Report to Congress on Integrated Plans to Comply with the Water Infrastructure Improvement Act of 2019

Office of Water
Washington, DC 20460

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Questions about this document should be directed to:

U.S. EPA Office of Wastewater Management

1200 Pennsylvania Avenue NW (4201M)
Washington, DC 20460
(202) 564-0748

Cover: Elliott Bay with Seattle skyline. Photo courtesy of Seattle Parks and Recreation.

Contents

Glossary and Abbreviations

Administrative Order—An enforcement document from EPA or a state that directs a municipality to take action to come into compliance and does not involve the judicial process.

Bypass—The intentional diversion of waste streams from any portion of a treatment facility.

Clean Water Act—The federal law passed by the U.S. Congress to control water pollution; it is officially titled the Federal Water Pollution Control Act Amendments of 1972.

Combined sewer overflow (CSO)—A discharge of untreated wastewater from a combined sewer system at a point prior to reaching the publicly owned treatment works treatment plant.

Combined sewer system—A municipal wastewater collection system owned by a state or municipality (as defined by Section 502(4) of the Clean Water Act) that conveys sanitary wastewaters (*i.e.*, domestic, commercial, and industrial) and stormwater through a single pipe system to a publicly owned wastewater treatment plant.

Consent decree—A legal agreement entered into by the United States (through EPA and the Department of Justice) and a municipality. Consent decrees are lodged with a court.

Dissolved oxygen—The oxygen freely available in water, vital for sustaining fish and other aquatic life as well as for preventing odors. Dissolved oxygen levels are one of the most important indicators of a waterbody's ability to support desirable aquatic life. Secondary treatment and advanced waste treatment are generally designed to ensure adequate dissolved oxygen in waste receiving waters.

Gray infrastructure—Piped drainage and water treatment systems designed to move urban stormwater away from the built environment.

Green infrastructure—The range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters (Clean Water Act Section 502).

Infiltration—Stormwater and groundwater that enter a sewer system through such means as defective pipes, pipe joints, connections, or manholes. Infiltration levels can be higher in older sewer systems where the infrastructure has deteriorated and where the original design, materials, and workmanship might have placed less emphasis on minimizing infiltration. Infiltration does not include inflow, though in some systems its flow characteristics can resemble those of inflow (*i.e.*, flow increases rapidly during and immediately after a rainfall event, due, for example, to a rapidly rising groundwater table).

Infiltration and inflow—The total quantity of water from both infiltration and inflow. Common strategies for reducing infiltration and inflow can include sewer main replacements, sewer main lining, manhole upgrades, lateral replacements, and elimination of illicit connections.

Inflow—Water, other than wastewater, that enters a sewer system from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross-connections between storm drains and sanitary sewers, catch basins, cooling towers, stormwater, or other drainage. Inflow does not include infiltration.

Long-term control plan (LTCP)—A water-quality-based CSO control plan that is ultimately intended to result in compliance with the Clean Water Act. LTCPs consider the site-specific nature of CSOs and evaluate the cost-effectiveness of a range of controls.

Municipal separate storm sewer system (MS4)—A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the Clean Water Act that discharges to waters of the United States; (ii) Designed or used for collecting or conveying storm water; (iii) Which is not a combined sewer; and (iv) Which is not part of a publicly owned treatment works (40 CFR § 122.26).

Publicly owned treatment works—A treatment works as defined by Section 212 of the Clean Water Act, which is owned by a State or municipality (as defined by Section 502(4) of the Clean Water Act). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a publicly owned treatment works treatment plant. The term also means the municipality as defined in Section 502(4) of the Clean Water Act, which has jurisdiction over the indirect discharges to and the discharges from such a treatment works (40 CFR § 403.3(q)).

Publicly owned treatment works treatment plant—That portion of the publicly owned treatment works which is designed to provide treatment (including recycling and reclamation) of municipal sewage and industrial waste (40 CFR § 403.3(r)).

Sanitary sewer overflow (SSO)—An untreated or partially treated sewage release from a sanitary sewer system prior to reaching the publicly owned treatment works treatment plant.

Sanitary sewer system—A municipal wastewater collection system that conveys domestic, commercial, and industrial wastewater (as well as limited amounts of infiltrated groundwater and stormwater) to a wastewater treatment facility. Areas served by sanitary sewer systems often have separate storm sewer systems to collect and convey stormwater from rainfall and snowmelt.

Sewer separation—The practice of separating a combined sewer system into separate sewers for sanitary and stormwater flows.

Storm sewer system—A municipal stormwater collection system that conveys stormwater, separate from sewage.

Total maximum daily load (TMDL)—The calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant load reduction target and allocates the necessary pollutant load reductions to the source(s) of the pollutant.

Waste load allocation—The portion of a receiving water's loading capacity that is allocated to one of its existing or future point source discharges of one or more pollutants. Waste load allocations constitute a type of water quality-based effluent limitation (40 CFR § 130.2(h)).

Wastewater treatment facility (WWTF)—A generic term for facilities that treat or manage wastewater, including publicly owned treatment works treatment plants.

Executive Summary

Congress enacted the Water Infrastructure Improvement Act (H.R. 7279) on January 14, 2019. The law directed the U.S. Environmental Protection Agency (EPA) to develop a report to Congress on the implementation of EPA's 2012 Integrated Municipal Stormwater and Wastewater Planning Approach Framework (EPA's Integrated Planning Framework). The Integrated Planning Framework was designed to help municipalities address competing clean water infrastructure investment needs and choose the most beneficial approaches for setting priorities and taking effective actions for achieving water quality goals. This report to Congress is a culmination of a nationwide scan, from March 2019 until July 2020, to determine how many municipalities have developed plans and which ones are implemented through permits, orders, or judicial consent decrees since EPA's Integrated Planning Framework was released on June 5, 2012.

Key findings:

- Twenty-seven municipalities have developed integrated plans in accordance with EPA's Integrated Planning Framework.
- Thirteen municipalities' integrated plans are being implemented through a permit, order, or judicial consent decree.
    - Six integrated plans are being implemented through permits.
    - One integrated plan is being implemented through an administrative order.
    - Six integrated plans are being implemented through consent decrees or consent orders.

Congress also directed EPA to report the costs, control measures, level of controls, and compliance schedules for each integrated plan implemented through a permit, order, or judicial consent decree. EPA's reading of integrated plans and conversations with the 13 municipalities found the following:

- Proposed budgets to implement integrated planning projects ranged from $15 million to $2 billion, with an average of $745 million.
- Integrated plans evaluated controls to prevent untreated sewage, partially treated sewage, and stormwater from entering waterways. They included controls for combined sewer overflows, sanitary sewer overflows, stormwater discharges, and wastewater treatment facilities.
- The schedules proposed in the integrated plans ranged from 5 years to 30 years, with an average of 21 years.

Municipalities are using EPA's Integrated Planning Framework to analyze existing wastewater and stormwater controls, gather stakeholder input throughout planning, and synchronize their goals with capital improvement plans. With the analyses, they can make smart investments for water resources management. Importantly, they can also create innovative and affordable ways to address the most serious water quality impairments first.

1 Introduction

The Clean Water Act passed by Congress in 1972 had a profound impact on reducing municipal water pollution by expanding and improving wastewater treatment across the country. As municipalities continue to improve their clean water infrastructure, they must successfully navigate and address issues, such as changing rainfall patterns and intensities, population growth and expanding service areas, aging infrastructure, competing priorities for public funds, and increasingly disparate impacts on their full range of ratepayers.

To help municipalities address competing issues and choose the most beneficial infrastructure approaches, the U.S. Environmental Protection Agency developed a voluntary approach for setting priorities and taking effective actions for achieving water quality goals. Launched in 2012, the Integrated Municipal Stormwater and Wastewater Planning Approach Framework (EPA's Integrated Planning Framework) is a tool to help municipalities achieve clean water requirements, better manage water resources, and enhance the quality of life for their residents.

EPA's Integrated Planning Framework was designed to present a flexible yet comprehensive process. Municipalities that have used it have benefited from the process for evaluating existing wastewater and stormwater controls, gathering stakeholder input throughout planning, and finding ways to address the most serious water quality impairments first. They have reported a range of benefits including cost savings, improved community buy-in, and greater pollutant load reductions than they would have achieved using traditional planning and scheduling techniques and siloed public works project management.

Recognizing the benefits of this approach, Congress enacted the Water Infrastructure Improvement Act (H.R. 7279) on January 14, 2019. This Act provides greater certainty that integrated planning offers municipalities a comprehensive, voluntary path to meeting Clean Water Act requirements. It directed EPA to develop a report to Congress on the implementation of integrated planning.

From March 2019 until July 2020, EPA reviewed integrated plan documentation nationwide to determine which municipalities developed integrated plans that have been implemented through a permit, order, or judicial consent decree since June 5, 2012, pursuant to the Integrated Planning Framework (refer to the map on page 2). This report is divided into the following sections:

- Section 2 offers details on the background and purpose of EPA's Integrated Planning Framework.
- Section 3 summarizes the benefits municipalities gain from using EPA's Integrated Planning Framework.

The Water Infrastructure Improvement Act, Section (3)(c), states:

REPORT TO CONGRESS.—Not later than 2 years after the date of enactment of this Act, the Administrator shall submit to the Committee on Environment and Public Works of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives, and make publicly available, a report on each integrated plan developed and implemented through a permit, order, or judicial consent decree pursuant to the Federal Water Pollution Control Act since the date of publication of the "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" issued by the Environmental Protection Agency and dated June 5, 2012, including a description of the control measures, levels of control, estimated costs, and compliance schedules for the requirements implemented through such an integrated plan.

- Section 4 offers a separate profile of each integrated plan that have been implemented through a permit, consent decree, or administrative order. These profiles also describe the water quality impacts and community benefits achieved.
- Appendix A provides a summary table of proposed costs, levels of controls, control measures, and compliance schedules for all the municipalities with integrated plans that are implemented through permits, consent decrees, or administrative orders as called for by the Water Infrastructure Improvement Act.

2 Background and Purpose of EPA's Integrated Planning Framework

Over the past nearly five decades, EPA, states, and municipalities have made significant progress protecting our waters through implementation of the Clean Water Act. However, challenges remain. As the nation faces population growth, aging infrastructure, limited resources, and increasingly complex water quality issues, new approaches to plan for and invest in infrastructure improvements are needed. Municipalities managing wastewater treatment facilities, sewer systems, and stormwater infrastructure must prioritize their investments. They must also evaluate different approaches and options for improving their systems, including gray, green, and data infrastructure investments. Focusing on each infrastructure need individually may constrain a municipality from addressing its most serious water quality issues first. To address this challenge, EPA developed the Integrated Planning Framework, a voluntary approach that municipalities can use to identify efficiencies and sequence investments to meet multiple wastewater and stormwater requirements by pursuing the highest-priority projects first. Integrated planning also promotes innovative solutions to improving water quality, such as green infrastructure, which not only helps to meet Clean Water Act obligations but also provides other benefits that can enhance a community's livability.

The integrated planning process is a comprehensive planning process that seeks to address a municipality's Clean Water Act–related obligations while prioritizing those with the greatest human health and environmental consequences. An assessment of existing water quality challenges in an integrated plan may identify multiple pollutants that impair water quality (*e.g.*, pathogens, nutrients, suspended solids) and multiple sources for these pollutants (*e.g.*, wastewater, stormwater). In such cases, a plan should describe the relative priorities of the projects chosen, including how those priorities reflect the relative importance of adverse impacts on public health and water quality. If a municipality's integrated plan addresses water quality impairments caused by pollutants from multiple regulated municipal wastewater and/or stormwater discharges, that plan can help the municipality articulate for its permitting authority the proposed sequencing and prioritization of projects.

