may be interested in implementing an watershed-based integrated planning approach.

Lessons Learned

Adam Eller, the Virginia DEQ permit writer, shared his "lessons learned" during development of the City's integrated municipal permit. According to Mr. Eller, one of the most challenging aspects of permit development was the lack of integrated municipal permit and integrated planning examples and resources, such as state or federal guidance, a permitting process checklist, or flow chart to ensure compliance with state and federal regulations. The City's integrated municipal permit was the first of its kind in Virginia. At the time of the initial multi-year (2014–2018) stakeholder input process, EPA's integrated planning framework approach was still a relatively new concept. Due to the newness of the approach, there were no other examples of this type of permit in Virginia and few nationally after which Virginia DEQ could model permitting strategies, language, requirements, processes, or compliance flexibilities. There were also few examples available to understand how the normal permitting processes might need to differ for an integrated municipal permit that covers multiple facilities. Mr. Eller suggested that having state or federal integrated planning guidance with examples and ideas for integrating different types of municipal facilities (e.g., CSS and MS4), as well as a permitting process checklist or flow chart to ensure compliance with federal and state regulations, would have been beneficial. EPA has since developed integrated planning examples, guidance, and tools, which are available on EPA's Integrated Planning website at https://www.epa.gov/npdes/integrated-planning-municipal-stormwater-and-wastewater.

When asked if the integrated municipal permit approach would be applicable to other watersheds, Mr. Eller suggested that the approach could be applicable to other municipalities that own or operate multiple facilities with discharge permits. A single, integrated permit can more easily allow a municipality to meet TMDL target goals by focusing on reducing overall net pollution in a watershed, which helps the permittee decide which projects will achieve a cleaner watershed faster. If the approach were used elsewhere, he suggests that the permitting authority tailor the integrated municipal permit to fit the particular municipality, facilities, outfall locations, and receiving waters.

Resources

Virginia Administrative Code (VAC). Water Quality Management Planning, James River Basin (9 VAC 25-720-60 et seq). https://law.lis.virginia.gov/admincode/title9/agency25/chapter720/section60/.

VAC. General Virginia Pollutant Discharge Elimination System (VPDES) Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia (VAC 25-820-10 et seq). Effective January 1, 2017. https://law.lis.virginia.gov/admincode/title9/agency25/chapter820/.

City of Richmond. March 2020. *Integrated CSS and MS4 2019 Annual Report*. https://www.rva.gov/sites/default/files/2021-04/Integrated%20CSS%20and%20MS4%202020%20Annual%20Report.pdf.

City of Richmond. January 2005. *Long Term CSO Control Plan*. https://www.accesswater.org/publications/proceedings/-292622/city-of-richmond-virginia-cso-long-term-control-plan.

City of Richmond. September 2019. *MS4 Program Plan*. https://www.rva.gov/sites/default/files/2019-06/MS4%20Program%20Plan%20FINAL%2006.05.2019.pdf.

City of Richmond. September 2017. *RVA Clean Water Plan*. https://rvah2o.org/rva-clean-water-plan/.

LimnoTech. October 2018. *Richmond, Virginia: Integrating Clean Water Planning and Implementation*. https://www.limno.com/richmond-virginia-integrating-clean-water-planning-and-implementation/.

U.S. Environmental Protection Agency (EPA). No date. *Chesapeake Bay Total Maximum Daily Load (TMDL)*. https://www.epa.gov/chesapeake-bay-tmdl.

EPA. January 2020. *The Straight Scoop on Integrated Planning*. https://www.epa.gov/green-infrastructure/straight-scoop-integrated-planning.

National Association of Clean Water Agencies (NACWA). "City of Richmond: A River Once Feared is Now Revered". https://nacwa50report.org/SuccessStories/Richmond.

Virginia Department of Environmental Quality (DEQ). August 2019. *Commonwealth of Virginia Chesapeake Bay TMDL Phase III Watershed Implementation Plan*. https://www.deq.virginia.gov/home/showpublisheddocument?id=4481.

Virginia DEQ. March 2005. *State Water Control Board Enforcement Action Special Order by Consent Issued to the City of Richmond Permit No. VA0063177*. https://www.deq.virginia.gov/home/showpublisheddocument?id=825.

Virginia DEQ. VPDES Integrated Permit No. VA0063177. Effective October 1, 2018.

Virginia DEQ. No date. *VPDES Integrated Permit No. VA0063177 Fact Sheet*.

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Permit Number:
VA0063177

Pollutants of Concern in Watershed:
Bacteria, mercury, chlordane, DDE, DDT, PCBs, pH, dissolved oxygen, chlorophyll a, and submerged aquatic vegetation

Pollutants Addressed in Permit:
Nutrients, bacteria, pH, dissolved oxygen, biochemical oxygen demand, and total suspended solids

Permit Issued:
October 1, 2018