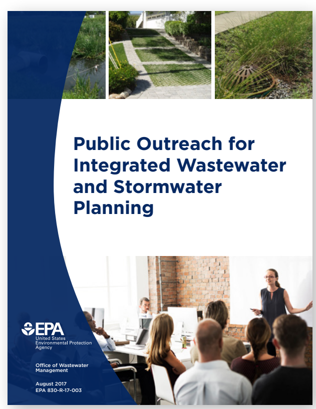
EPA's Integrated Planning Framework lays out a flexible process and includes overarching principles and essential elements that integrated plans should address.

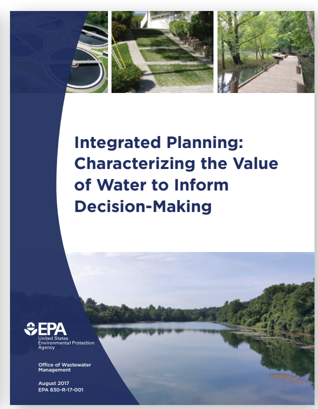
New Bedford's wastewater treatment facility at Fort Rodman. Photo courtesy of Shoreline Aerial Photography LLC, provided by CDM Smith.

Six Elements Identified in EPA's Integrated Planning Framework

1. A description of the water quality, human health, and regulatory issues to be addressed in the plan.
2. A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.
3. A process that opens and maintains channels of communication with relevant community stakeholders to give full consideration of the views of others in the planning process and during implementation of the plan.
4. A process for identifying, evaluating, and selecting options and proposing implementation schedules.
5. A process for evaluating the performance of projects identified in a plan, which can include evaluating monitoring data, information developed by pilot studies, and other studies.
6. A process for identifying, evaluating, and selecting proposed new projects or modifications to ongoing or planned projects and implementation schedules based on changing circumstances.

Since 2012, EPA has provided integrated planning technical assistance to five municipalities around the country. The assistance piloted EPA's Integrated Planning Framework for communities with different sizes, water quality goals, and infrastructure challenges. Feedback from the five projects provided practical examples and demonstrated benefits for communities interested in launching an integrated planning process.





EPA has also developed a variety of reports and associated tools to support communities. These tools focus on effective approaches for engaging the public, gathering valuable stakeholder input, and methods for analyzing data to estimate benefits to water resources.

By providing technical assistance, developing tools to help communities, and carrying out research for this report, EPA has gathered the knowledge and experience it needs to foster broad adoption of integrated planning.

3 Benefits of Integrated Planning

Integrated planning offers municipalities a holistic, long-term way to achieve their Clean Water Act goals. With a process for bringing all partners and stakeholders to the table, a municipality can synchronize its community's goals with capital improvement plans to ensure smart investments for water resources management. It can set priorities—for example, stormwater capture, drinking water source protection, wastewater reuse, or streambank restoration—that help meet Clean Water Act regulatory requirements and improve amenities that can make its community a great place to live and work.

Holistic planning with extensive stakeholder engagement is leading to the following major benefits for the communities highlighted in this report:

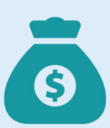
- Faster water quality improvements and health protections.
- More cost-effective and affordable infrastructure investments.
- Consideration of investments that support other community objectives.
- Innovative long-term solutions that reduce pollution sources rather than just controlling or treating discharges.

Faster Water Quality Improvements and Health Protections

The consent decree for Seattle, Washington—requiring the city to limit combined sewer overflows (CSOs) to one per outfall per year—allowed the city to develop an integrated plan if that plan resulted in significant water quality improvements beyond what the CSO projects alone would achieve under a long-term control plan. During the integrated planning process, Seattle identified, ranked, and compared potential stormwater projects to the lowest-ranking CSO projects based on water quality impacts and other community benefits. The resulting integrated plan featured three stormwater projects that modeling showed would remove larger quantities of polychlorinated biphenyls (PCBs), fecal coliform, total suspended solids, phosphorus, and other pollutants than the CSO projects alone. This projection proved to be correct. For example, a 2018 expanded stormwater arterial street sweeping project in Seattle removed nearly 60 tons of total suspended solids and 90 pounds of phosphorus—about 90 times as much total suspended solids and 4.5 times as much phosphorus as the 6 CSO projects deferred to 2028–2030 in the plan, though fecal coliform reduction was only 15 percent of the deferred CSO projects.

More Cost-Effective and Affordable Infrastructure Investments

Akron, Ohio, pursued integrated planning to address projects required by a consent decree, which totaled $1.14 billion in capital costs. Through revised project sequencing, implementation of green infrastructure, and partial sewer separation, the city:



Saved $158 million in project costs between 2015 and 2019.

Treated an additional 826 million gallons of wastewater beyond what the consent decree required.

Considering Investments That Support Other Community Objectives

Springfield, Missouri; Greene County; and the area's public utility company developed a "citizen-focused approach" to address water quality impairments and community priorities. The city organized an Environmental Priorities Task Force of community members, city and county staff, and technical experts to holistically examine the city's environmental resources and identify challenges important to the community. This group worked together to:

- Set goals, such as reducing polycyclic aromatic hydrocarbons in stormwater to improve water quality.
- Identify affordable solutions to wastewater and stormwater challenges.
- Meet objectives for solid waste and air quality.

To achieve its goal of reducing polycyclic aromatic hydrocarbons (PAHs) in stormwater, the city implemented a "Clean Pavement Initiative" to encourage businesses and residents to voluntarily choose sealants for parking lots and driveways that are lower in polycyclic aromatic hydrocarbons.

Innovative Long-Term Solutions That Reduce Pollution Sources Rather Than Just Controlling or Treating Discharges

Richmond, Virginia, initiated an integrated planning process to gain efficiencies in managing multiple water quality requirements and make progress toward its clean water goals. A primary driver for Richmond was to develop a single integrated permit that complies with pollutant load allocations for bacteria, nitrogen, phosphorus, and sediments in three separate permits. After Richmond engaged the public extensively throughout the planning process and completed the integrated plan, the Virginia Department of Environmental Quality issued Richmond an integrated permit covering the wastewater treatment facility, CSOs, and stormwater discharges. This permit includes the city's integrated plan as documentation of the integrated planning process. Since it began implementing the plan, Richmond has installed green infrastructure practices that treat stormwater discharges from nearly 20 acres in the combined and separate sewer areas.

4 Integrated Plans Implemented Through Permits, Orders, or Judicial Consent Decrees

EPA reviewed planning documents from municipalities across the country and identified nearly 27 that used the integrated planning process outlined in EPA's Integrated Planning Framework. Out of the 27 municipalities that completed integrated plans in accordance with the Integrated Planning Framework, 13 municipalities implemented their plans through permits, administrative orders, or judicial consent decrees, which is what the Water Infrastructure Improvement Act referred to in its requirement for EPA's Report to Congress. This section presents profiles of these 13 municipalities, with details on their challenges, integrated planning processes, and results as described in their integrated plans, as well as associated permits, orders, or judicial consent degrees. Appendix A includes a table with further plan-specific details.

A great blue heron looks for its next meal on the James River as rafters paddle by in Richmond's downtown rapids. Photo courtesy of RVA Paddlesports.

New Bedford, Massachusetts

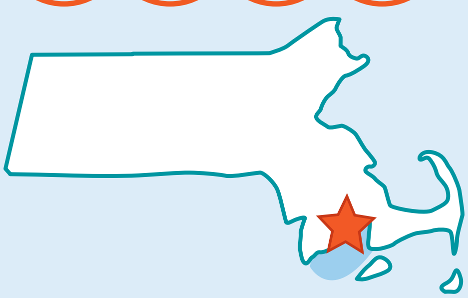
EPA Region 1

lighting the way NB new bedford

2017 Long Term CSO Control and Integrated Capital Improvements Plan

100,000 *population*

CSO MS4 SSO WWTF



Core Issues Addressed Through the Integrated Planning Process

- Water quality impairments
- Public health and safety
- Existing infrastructure reliability
- Climate change
- Sustainability
- Need for economic development

Located on Buzzards Bay in southeastern Massachusetts, New Bedford is a city with a rich maritime history and a population of nearly 100,000. New Bedford owns and operates combined and separate sanitary sewers that transport wastewater to the city's wastewater treatment facility, which discharges into Buzzards Bay. The city's storm sewers and CSO outfalls discharge into the Acushnet River estuary, Clarks Cove, and New Bedford Harbor. Buzzards Bay supports tourism, marinas, and recreational fishing.

Challenges

In 1987, New Bedford agreed to reduce CSOs and build a new secondary wastewater treatment facility under a consent decree with EPA and the Massachusetts Department of Environmental Protection. The consent decree was updated in 1990 and 1995 to address cited affordability constraints and allow the city to prioritize wastewater treatment facility improvements and delay CSO abatement activities.

By 2012, New Bedford had reduced CSO volumes by 91 percent since 1990, but it still discharged 284 million gallons of sewage into waterways that year. That same year, EPA issued an administrative order that required the city to address sanitary sewer overflows (SSOs) and develop a scope for updating its long-term control plan (LTCP) for managing CSOs. In addition to these requirements, New Bedford anticipated new nitrogen effluent limits that could require costly upgrades to its wastewater treatment facility. The city also has a stormwater discharge permit that includes a total maximum daily load (TMDL) for pathogens in Buzzards Bay.

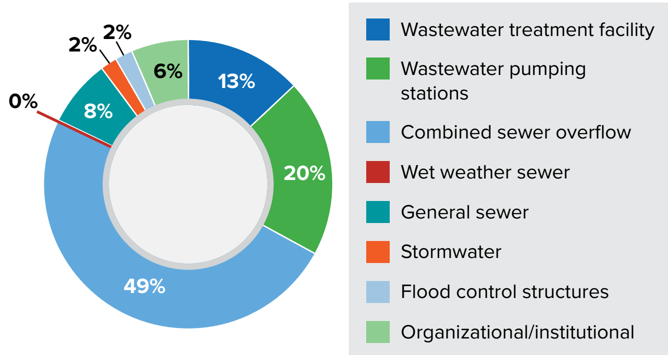
Integrated Planning in Action

By 2016, New Bedford met all the deadlines in EPA's 2012 administrative order and submitted a scope of work to integrate the LTCP with a capital improvement plan in lieu of the more traditional LTCP that the order required. The city asked to use the proposed integrated planning approach to prioritize projects that would address overarching issues.

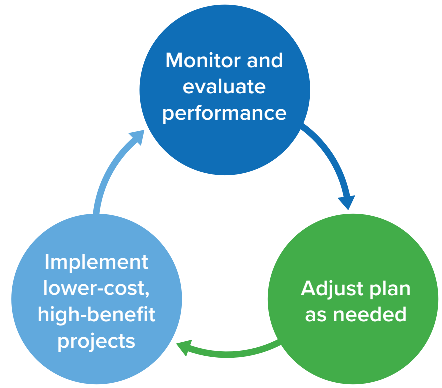
New Bedford staff held meetings with various stakeholders, city departments, and the public and identified more than 150 concerns and impacts. For example, bacteria reduction and system failure prevention were the city's priorities in addition to CSO abatement. The city then distilled this input into six core issues to address through integrated planning (see box at left) and established goals for each. For example, the city set the following six project goals for addressing water quality impairments: 1) address management goals in the TMDL; 2) reduce nitrogen and phosphorus to increase dissolved oxygen concentrations; 3) control/reduce discharges of oil, grease, and trash; 4) ensure the wastewater treatment facility is operated to reduce nitrogen discharges; 5) prioritize control of CSOs in sensitive areas; and 6) meet the requirements of the city's stormwater permit.

New Bedford identified locations within the city where systems were

Projected Distribution of 20-Year Integrated Capital Plan Costs by Category



Approach to Project Implementation and Monitoring



not performing optimally or needed improvement to meet plan goals through a series of internal workshops, public meetings, document reviews, modeling, system assessments, and site investigations. The city proposed projects to address all identified problems in these specific locations; however, the full suite of projects would have cost $1.2 billion, which the city deemed unaffordable. Therefore, the planning team focused on how best to prioritize and select projects to include in the integrated plan.

New Bedford first divided the full suite of projects into eight categories (see box below). It then prioritized the projects within each category, considering how critical the associated infrastructure was, the water quality benefits, how well each project supported compliance with permits and the administrative order, social impacts, administrative considerations, and anticipated construction costs. The city also conducted modeling to determine how much wastewater treatment facility, pumping station, and CSO control projects would reduce CSO volume and flooding, as well as how much infrastructure would be renewed.

From the prioritized category-specific lists, New Bedford then chose projects for its integrated plan based on affordability, alignment with other city initiatives or projects, and necessity for maintaining reliable operation of the sewers and wastewater treatment facility. The city selected projects from all eight categories. The city also proposed a schedule that equitably distributed projects across 20 years (2017–2036) to avoid large rate increases in any given year.

The capital budget for New Bedford's final recommended plan totaled about $260 million over 20 years (see graphic above). More than half of the total cost (*i.e.*, $143 million) was for combined sewer projects; another third was for wastewater infrastructure renewal projects. The schedule focused first on infrastructure repair and renewal to eliminate illicit connections to the storm sewer system, reduce infiltration and inflow into the combined sewer system, and eliminate a CSO outfall. New Bedford's recommended plan included optimizing the existing wastewater treatment facility to maintain low nitrogen effluent levels, rather than installing new equipment.

New Bedford projected that the plan would reduce CSO volume by an additional 82 million gallons from the city's 2016 levels, resulting in a 97 percent reduction from its 1990 levels. It prioritized CSO reduction to Clarks Cove, which is the most sensitive receiving water. At the time of plan completion, New Bedford expected to achieve a 48 percent reduction in total nitrogen discharge and a substantial reduction in bacteria discharged during rain events to the Acushnet River, Clarks Cove, and New Bedford Harbor.

Project Categories

- Wastewater treatment facility
- Pumping stations
- CSO controls
- Wet weather sewer
- General sewer
- Stormwater controls
- Flood control structures
- Organizational/ institutional

Results

New Bedford submitted its *Long Term CSO Control and Integrated Capital Improvements Plan* to EPA in 2017. A 2019 consent order formally implemented the first phase of the plan that included projects for the first seven years. The city started several integrated plan projects before the 2019 order, including equipment upgrades at the wastewater treatment facility, two sewer separation projects, two pumping station upgrades, and a flow monitoring program.

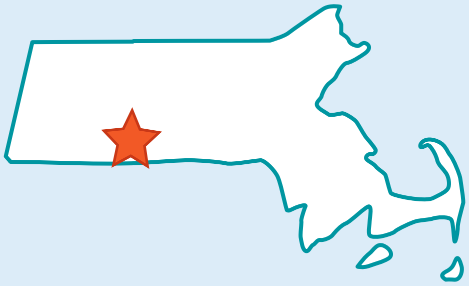
Springfield, Massachusetts

EPA Region 1

2014 Springfield Water and Sewer Commission Integrated Wastewater Plan

155,000 *population*

CSO SSO



Springfield is the third largest city in Massachusetts, with a population of about 155,000. The Springfield Water and Sewer Commission is an independent regional public utility that operates combined and separate sanitary sewer systems that transport wastewater to a wastewater treatment facility. This facility and portions of the city's storm sewer system discharge into the Connecticut River—the longest river in New England and one of only two American Heritage Rivers in New England. The Connecticut River in Springfield is a popular recreational venue. Along with fishing and boating, the Connecticut River Walk and Bikeway includes a 4-mile stretch along the Springfield riverfront that is popular for walking, jogging, biking, and rollerblading.

Challenges

Springfield is an older post-industrial city with aging infrastructure. Springfield has experienced frequent CSOs, which discharge sewage into the Connecticut, Chicopee, and Mill Rivers. During heavy rain events, stormwater enters the Commission's combined and separate sanitary sewer system, causing CSOs and SSOs because of lack of system capacity. The Commission had reduced SSOs by 70 percent between 2006 and 2013 and wanted to further reduce these discharges. Springfield's wastewater treatment facility is also the largest contributor to the Connecticut River Watershed's total nitrogen loading. In 2001, a TMDL (established for Long Island Sound, into which the watershed drains) required the facility to reduce nitrogen loading. Without a long-term plan to maintain aging infrastructure and meet Clean Water Act requirements, the Commission struggled with prioritizing projects that address CSO and SSO events, as well as future nutrient reduction requirements at the wastewater treatment facility.

The Commission invested $100 million between 2000 and 2012 to reduce CSOs as required by a series of administrative orders and based on a draft 2000 LTCP. The administrative order issued by EPA in 2008 required the Commission to finalize its LTCP to reduce

Riverfront Park with Memorial Bridge in the background. Photo courtesy of Jaimye Bartak, SWSC.

Springfield Dragon Boat Festival on the Connecticut River. Photo courtesy of Mark M. Murray.

CSO volume by 85 percent. Understanding the competing needs of CSO compliance projects and other infrastructure renewal projects, the Commission recognized that the Integrated Planning Framework would allow for an adaptable approach to prioritize all the utility's wastewater needs.

Integrated Planning in Action

Between 2012 and 2014 the Commission performed comprehensive evaluations and condition assessments of all its wastewater assets by implementing a robust asset management program. That program's data-driven strategy helped create a prioritized list of needs based on risk and consequence of failure. In 2014, the Commission began the integrated planning process in order to address the high-risk infrastructure and renewal projects while also meeting CSO obligations faster and more cost-effectively. The Commission began by prioritizing the 2012 LTCP CSO projects and wastewater capital improvement projects based on CSO volume reduction and human health benefits. The Commission sequenced the highest-volume, most cost-effective CSO projects first, thereby reducing financial burden on ratepayers. This allowed Springfield the financial flexibility to implement wastewater capital improvement projects to improve the resiliency and reliability of its system. Projects such as sewer rehabilitation and a pumping station renewal project could be implemented more quickly to help the Commission achieve CSO reduction milestones and improve operational performance at the wastewater treatment facility.

The Commission's proposed integrated plan schedule included six phases of CSO projects over 20 years and 11 phases of wastewater capital improvements over 40 years. The CSO projects were sequenced to reduce projected CSO volume by over 50 percent within the first two phases—more quickly than what would have been achieved by implementing the original LTCP. Integrated plan projects proposed later in the schedule balanced further CSO reductions with capital improvements necessary to maintain infrastructure and address SSOs.

The broader system understanding achieved through the integrated planning process, along with a better understanding of financial conditions, capabilities, and rate impacts, allowed the Commission to better evaluate a variety of alternatives and choose projects with multiple benefits across key metrics. The box below shows the secondary benefits the Commission expected to gain.

The total cost of the integrated plan through 2035 was projected to be $447.2 million. The plan estimated an 89 percent annual CSO volume reduction upon completion.

Results

The Commission's *Integrated Wastewater Plan* was implemented in a 2014 administrative order from EPA, which required Springfield to complete the second and third phases of CSO improvements. Initial projects reduced CSO discharge volume and SSO events: CSO volume dropped 56 percent from baseline levels in 2017 and the number of SSO events decreased by 47 percent from 2014 to 2019. In 2018, based on outcomes from its asset management ranking system, the Commission completed rehabilitation of a major interceptor sewer project.

Secondary Benefits from the Integrated Planning Process

- Risk reduction
- Better system reliability
- Better performance
- More resiliency
- More long-term rate stability

Richmond, Virginia

EPA Region 3

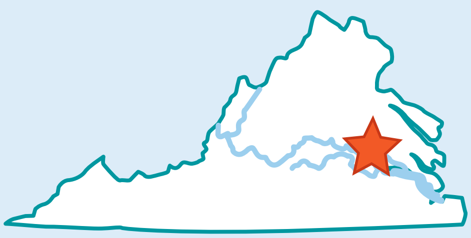
Richmond is the capital of Virginia, home to about 227,000 people. The James River, Virginia's largest river and the largest tributary to the Chesapeake Bay, runs through the capital. The James River cuts through the heart of the city and has rapids that are popular with boaters and whitewater rafters.

The city of Richmond manages three water utilities: wastewater, stormwater, and drinking water. Flows from Richmond's combined and separate sanitary sewer systems are treated at the city's wastewater treatment facility, which discharges into the James River. About two-thirds of Richmond is served by a storm sewer system. Stormwater discharges and CSOs also flow into the James River, as well as its tributaries.

2017 RVA Clean Water Plan

227,000 *population*

CSO MS4 WWTF



Challenges

Stormwater, discharges from the wastewater treatment facility, and sewage overflows contribute bacteria, sediment, and nutrients into Richmond's local waterways and ultimately the Chesapeake Bay. Requirements to control and reduce pollutant discharges to the James River and its tributaries historically were defined in many separate permits, orders, and regulations. These separate water quality requirements included waste load allocations associated with TMDLs for bacteria, nitrogen, phosphorus, and sediment in three separate permits: a permit for wastewater treatment facility discharges, a wastewater treatment facility general permit for nutrients, and a permit for stormwater discharges. Richmond also agreed to a 2005 consent order from the Virginia Department of Environmental Quality to better regulate CSOs through an LTCP.

Integrated Planning in Action

In 2014, Richmond began a stakeholder-driven integrated planning process to gain efficiencies in managing multiple water quality requirements and make progress toward its clean water goals. This process emphasized stakeholder involvement because of the importance of water quality to many groups and the general public, and because of the need to collaborate to achieve goals. Another primary driver for Richmond was to develop a single integrated permit that complies with an aggregated waste load allocation for the city's wastewater treatment facility, CSOs, and stormwater discharges. Both the city's and the community's goals guided a list of comprehensive water protection-based strategies for the plan. In addition, the city evaluated the impact the existing regulations would have on residents' water and sewer rates. Based on this evaluation, Richmond determined that it needed to maximize the effectiveness of funds through analysis of alternatives and sequencing of actions to address human health and water quality.

Richmond engaged the public extensively throughout the planning process. The city developed an outreach plan and established a technical stakeholder group that included environmental non-governmental organizations, utilities, community coalitions, city planners, park and river protection organizations, universities, and state regulators. The city used a third-party facilitator to build a trusting relationship with stakeholders and gather useful input. Richmond also created an outreach campaign to promote the city's progress and educate the community about pollution prevention.

The city's water quality managers and stakeholders produced a common set of integrated planning goals (see box on page 13). For each goal, the stakeholders developed multiple objectives, then evaluated the strategies to achieve these objectives (see table on page 13). For example, the pollutant reduction strategy included illicit

Estimated Five-Year Costs of Richmond's Proposed Strategies

Strategy	Capital Cost	Operation and Maintenance Cost (Five Years)	Total Cost
Riparian restoration	$900,000	$200,000	$1,100,000
Storm sewer green infrastructure	$10,500,000	$2,000,000	$12,500,000
Combined sewer green infrastructure	$2,600,000	$750,000	$3,350,000
Stream restoration	$1,700,000	$1,200,000	$2,900,000
Planting native species	$70,000	$95,000	$165,000
Planting trees	$1,600,000	$600,000	$2,200,000
Land conservation	*	*	*
Water conservation	$220,000	$50,000	$270,000
Pollutant reduction in storm sewer areas	$16,385,000	†	$16,385,000
Total	$33,975,000	$4,895,000	$38,870,000

** The city did not estimate costs for the land conservation strategy.*
† The city will estimate operation and maintenance costs for street sweeping and catch basin cleanout activities for each of the five years of the permit.

Richmond's Integrated Planning Goals

- Manage wastewater and stormwater to improve the quality and quantity of groundwater and surface water
- Protect and restore habitats to support balanced aquatic and terrestrial communities
- Eliminate redundant activities; be more efficient and effective in addressing wet weather impacts and improving water resources
- Work to identify projects to encourage public participation in reducing water pollution
- Implement land conservation and restoration practices to improve water quality
- Create partnerships to minimize costs and identify the most environmentally beneficial projects
- Maximize water availability through efficient management of drinking water, stormwater, and wastewater
- Provide safe, accessible, and ecologically sustainable water-related recreational opportunities for all
- Collaborate to gather consistent high-quality data to characterize the status and trends of water resources to gauge the effectiveness of restoration efforts

discharge special studies and best management practice performance modeling to reduce pollutant discharges in the storm sewer areas.

The city then modeled the strategies to see how effective they would be in meeting Richmond's permit requirements, water quality standards, and other integrated planning objectives. The planning team developed specific metrics and associated targets for each strategy, such as pounds of pollutant removed, linear feet of stream restored, and acres of tree canopy planted.

The city estimated the costs of nine strategies for the first five years of implementation would be about $39 million (see table above). Richmond estimated a longer-term schedule for CSO projects based on its LTCP. Capital, operation, and maintenance for Richmond's LTCP CSO infrastructure projects would cost more than $392 million over 30 years.

Richmond's final integrated plan describes a process the city will use to implement individual projects to help meet its targets while keeping affordability in mind.

Results

In 2018, the Virginia Department of Environmental Quality issued Richmond an integrated permit covering the wastewater treatment facility, CSOs, and stormwater discharges. This permit includes aggregate annual waste load limits and monitoring requirements for all systems Richmond manages. The permit holistically considers stormwater and combined sewer system focused projects in light of the benefit-cost ratio and pollution reduction benefits when choosing and implementing projects and practices. Richmond's integrated permit implements the *RVA Clean Water Plan*, which the city published in 2017 as final documentation of the integrated planning process.

Since it began implementing the *RVA Clean Water Plan*, Richmond has made significant progress toward its targets. As of January 2020, the city had reached:

- 66 percent of its target for building LTCP CSO projects.
- 623 percent of its stream restoration target, restoring 13,080 more linear feet of stream than planned.
- 23 percent of its green infrastructure target for the combined sewer system.
- 12 percent of its green infrastructure target for the storm sewer system.
- 30 percent of its tree planting target.
- 950 percent of its land conservation target, conserving 103 more acres than planned.

Atlanta, Georgia

EPA Region 4

CITY OF ATLANTA DEPARTMENT OF
watershed management

2019 Integrated Plan for the City of Atlanta

500,000 *population*

CSO MS4

Atlanta is the capital of Georgia, home to approximately 500,000 people and the center of a metropolitan area of more than 6 million people. The city operates separate sanitary and combined sewer systems, which connect to three wastewater treatment facilities that discharge to the Chattahoochee River. The combined sewer system also includes remote treatment facilities that provide partial treatment of CSOs during heavy storms. In addition to these wastewater sewer systems, Atlanta operates a storm sewer system that discharges to the Chattahoochee and Ocmulgee Rivers. The Chattahoochee is popular for tubing, paddle boarding, and canoeing, and was the first U.S. river to be named a National Water Trail.

Challenges

Excess stormwater entering Atlanta's combined sewer system during storms causes CSOs. The wastewater treatment facilities may also reach maximum capacity because of excess flows from the combined sewer or inflow into the sanitary sewer system during these storms. The CSO remote treatment facilities are designed to reduce pollution from these overflows; they go into operation at certain CSO points when the wastewater treatment facilities are at maximum flow treatment capacity. In 2015, some of these remote "partial treatment" facilities did not treat to levels that met water quality standards for metals, so the Georgia Department of Natural Resources issued Atlanta two combined sewer system permits that required the city to develop an integrated plan to address discharges from the partial treatment facilities. The permits specified that green infrastructure and innovative technology should be considered as mechanisms to protect human health and improve water quality in the integrated plan. In addition, the city must comply with permits for its wastewater treatment facilities and a stormwater permit for discharges from the storm sewer system.

Atlanta's Performance Criteria

- Risk mitigation
- Regulatory compliance
- Operational efficiency
- Durability/resiliency
- Sustainability initiatives
- Visibility
- Safety and reliability

Integrated Planning in Action

In 2015, Atlanta began an integrated planning process to meet permit requirements and reduce the use of its remote partial treatment facilities. The city developed a process for identifying projects that would reduce runoff volumes and pollutant loadings, then evaluated these projects based on cost (*i.e.*, whether they were possible under available funding) and how well they met performance criteria (see box at left). Atlanta's final integrated plan did not identify specific projects but rather committed to pursue projects through the proposed evaluation and selection process that protect the environment, support economic development, and improve quality of life as priorities for implementation.

Results

The Georgia Department of Natural Resources approved the *Integrated Plan for the City of Atlanta* in 2019. Using the project selection process outlined in the integrated plan, the city designed the Rodney Cook Sr. Park, a green infrastructure project designed to alleviate flooding by capturing and storing up to 10 million gallons of stormwater using rain gardens, stormwater planters, and constructed wetlands. The plan called for this project to be completed in 2020, and to date it has helped mitigate CSOs.

Cook Park capacity relief project. Photo courtesy of J. Cory Rayburn.

Akron, Ohio

EPA Region 5

2015 Integrated Plan

200,000 *population*

CSO WWTF

Cuyahoga River Homecoming, June 2020. Photo courtesy of City of Akron.

The City of Akron, in northeastern Ohio, has a population of about 200,000. Akron operates combined and separate sanitary sewer systems in addition to storm sewers. The combined and separate sanitary sewer systems transport wastewater to the city's wastewater treatment facility, which discharges to the Cuyahoga River, while the storm sewer system discharges to the Ohio Canal and Little Cuyahoga River. These tributaries flow to the Cuyahoga River, which is the southern gateway to the Cuyahoga Valley National Park. In 2019, the national river conservation organization American Rivers named the Cuyahoga River its "River of the Year" to celebrate the environmental progress made during the prior 50 years.

Challenges

Akron historically has discharged an estimated 1.2 billion gallons of CSOs per year. Also due to excess flows during heavy rainfall events, the city's wastewater treatment facility discharged an average 1.2 billion gallons of partially treated wastewater per year into the Cuyahoga River and its tributaries resulting from bypasses of the secondary treatment units. The Cuyahoga River is impaired by bacteria, nutrients, and dissolved oxygen.

In 2014, a U.S. District Court entered a consent decree with EPA, the Ohio Environmental Protection Agency, and Akron that required Akron to implement its LTCP (as updated in 2011). At the time of the consent decree, Akron had already reduced its CSO volume to 816 million gallons per year. The LTCP included separating a portion of its combined sewers, installing 10 storage basins and 2 wastewater storage tunnels, upgrading the wastewater treatment facility, and completing collection system projects. The city estimated it would cost more than $1.14 billion to implement the required projects by 2027 to meet the required level of control of zero untreated overflows in a typical year and zero bypasses of secondary treatment at the wastewater treatment facility. Akron raised sewer rates significantly between 2005 and 2015 but determined that current sewer rates were not high enough to pay for the consent decree projects and meet other Clean Water Act obligations, such as stormwater requirements.

Integrated Planning in Action

In December 2013, Akron began an integrated planning process to consider green infrastructure and other innovative solutions that might improve water quality faster and more cost-effectively than the existing LTCP projects. The city involved the public throughout this process through educational events, meetings, and a stakeholder group it formed. Akron also communicated with stakeholders through newspaper articles, utility bill mailers, and a website. The city rebranded its CSO program as Akron Waterways Renewed! to better communicate the benefits of improving water quality to the public.

Uhler conveyance project and Little Cuyahoga River stream bank restoration. Photo courtesy of City of Akron.

Akron first chose projects to include in the integrated plan and prioritized them based on environmental, economic, and social benefits (graphic below). The prioritization process identified which projects would be implemented first. The city scored projects based on weighted criteria (see chart below). The highest-scoring projects included some of the original LTCP projects as well as alternatives to LTCP projects. These included improvements to the wastewater treatment facility, the use of green infrastructure to attenuate CSO flows and capture stormwater in the separate storm sewer areas, dam removal, streambank restoration, flood mitigation, and sanitary sewer rehabilitation.

The city used a financial model to compare integrated plan project scenarios with the original LTCP projects. The model was able to prioritize and sequence projects based on funding availability, rate requirements, cost, affordability, and construction schedules. Once the modeling framework was set up, Akron assessed alternative scenarios to estimate costs, future schedules, affordability, and rate increases. The city modeled scenarios with construction completion by 2027 and 2040. Akron concluded that the integrated plan projects would require a cumulative lower rate increase through 2040 compared to the original LTCP projects.

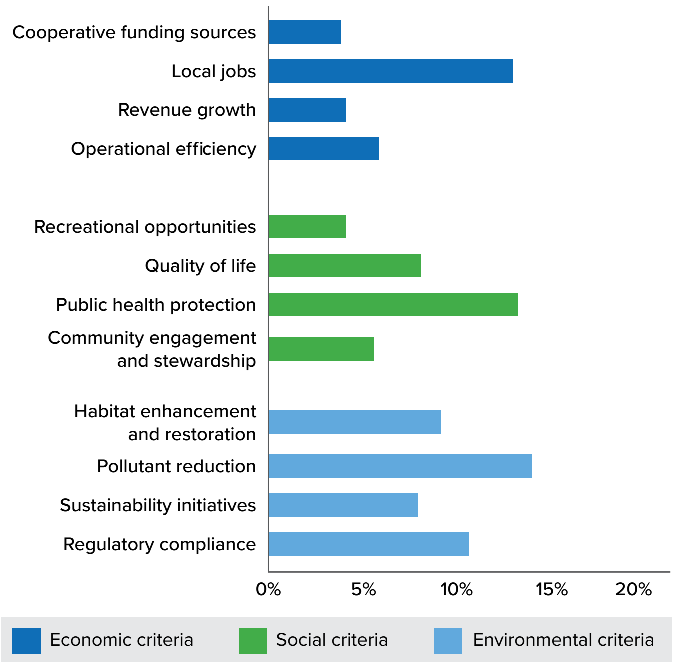
As part of the integrated planning process, Akron also modeled the environmental benefits of the integrated plan projects compared to the original LTCP projects. Akron concluded that the integrated plan would reduce the same CSO and bypass volume as the original LTCP, through a suite of projects carried out earlier than in the original LTCP schedule. Proposed green infrastructure would reduce total suspended solids and bacteria in stormwater while providing additional community benefits.

Results

Akron submitted the *City of Akron Integrated Plan* in 2015. In 2016 and 2019, EPA agreed to amend the consent decree to require Akron to complete some of the projects in the integrated plan by 2027. These included some green infrastructure projects, partial sewer separation, and a bypass treatment technology at the wastewater treatment facility—along with revised project sequencing. As of 2019, the city had completed or started 92 percent of the projects required under the consent decree, and it had saved an estimated $158 million on project costs through integrated planning since 2015. In addition, by prioritizing bypass treatment technology at the wastewater treatment facility, Akron was able to expand secondary treatment capacity faster than anticipated, resulting in secondary treatment of 826 million gallons of wastewater above what the consent decree required.

In March 2020, Akron accepted the Outstanding Achievement Award from the American Council of Engineering Companies for one of the integrated plan projects: the Aqueduct Street Green Improvement project, completed in 2018. Akron also received Gold Level recognition in the Ohio EPA's Encouraging Environmental Excellence program.

Triple Bottom Line Weighted Criteria Based on Economic, Social, and Environmental Categories



Columbus, Ohio

EPA Region 5

BLUEPRINT COLUMBUS
Clean streams.
Strong neighborhoods.

Columbus is the capital of Ohio and has a population of nearly 900,000. The city operates separate sanitary, combined, and storm sewers that discharge to the Scioto and Olentangy Rivers. The separate sanitary and combined sewer systems connect to two wastewater treatment facilities that discharge into the Scioto River. The river runs through the middle of downtown Columbus. In 2015, Columbus opened the "Scioto Mile"—a massive project to rehabilitate the river that included habitat restoration, miles of trails, and 33 acres of new parkland.

Integrated Plan and 2015 WWMP Update Report

900,000 *population*

Challenges

During heavy storms, stormwater and groundwater enter Columbus's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). This leads to sewage releases in the form of SSOs and backups into basements. In addition, large storms cause CSOs and bypasses at the wastewater treatment facilities. These overflows and bypasses lead to the discharge of sewage and partially treated wastewater into the Scioto and Olentangy Rivers. Both wastewater treatment facilities have permits that require the city to control these discharges. Columbus also has a stormwater permit that requires the city to implement a management plan to improve stormwater quality. All three permits implement TMDLs for bacteria, nutrients, sediment, and total suspended solids.

Columbus agreed to eliminate SSOs and basement backups and to address CSOs in two separate consent orders, filed with the Ohio EPA in 2002 and 2004. To meet all the consent order requirements, the city developed a combined Wet Weather Management Plan (WWMP) in 2005, which had an implementation cost of $2.5 billion over 30 years.

Integrated Planning in Action

In 2012, the city began an integrated planning process to update the 2005 WWMP and consider more beneficial and cost-effective solutions to address SSOs, CSOs, and stormwater pollution. Columbus used a city-wide engagement approach, called Blueprint Columbus, to educate residents about sewer overflows, get feedback on proposed options, and improve outreach to homeowners. The city also created a community advisory panel to provide guidance during the development of the plan.

Planners developed and analyzed two options for updating the 2005 WWMP:

- A "Blueprint" option that focused on reducing the sources of infiltration and inflow and implementing green infrastructure in certain areas of the city (see box on page 19).
- A "gray" option that focused on managing a likely increase of flows over time. This option would use tunnels for excess storage, increase the size of sewer pipes, and clean and line pipes to transport and minimize sewer overflows.

The Scioto River with Columbus skyline.
Photo courtesy of City of Columbus.

Blueprint rain garden in the Clintonville neighborhood of Columbus. Photo courtesy of City of Columbus.

Columbus first compared how well the options could achieve compliance goals, additional water quality improvements, regional economic benefits and job creation, neighborhood benefits, and sustainability. In addition to meeting all water quality compliance obligations, green infrastructure in the Blueprint option would achieve a greater reduction in overflows and remove an estimated 342 tons of sediment each year. Columbus also estimated that the city's investment in maintaining private laterals would save homeowners $453 million, and that the Blueprint option would create more than 700 jobs over 20 years.

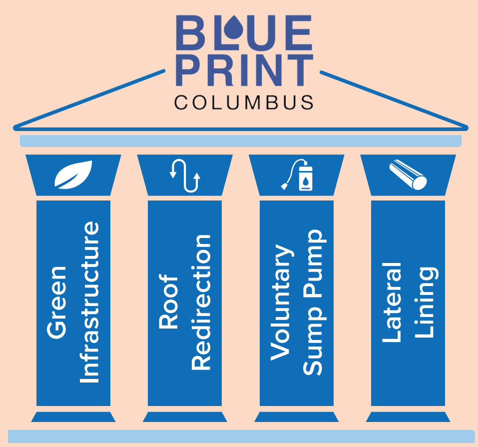
Next, Columbus evaluated how the cost of the two options would affect water and sewer bills, particularly for households with lower income. Analysis showed that even with a faster 20-year implementation schedule, the Blueprint and gray options would require lower rate increases than the 2005 WWMP, which had a 30-year schedule.

After considering implementation schedules, Columbus tabulated how much each option would cost in total over 20 years. The city determined that the Blueprint option would be more expensive than the gray option. However, it chose to invest the additional funds because of the stormwater quality benefits and the larger reduction in overflows that the Blueprint option would achieve.

Columbus estimated that revising the 2005 WWMP using the Blueprint option would require capital costs of $1.74 billion, with an estimated operation and maintenance cost of $60 million over 20 years (through 2035). The capital cost estimate includes $400 million for some projects identified in the 2005 WWMP, including adding a process to partially treat bypasses at the wastewater treatment facility, and $1.3 billion for new green infrastructure and infiltration and inflow reduction projects.

Results

In 2015, Columbus finalized its *Integrated Plan and 2015 WWMP Update Report*. The Ohio EPA approved the plan that same year and incorporated it into one of the city's existing wastewater treatment facility permits. Columbus has made significant progress in implementing the plan's "pillars," which include installing more than 400 rain gardens along roadways and parking lots, more than 30,000 square feet of porous pavement, and 350 private sump pumps—along with assessing more than 670 homes (25 percent of the target number) for improvements to reduce infiltration and inflow. As a result, the city experienced 30 percent fewer SSOs in 2019 than in the previous year, despite above-average precipitation.



Four Pillars of the Blueprint Option

- Installing green infrastructure (rain gardens and porous pavement) to help slowly filter water
- Redirecting downspouts so runoff from roofs goes into the storm sewer
- Installing sump pumps to direct excess groundwater to the storm sewer and keep it from getting into the sanitary sewer
- Lining pipes (specifically, "laterals" that connect homes to the sewer main) to reduce infiltration through cracks

Lima, Ohio

EPA Region 5

The City of Lima, in northwestern Ohio, is home to about 37,000 people. A combined sewer system serves about 60 percent of the city. The other 40 percent is served by separate sanitary sewers and storm sewers. Wastewater from the combined and separate sanitary sewers is conveyed to the city's wastewater treatment facility. Treated wastewater from this facility and stormwater discharges flow into the Ottawa River, a central feature for the town. The 4.2-mile Ottawa River Bikeway winds alongside the river and connects the city's parks, the downtown business district, and the local high school.

2014 Integrated Plan

37,000 *population*

CSO SSO WWTF

Challenges

Lima experiences SSOs and CSOs mainly due to inadequate capacity at the wastewater treatment facility during storms. Under a 2015 consent decree with EPA and the state of Ohio, the city agreed to make major structural improvements to control CSOs and to eliminate sewage overflows from the sanitary sewer system. Lima also must comply with permit limits for nutrients, sediment, and bacteria entering the Ottawa River. The potential cost to address these issues traditionally exceeded the financial capability of the city and its residents.

Bike path over the Ottawa River. Photo courtesy of City of Lima.

Ottawa River Bridge bike path. Photo courtesy of City of Lima.

Integrated Planning in Action

City leaders thought it was not feasible to rapidly raise utility rates to quickly accomplish the needed improvements agreed to in the consent decree, particularly in light of Lima's declining population and other economic challenges. Lima decided to develop an integrated plan to change the sequence of projects to achieve the greatest environmental benefits first while avoiding large rate increases.

Lima modeled a variety of control options within the collection systems, at pump stations, and at the wastewater treatment facility to determine which sequence of controls would achieve the greatest environmental benefits at an affordable cost. The city devised a draft plan, then engaged the public. Lima updated the public on its draft and final proposals through city council meetings, neighborhood association meetings, chamber of commerce meetings, and meetings with other stakeholder groups.

The resulting integrated plan proposed first expanding treatment capacity at the wastewater treatment facility, then installing controls (*i.e.*, sewer separation, real-time control, tank and pump station improvements) that would capture more than 97 percent of CSO volume, and finally conducting separate sanitary system upgrades such as pump station improvements to reduce SSOs. Lima prioritized the CSO projects over SSO projects because CSO volume was substantially higher than SSO volume and the CSOs had a greater potential for direct human contact.

The total capital cost of the integrated plan projects was estimated at $147.6 million over 28 years: substantially less than the city would have had to spend without using an integrated planning approach, while still meeting the performance criteria contained in the consent decree. By expanding capacity at the wastewater treatment facility first, the city was able to reduce CSOs faster and at a lower cost than if it had not developed an integrated plan as part of its consent decree. Through the implementation of the integrated plan, Lima anticipated it would significantly reduce the amount of bacteria, nutrients, organic matter, and suspended solids entering the Ottawa River.

Results

Lima's integrated plan was included in an EPA consent decree in 2015. In 2018, Lima increased its wastewater treatment facility's wet weather capacity from 53 million to 70 million gallons per day and eliminated untreated bypasses. The city also designed a storage basin that is expected to further reduce CSOs to the Ottawa River when construction is completed.

Boone, Iowa

EPA Region 7

2016 Integrated Wastewater Plan

13,000 *population*

SSO WWTF

Boone, Iowa, is home to nearly 13,000 people. The city operates sanitary and storm sewer systems. Most of the sanitary sewer system was installed more than 100 years ago and has not been replaced. Boone's wastewater treatment facility and storm sewer system discharge to Honey Creek, a tributary to the Des Moines River, the largest river in Iowa. The river supports tourism and recreation, including boating on the 100-mile Des Moines River Water Trail, which follows the river as it winds through Boone County.

Challenges

During heavy storms, stormwater and groundwater enter Boone's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). This causes SSOs at one pump station and sewage backups into basements. These SSOs lead to the discharge of sewage, which contains high concentrations of pollutants, such as bacteria, to the Des Moines River. In addition, the city's 2014 wastewater treatment facility permit required the city to install disinfection equipment to meet more stringent bacteria effluent limits by 2018. As a small community, Boone has faced challenges in balancing environmental compliance with financial capabilities.

Integrated Planning in Action

Boone decided to use an integrated planning approach to prioritize projects to achieve the greatest environmental and human health benefits using existing rate revenue to avoid short-term rate spikes. The city conducted an open process: it engaged the community through civic organizations and open house meetings and educated the city council about the importance of preventing less polluted stormwater and groundwater from entering the sanitary sewer system. Boone also kept the public informed throughout the planning process using a wide variety of media, including radio shows, newsletters, a website, social media, and the local newspaper.

The city's plan indicated that reducing infiltration and inflow first would result in the highest human health and water quality impacts by reducing basement backups and SSO discharges. The integrated plan included a project schedule that delayed the installation of disinfection equipment by five years while the city focused on addressing infiltration and inflow. The integrated plan projects cost $15.4 million over 16 years (2016–2033), including about $10 million in capital costs and $5.4 million for operation and maintenance.

Results

In 2016, the city submitted the *Integrated Wastewater Plan* to the Iowa Department of Natural Resources. The Department approved the plan that same year. In 2018, Boone's City Council passed an ordinance that gave Boone's Sewer Department authority to inspect and disconnect sump pumps and roof drains from residences connected to the sanitary sewer system or require that they pay a monthly fee on their utility bill. One year later, in 2019, the Department of Natural Resources issued a wastewater treatment facility permit that allowed the city to delay installing disinfection equipment to meet new bacteria limits by five years in order to more quickly reduce SSOs and reduce infiltration and inflow.

Since plan approval, Boone has installed flow meters in 1 of the 4 pilot project areas and disconnected 60 sump pumps from the sanitary sewer to reduce inflow. The city reports that this has reduced the amount of wastewater flowing to the wastewater treatment facility by 30 percent, which is more than half of the 50 percent flow reduction goal. Sequencing the infiltration and inflow work first led to less water flowing to the wastewater treatment facility, thus reducing the size of the disinfection system needed and saving the city about $500,000 to $750,000. In 2019, the city also has received no basement backup complaints from residences in the pilot area, down from the 15–20 complaints it had received before disconnecting the residents' sump pumps.

Kate Shelley High Bridge, crossing over the Des Moines River.

Johnson County, Kansas

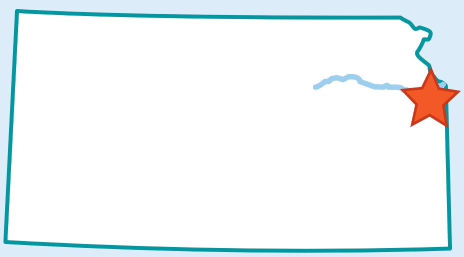
EPA Region 7

JOHNSON COUNTY KANSAS Wastewater

2019 Integrated Management Plan

600,000 *population*

SSO WWTF



A paddle boarder enjoying the lake at Shawnee Mission Park. Photo courtesy of Donna Daugherty.

With a population of about 600,000 people, Johnson County is the most populous county in Kansas. Located just west of Kansas City, Missouri, Johnson County is home to several growing suburbs and two of the four largest cities in Kansas (Overland Park and Olathe). Johnson County Wastewater operates a sewer system that collects and transports wastewater to six wastewater treatment facilities that discharge to tributaries of the Kansas and Blue Rivers. One of these tributaries, Little Bull Creek, flows into Hillsdale Lake, which is the centerpiece of a popular local state park.

Challenges

During heavy storms, stormwater and groundwater enter Johnson County's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). Under these conditions, the capacity of the sewer system and treatment facility may be exceeded, resulting in SSOs. In some parts of the county, satellite facilities partially treat a portion of these SSOs before they are released. However, in other areas, SSOs discharge sewage directly into the Blue and Kansas Rivers.

In early 2019, Johnson County made plans to tackle complex challenges associated with Clean Water Act requirements. The county needed to protect water quality in local waterways by addressing eight TMDLs as implemented in six separate wastewater treatment facility permits. The county expected two additional TMDLs to be incorporated into the permits during the next permit term. It also anticipated new ammonia limits at two of the wastewater treatment facilities, which would require major capital improvements to comply with such limits.

In addition to meeting water quality requirements, the county wanted to explore increasing land application of biosolids and cogeneration of methane at wastewater treatment facilities. This would use resources more efficiently and reduce operating costs and adverse environmental impacts caused by chemicals in the biosolids.

Integrated Planning in Action

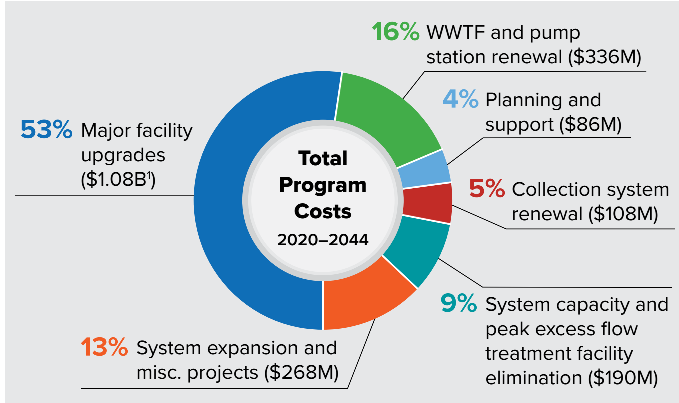
To address water quality challenges and pursue these other environmental priorities, the county created a multi-phased 25-year schedule to address immediate compliance requirements and then refine the plan as appropriate based on additional data.

Johnson County began the first phase by identifying ongoing projects and necessary infrastructure improvements based on previous planning efforts and wastewater system assessments. The county then reviewed existing capital improvement projects and chose possible solutions to water quality challenges, such as wastewater treatment facility upgrades and collection system repair and replacement. The county prioritized these projects based on their ability to achieve three main objectives: environmental protection, customer service, and community enhancement. They also identified seven sub-objectives (see details in the box below).

Based on this analysis, the county developed its 25-year schedule of projects. The schedule included as many of the highest-priority projects as possible, while maintaining affordability for rate payers. The county addressed collection system challenges by including projects to increase storage and conveyance capacity, reduce public and private sources of infiltration and inflow, and rehabilitate the existing infrastructure. The county sequenced these projects so the ones that met the most objectives, such as expansion and treatment upgrades at three wastewater treatment facilities and the elimination of satellite facilities, would occur within the first 10 years. Projects that did not address multiple objectives, such as resource recovery and expansion of two other wastewater treatment facilities, fell later in the schedule. Johnson County estimated that the projects in this first phase of the integrated plan would have a total capital cost of $2.07 billion over the 25-year planning period (2020–2044) (see graphic to right).

The second phase of planning will refine the 25-year schedule using more detailed planning studies and a more comprehensive assessment of community priorities. After the second phase ends in late 2022, Johnson County plans to monitor project performance and update the integrated plan at least every five years to achieve the greatest benefits.

Projected Distribution of 25-Year Integrated Management Plan Costs by Category



[1] Cost includes $173 million expenditure for Tomahawk Creek WWTF prior to 2020.

The county used existing community engagement programs and input from the Board of County Commissioners to solicit feedback on the first phase of planning. The first-phase *Integrated Management Plan* indicates that the second phase will include broader engagement to support a more comprehensive assessment of community priorities.

Results

In 2019, Johnson County submitted the *Integrated Management Plan* to the Kansas Department of Health and Environment (KDHE), which implemented the plan through a consent order that same year. The consent order included implementation schedules for nitrogen and phosphorus removal at two of the wastewater treatment facilities, and eventual elimination of satellite facilities as the county increases collection and full treatment capacity. KDHE issued amended permits for these two wastewater treatment facilities in 2020. The permits acknowledged the receipt of the integrated plan and indicated that KDHE would use the plan when making future regulatory decisions. The county expects to complete the prioritized wastewater treatment facility expansion project by spring 2022.

Sub-Objectives for Prioritizing Projects in Johnson County

- Improve water quality
- Meet regulatory obligations
- Efficiently use and protect natural resources
- Minimize human health and property impacts
- Achieve financial benefits
- Be a good neighbor
- Foster responsible growth and important development

Lawrence, Kansas

EPA Region 7

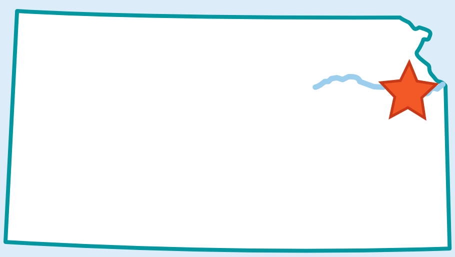
City of Lawrence

Lawrence, Kansas, has a population of nearly 100,000 and lies between the Kansas and Wakarusa Rivers. Lawrence operates a separate sewer collection system along with a storm sewer system. Before 2018, it had one wastewater treatment facility that discharged to the Kansas River. This river was historically used for steamboat traffic but is now a popular location for recreation and culture. The portion that flows through Lawrence is literally a work of art: an internationally known earth artist created a rock mural on the bank of the river near downtown.

Integrated 2012 Wastewater Utilities Plan

100,000 *population*

SSO WWTF



Challenges

During heavy storms, stormwater and groundwater entered Lawrence's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). This led to SSOs that discharged sewage to the Kansas River. Meanwhile, more stringent effluent limits were about to be set for the wastewater treatment facility due to concerns about nutrient pollution in the Kansas River. The city had just one wastewater treatment facility and Lawrence's growing population required the city to plan for a second wastewater treatment facility to avoid exceeding the existing facility's capacity.

Integrated Planning in Action

Lawrence used an integrated planning approach to identify affordable projects to increase wastewater treatment and flow capacity. The city created project categories and prioritized projects from these categories based on improvements needed to meet current capacity requirements, followed by those that provided capacity for future growth in the service area. The city then performed a cost-benefit comparison between the projects and calculated the rate impacts on customers under different scenarios. Finally, Lawrence city officials sought public input on the population projections used to develop the wastewater master plan through capital improvement planning hearings and a public comment process.

Kansas River and the Bowersock Dam in downtown Lawrence. Photo courtesy of Josh Carson, City of Lawrence.

Project Categories

- Existing collection system improvements
- Existing collection system rehabilitation
- New wastewater treatment facility
- Existing wastewater treatment facility improvements
- Annual wastewater utility maintenance

Lawrence considered all of these data and documented the selected projects in the integrated plan:

- The EcoFlow Rapid Rainwater Reduction Program, designed to reduce infiltration and inflow by 35 percent in the defined project area. The program would reduce the flows entering the collection system during wet weather, decreasing the need for collection system capacity projects.
- Construction of new sewer infrastructure to convey flows during large storms to the existing wastewater treatment facility.
- Infrastructure for and construction of a new wastewater treatment facility.
- Improvements to the existing wastewater treatment facility to comply with anticipated nutrient limits.

The cost of the integrated plan was estimated at $161.2 million through 2030—$148.3 million for existing system improvements and $12.9 million for service to future growth areas.

Results

In 2014, the *Integrated 2012 Wastewater Utilities Plan* was implemented through a memorandum of understanding between the city and KDHE; in 2019, KDHE issued permits for both wastewater treatment facilities that incorporated the memorandum. This agreement included a 20-year implementation schedule for integrated plan projects. In 2014, the city implemented the EcoFlow Rapid Rainwater Reduction Program to reduce infiltration and inflow. As of 2020, Lawrence had completed over 1,900 private property infiltration and inflow repairs, over 600 manhole repairs, and over 400 sanitary sewer repairs, as well as lining approximately 200,000 linear feet of sanitary sewer pipe to reduce infiltration and SSO events. The city finished building its new wastewater treatment facility in the spring of 2018.

Kansas River above the Bowersock Dam, looking south toward Burcham Park Trail.
Photo courtesy of Josh Carson, City of Lawrence.

Columbia, Missouri

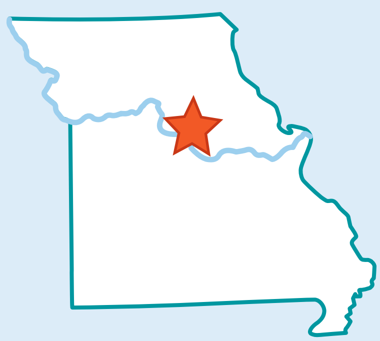
EPA Region 7

city of Columbia
Sewer & Stormwater Utilities

Columbia Wastewater and Stormwater Integrated Management Plan

120,000 *population*

MS4 SSO WWTF

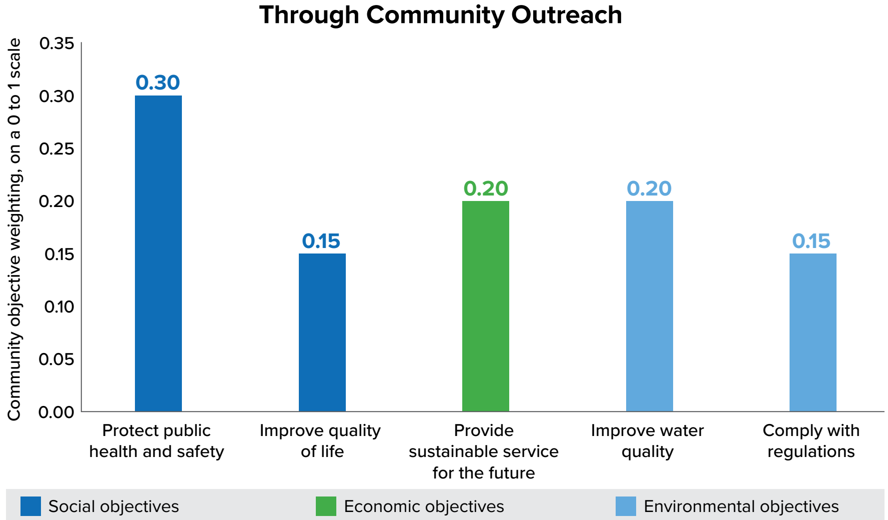


Columbia is Missouri's fourth largest city, with a population of about 120,000. It is located near the geographic center of the state and is well known for its urban streams and lakes. Columbia manages its wastewater through a separate sanitary sewer that the city owns and operates. It transports sewage to the city's wastewater treatment facility, which discharges to the Eagle Bluffs Conservation Area—a large wetland that eventually drains into the Missouri River. Columbia also operates a storm sewer system that is permitted jointly with Boone County and the University of Missouri. The storm sewer system discharges to Missouri River tributaries, including Hinkson Creek, which runs through Columbia and features several trails and parks along its path.

Challenges

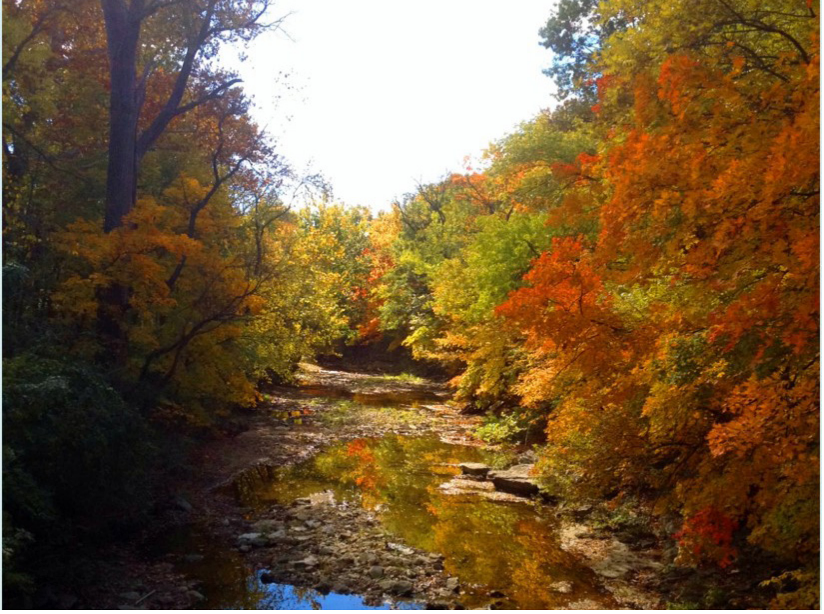
During heavy storms, stormwater and groundwater enter Columbia's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). This leads to SSOs that discharge sewage to the city's waterways, and it causes sewage to back up into basements. In 2011, the Missouri Department of Natural Resources (MDNR) initiated enforcement negotiations with the city to address SSOs. Around the same time, MDNR and EPA developed a TMDL for Hinkson Creek for biological impairment, an indication that pollution is negatively affecting aquatic life in the water body. This is in part due to stormwater discharges from Columbia, the University of Missouri, and Boone County. In 2013, the city invested $64 million to expand and upgrade its wastewater treatment facility to meet new permit limits for ammonia. The city anticipated that more nutrient, bacteria, and dissolved oxygen limits would be incorporated into the wastewater treatment facility permit during future permit terms that would cost another $40 million.

Triple Bottom Line Weighted Criteria Developed Through Community Outreach



Integrated Planning in Action

In 2017, Columbia and MDNR agreed that the city would develop an integrated plan to prioritize wastewater and stormwater improvements for consideration in future regulatory decisions (graphic to left). The city hosted a two-day workshop with representatives from various city departments, the University of Missouri, Boone County, and the Boone County Regional Sewer District to develop goals for the integrated plan and



Hinkson Creek shows off its autumn colors.
Photo courtesy of City of Columbia.

strategies to meet those goals. The city kept the public engaged throughout the planning process by distributing fact sheets, developing a project website, issuing press releases, posting updates on social media, developing an online survey, and conducting community workshops. Through these workshops, the city developed community objectives to be used when evaluating plan options (see box to right).

Columbia developed three funding levels, each with a combination of sanitary sewer collection system, wastewater treatment facility, and storm sewer system projects that met or exceeded existing Clean Water Act obligations. The funding levels represented incremental amounts of infrastructure service, community expectations, and anticipatory project commitments:

- Level 1: Projects to meet community expectations and current Clean Water Act requirements.
- Level 2: All projects from Level 1 plus other infrastructure commitments to meet known future Clean Water Act requirements.
- Level 3: All projects from Level 2 plus additional projects that meet all anticipated future infrastructure needs and Clean Water Act requirements.

After outlining the three funding levels, city staff calculated a total benefit score for each suite of projects that represented the anticipated value they would produce for the community. Community priorities established throughout the outreach program formed the basis for the scoring criteria and process. The city then conducted a benefit-cost analysis for each suite of projects under each level. Based on this comparison, the city determined that it would be most cost effective to create an optimized suite of alternatives composed of wastewater treatment facility and collection system projects from Level 1 and stormwater projects from Level 2.

Community Objectives for Columbia's Integrated Planning Process

- Meet Clean Water Act requirements
- Protect important regional waterbodies
- Protect or improve water quality in city streams
- Provide services to growing areas
- Improve services to underserved and redeveloping areas
- Renew systems beyond effective life
- Reduce potential for property damage
- Provide community-wide benefits
- Reduce safety hazards from system failures

Columbia preferred this optimized program portfolio for its integrated plan. The city estimated that its plan would require $1.02 billion over 20 years for capital and programmatic costs. To ensure affordability and produce the greatest possible benefits to human health and water quality, the plan proposed revising assumptions every 5–10 years for project costs, implementation dates, socioeconomic conditions, and regulatory requirements.

Results

The *Columbia Wastewater and Stormwater Integrated Management Plan* was adopted by the Columbia City Council in 2019 and implemented in the wastewater treatment facility and storm sewer permits MDNR issued in July 2020. In the permits, MDNR committed to using the plan when making future regulatory decisions. Columbia's wastewater treatment facility permit required an annual progress report on any proposed updates to the plan, the past year's implementation activities, and the implementation activities proposed for the following year.

Springfield, Missouri

EPA Region 7

Springfield - Greene County, Missouri
Integrated Plan for the Environment

Integrated Plan for the Environment

167,000 *population*

MS4 SSO WWTF

Paddle boarders enjoying Lake Springfield. Photo courtesy of Springfield Convention and Visitors Bureau.

Located in the heart of the Ozarks, Springfield is the third largest city in Missouri, with a population of more than 167,000. The city manages a separate sanitary system as well as a storm sewer system and operates two wastewater treatment facilities. One of these discharges to the James River Watershed and the other discharges to the Sac River Watershed. Springfield's storm sewer system discharges to tributaries of the James River. The James River is a popular recreation destination and features a 6-mile "water trail" for canoeing and kayaking that flows through Springfield and connects to the Trail of Honor—a riverside walking trail that winds through the Missouri Veterans Cemetery.

Challenges

During heavy storms, stormwater and groundwater enter Springfield's sanitary sewer system through cracks and improper connections (*i.e.*, infiltration and inflow). This leads to SSOs and bypasses at the wastewater treatment facilities. In 2012, Springfield agreed to address SSOs and reduce bypasses under an amended consent judgment with MDNR. This judgment required the city to spend $50 million and complete Early Action Plan projects in the first seven years while it developed an overflow control plan.

Springfield must also comply with two wastewater treatment facility permits and a stormwater permit that implement TMDLs for bacteria in the Little Sac River and nutrients in the James River. Some local rivers and streams are also impaired by polycyclic aromatic hydrocarbons in stormwater runoff from driveways and parking lots.

Integrated Planning in Action

The city, Greene County, and city utilities developed a "citizen-focused approach" to address water quality impairments and other community priorities using local knowledge to holistically examine the city's environmental resources. The city organized an Environmental Priorities Task Force of community members, city and county staff, and technical experts to address these challenges and identify other priorities important to the community. This group set goals and worked together to identify affordable solutions to wastewater and stormwater challenges, as well as to meet solid waste and air quality objectives, using four key elements (see box on page 31). The task force identified and ranked sources of pollution based on the impact on the environment. They then identified possible strategies to address these sources and conducted a cost-benefit analysis to determine which strategies would provide the most social and environmental benefit per dollar spent. Using this process, Springfield determined that the most cost-effective strategies to pursue were stormwater detention basin retrofits, enhanced nutrient removal at one of the city's wastewater treatment facilities, programs to reduce polycyclic aromatic hydrocarbons in stormwater, and SSO controls to reduce infiltration and inflow of water into the sanitary sewer system. Springfield did not select specific projects during the planning process, but rather committed to pursue projects that align with the selected strategies.

Results

In 2015, Springfield released its *Integrated Plan for the Environment*. That same year the city completed an SSO control plan that—based on findings from the integrated planning process—identified and compared solutions to control SSOs. The approved overflow control plan included $200 million in SSO improvements to be completed over 10 years (by 2025). MDNR approved Springfield's integrated plan and referenced it in the city's 2017 municipal stormwater permit and 2020 wastewater permits. These permits require that Springfield identify cost-effective solutions to address the most significant sources of pollution as proposed in the integrated plan. Since the stormwater permit was issued, Springfield has implemented a "Clean Pavement Initiative" that encourages businesses and residents to voluntarily choose sealants for parking lots and driveways that are lower in polycyclic aromatic hydrocarbons. Several businesses and citizens have committed to choose asphalt-based sealant and received signage showing their commitment. Springfield also implemented a pilot voluntary detention basin retrofit program, completing the first project in 2019.

Key Elements

- Prioritizing the most significant pollution sources
- Prioritizing cost-effective solutions
- Capturing community priorities
- Assessing financial capability

Approach for Ensuring a Sustainable Return on Investment, Using the Four Key Elements as Guidance

Kayakers on the James River. Photo courtesy of Springfield Convention and Visitors Bureau.

Seattle, Washington

EPA Region 10

Seattle Public Utilities

Seattle, Washington, is the largest city in the Pacific Northwest, with a population of more than 700,000. This seaport city is located in King County, sandwiched between Puget Sound—the second largest estuary in the United States—and Lake Washington. Seattle operates a combined sewer system and a separate storm sewer system. The combined sewer system brings stormwater and sewage to one of the six wastewater treatment facilities owned and operated by King County. The storm sewer system discharges about 13 billion gallons of stormwater per year. These facilities and systems discharge to Puget Sound, Elliott Bay, Lake Washington, and the Lower Duwamish Waterway.

[2015 Plan to Protect Seattle's Waterways]

700,000 *population*

CSO MS4

Challenges

Between 2007 and 2010, about 200 million gallons of sewage entered Seattle's local water bodies every year through CSOs and unauthorized discharges. Both CSOs and stormwater discharges add metals, total suspended solids, nutrients, bacteria, and organic compounds to local waterways. In 2013, the city agreed to reduce CSO discharges to meet the Washington Department of Ecology's limit of one overflow per outfall per year. The consent decree required Seattle to develop a CSO LTCP and complete construction of CSO projects by 2025. It also gave Seattle an alternative: develop an integrated plan and potentially extend the CSO project construction deadline, but only if the integrated plan results in significant water quality improvements beyond what the CSO projects under the LTCP would have achieved alone.

Integrated Planning in Action

In 2013, Seattle began to develop two plans: an LTCP with CSO projects and an integrated plan with both CSO and stormwater projects. The city engaged the public throughout the planning process. Seattle made information available through community updates, briefings, animations, visualizations, website videos and updates, and an email listserv. The city solicited input through public information meetings, scoping sessions, online questionnaires, and emails.

Seattle identified potential stormwater projects to include in the integrated plan, then ranked these projects based on water quality impacts and other criteria (see details in the box on page 33). The city then compared the highest-ranking stormwater projects with the lowest-ranking CSO projects.

Using this analysis, Seattle developed an integrated plan with three stormwater projects that it determined would provide better public health and environmental benefits than the CSO projects alone. Modeling showed that these stormwater projects would remove larger quantities of PCBs, fecal coliform, phosphorus, and other pollutants. They include:

- Reconstructing city rights-of-way to include bioretention basins (a green infrastructure practice) that infiltrate stormwater to reduce the amount discharged and remove pollutants.
- Building a facility to treat stormwater from a largely industrial area.
- Increasing street sweeping on major roads to minimize stormwater contamination.

The integrated plan also included several large, more effective CSO projects—such as sewer system improvements, CSO storage facilities, and a new tunnel—that were expected to lead to significant reductions in pollution. The plan deferred completion of six other small CSO projects beyond 2025.

Seattle's analysis concluded that the integrated plan would achieve greater water quality benefits than the LTCP. Even with certain CSO projects deferred, the stormwater projects would treat a much larger volume of stormwater than the deferred CSO projects, resulting in greater reductions of total suspended solids, metals, bacteria, and other pollutants. For example, Seattle estimated that the integrated planning projects would remove 110 more pounds of zinc per year than the LTCP projects alone. The city projected that enhanced street sweeping would keep an estimated 40 tons of total suspended solids out of waterways every year.

Seattle estimated that the integrated plan would cost a total of $592 million over 20 years, including both capital and operation and maintenance costs. Stormwater projects accounted for $88 million—about 15 percent of the total cost. The integrated plan included $450 million in non-deferred CSO projects and proposed to defer $54 million in CSO projects until 2028–2030, which is later than the consent decree and LTCP. The integrated plan was ultimately more expensive than the LTCP option, but it extended CSO project implementation by four to five years, and the proposed stormwater projects were predicted to achieve greater water quality benefits than the deferred CSO projects.

Results

EPA and the Washington Department of Ecology approved the *Plan to Protect Seattle's Waterways* in 2015. The city's CSO discharge permit, issued in 2016, required two of the three proposed stormwater projects (*i.e.*, bioretention in city rights-of-way and street sweeping) and deferred the six small CSO projects in accordance with the schedule identified in Seattle's integrated plan.

Seattle's Selection Process for Integrated Plan Projects

To choose projects for the integrated plan, Seattle:

- Modeled pollutant reduction of each project
- Estimated each project's effectiveness at reducing human and animal exposure to bacteria and other harmful pollutants
- Determined how close each project would be to planned stormwater projects
- Ranked stormwater and CSO projects based on water quality impacts, proximity to existing stormwater projects, performance risk, operation and maintenance costs, and community values
- Compared the benefits of prioritized stormwater projects and lower-volume CSO projects to ensure that the stormwater projects would achieve significantly higher benefits

As of 2018, the city reduced CSO discharges by 41 percent. During 2018, the street sweeping program removed nearly 60 tons of total suspended solids. Seattle finished constructing right-of-way bioretention in one area in 2017 that was designed to reduce CSO discharge volume by one million gallons per year. This green infrastructure project also benefits the community by increasing pedestrian activity, calming traffic, improving aesthetics, and increasing public awareness of how impervious surfaces affect stormwater. In April 2020, Seattle Public Utilities received a $192 million Water Infrastructure Finance and Innovation Act loan to help finance an underground storage tunnel recommended in the plan. This storage tunnel is designed to reduce CSOs at 6 outfalls, and its construction is expected to create over 1,000 jobs.

Elliott Bay with Seattle skyline. Photo courtesy of Seattle Parks and Recreation.

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Appendix A: Summary of Municipalities with Integrated Plans Implemented Through Permits, Orders, or Judicial Consent Decrees

Richmond's business district seen from the south bank of the James River, just above the river's fall line. Photo courtesy of West Cary Group.

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of New Bedford, Massachusetts	1	Long Term CSO Control and Integrated Capital Improvements Plan	2017	Consent Order Docket No. CWA-AO-R01-FY20-15 issued in 2019	CSO, MS4, SSO, WWTF	Yes	The consent order includes both CSO and non-CSO projects in lieu of the traditional LTCP required by the 2012 order.	The consent order includes a modified schedule composed of WWTF, stormwater, wet weather sewer, and general sewer projects within the first six years (2017–2023).	The plan included a budget of $260M over 20 years: ■ $28.3M for WWTF ■ $49.3M for pumping stations ■ $143.2M for CSO improvements ■ $0.2M for wet weather sewer ■ $22M for general sewer ■ $5.1M for stormwater ■ $5.8M for flood control structures ■ $6.7M for vehicles, equipment, and administration
City of Springfield, Massachusetts	1	Springfield Water and Sewer Commission Integrated Wastewater Plan	2014	Administrative Order No. 14-007 issued in 2014	CSO, SSO	No	The administrative order required completion of two phases of CSO improvement projects.	The administrative order required one phase of CSO improvements to be completed by the end of 2020, and the other by the end of 2021.	The plan included a budget of $447M in total estimated costs over 20 years: ■ $183M for CSO improvements ■ $294M for wastewater projects ■ $14.8M for shared cross-utility projects

Abbreviations
CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Richmond, Virginia	3	2017 RVA Clean Water Plan	2017	VPDES Permit No. VA0063177 issued in 2018	CSO, MS4, WWTF	Yes	The permit includes aggregated load reduction targets (based on MS4, WWTF, and CSO waste load allocations) for total nitrogen, total phosphorus, total suspended solids, and bacteria. The permit establishes factors, including adequate funding, a benefit-cost ratio, and pollution reduction benefits when choosing and implementing stormwater and combined sewer system focused projects.	The city's permit requires that projects described in the RVA Clean Water Plan be implemented in the five-year permit cycle.	The plan included a budget of $431M: ■ $34M over five years for green infrastructure capital ■ $5M over five years for green infrastructure operation and maintenance ■ $392M over 30 years for CSO infrastructure
City of Atlanta, Georgia	4	Integrated Plan for the City of Atlanta	Draft completed 2019	NPDES Permit Nos. GA0037168 and GA0038644 issued in 2015	CSO, MS4	Yes	The two permits required the city to develop an integrated plan, and in 2019, the Georgia Department of Natural Resources determined that the plan satisfied the permit conditions.	The permits do not include a compliance schedule.	A project list and budget have not been proposed.

Abbreviations

CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Akron, Ohio	5	Integrated Plan	2015	NPDES Permit No. OH0023833 issued in 2020 OEPA Consent Decree 5:09 cv 00-272 amendments issued in 2016 and 2019	CSO, WWTF	Yes	The two consent decree amendments allow for revised sequencing of projects and controls. The first amendment modified the design of an interceptor project and revised sequencing of two projects, allowing for an increase in secondary treatment capacity ahead of the original schedule. The second amendment revised the side-stream treatment to add storage capacity and replace gray infrastructure with green infrastructure.	The first consent decree amendment required the installation of additional secondary treatment capacity to be completed by April 30, 2019, and side-stream treatment is required by the end of 2021.	The plan included a budget of $1.4B over 25 years: ■ $502M for annual projects (*e.g.*, renewal, monitoring) ■ $857M for CSO projects – $773M for collection system improvements, including $330M for alternative projects (*e.g.*, green infrastructure, sewer separation) – $84M for WWTF capacity improvements ■ $79M for non-CSO projects

Abbreviations
CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Columbus, Ohio	5	Blueprint 2035	2015	OEPA Consent Order Case Nos. 02-CVH-05-5768 and 04-CVH-05-5336 issued in 2015 NPDES Permit No. OH0024741 issued in 2017	CSO, SSO	Yes	OEPA approved the plan and indicated it met consent order requirements. The plan included CSO/SSO reduction through green infrastructure and infiltration and inflow reduction in addition to a revised set of collection system improvements.	The approved Blueprint plan includes an implementation schedule ending in 2035.	The plan included a budget of $1.74B over 20 years: ■ $400M for gray infrastructure projects identified in the 2005 Wet Weather Management Plan ■ $1.33B for green infrastructure and infiltration and inflow reduction projects ■ $60M for operation and maintenance
City of Lima, Ohio	5	Integrated Plan	2014	Consent Decree Case No. 3:14 CV 2551 issued in 2015	CSO, SSO, WWTF	Yes	The project list from the plan is included in Appendix A of the consent decree. Projects include WWTF improvements, CSO control measures, and SSO control measures.	The consent decree required submittal of a WWTF Flow Maximization Plan by July 1, 2018, and full operation of all CSO control measures by August 30, 2024.	The plan included a budget of $148M over 28 years: ■ $40.7M for CSO improvements ■ $29.2M for WWTF improvements ■ $30.3M for SSO abatement improvements ■ $30.8M for asset management ■ $16.5M for stormwater

Abbreviations
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Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Boone, Iowa	7	Integrated Wastewater Plan	2016	NPDES Permit No. IA0079421 issued in 2019	SSO, WWTF	No	The permit allows the city additional time to install WWTF disinfection equipment in order to prioritize completion of infiltration and inflow projects.	The permit revises the final compliance date for established bacteria limits to March 1, 2023. The original deadline was May 1, 2018.	The plan included a budget of $15.4M over 16 years: ■ $10M in capital costs ■ $5.4M for operation and maintenance
Johnson County, Kansas	7	Integrated Management Plan	2019	Consent order Case No. 19-E-5 BOW issued in 2019	SSO, WWTF	No	The consent order requires implementation of the integrated plan, including implementation schedules for nitrogen and total phosphorus removal at two of the WWTFs and an implementation schedule to address satellite facility discharges.	The consent order requires that the city implement the proposed 25-year schedule in the integrated plan, which includes satellite facility upgrades in the first 6 years and 2 WWTF upgrades in the first 10 years.	The plan included a budget of $2.07B over 25 years: ■ $1.08B for major facility upgrades ■ $336M for WWTF and pump station renewal ■ $86M for planning and support ■ $108M for collection system renewal ■ $190M for system capacity and satellite facility elimination ■ $268M for system expansion

Abbreviations
CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Lawrence, Kansas	7	Integrated 2012 Wastewater Utilities Plan	2012	Kansas River WWTF Permit No. KS0038644 issued in 2019 Wakarusa River WWTF Permit No. KS0099031 issued in 2019	SSO, WWTF	No	Each permit includes a supplemental information section that references the integrated plan the Kansas Department of Health and Environment reviewed and approved. It also cites a Memorandum of Understanding between the Department and the city that requires the wastewater and stormwater collection system improvements in the plan per the established schedule as well as annual reporting.	The Memorandum of Understanding establishes the 18-year schedule proposed in the plan, which includes collection system rehabilitation and construction of a new WWTF to start in 2013. Other collection system projects are projected to start between 2013 and 2030. The Kansas River permit requires efforts to reduce nitrogen and phosphorus through mechanical methods and report the results to the Department by February 1, 2017. The Wakarusa River permit outlines a phased-in approach for future plant expansion.	The plan included a budget of $161M for capital improvements: ■ $148M for existing system improvements ■ $12.9M for service to future growth areas

Abbreviations
CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Columbia, Missouri	7	Wastewater and Stormwater Integrated Management Plan	2018	NPDES Permit Nos. MO0097837 and MO0136557 Issued in 2020	MS4, SSO, WWTF	No	The city's WWTF permit required an annual implementation progress report that includes any proposed updates to the plan, the past year's implementation activities, and the planning implementation activities for the following year.	The approved plan includes a 20-year implementation schedule.	The plan included a budget of $1.04B for capital and programmatic costs over 20 years: ■ $227M for stormwater improvements ■ $816M for wastewater improvements
City of Springfield, Missouri	7	Integrated Plan for the Environment	Draft completed 2015	NPDES Permit No. MO0126322 issued in 2017	MS4, SSO, WWTF	No	The MS4 permit states that it is the intent of the Missouri Department of Natural Resources for the city to continue to identify affordable and effective solutions in accordance with the integrated plan. In addition, the MS4 permit indicates that the permittee may submit an integrated plan as an approach for implementing its TMDL assumptions and as an attainment plan if one is required.	The permit does not include a compliance schedule.	A project list and budget has not been proposed.

Abbreviations

CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility

Permittee	EPA Region	Plan Name	Year Plan Completed	Implementation Mechanism(s)	Discharges Addressed	Green Infrastructure Proposed	Integrated Control Measures/Levels of Control	Compliance Schedule for Requirements	Proposed Costs in Plan
City of Seattle, Washington	10	Plan to Protect Seattle's Waterways	2015	NPDES Permit No. WA0031682 issued in 2016 Consent Decree Case Number 2:13-cv-00678 issued in 2013	CSO, MS4	Yes	The permit requires completion of the non-deferred LTCP and two of the three proposed stormwater projects. The consent decree allowed the city to submit an integrated plan to meet consent decree requirements and required the city to implement the plan upon approval.	The permit lists required LTCP and integrated plan projects and specified completion dates. The permit required construction of natural drainage systems to begin by July 2019 and post-construction monitoring of street sweeping expansion arterials to be complete by September 2019.	The plan included a budget of $592M for capital improvements and operation and maintenance over 16 years: ■ $450M in non-deferred LTCP costs ■ $54M in deferred LTCP costs ■ $88M in stormwater project costs

Abbreviations

CSO: combined sewer overflow; LTCP: long-term control plan; MS4: municipal separate storm sewer system; NPDES: National Pollutant Discharge Elimination System; OEPA: Ohio Environmental Protection Agency; SSO: sanitary sewer overflow; VPDES: Virginia Pollutant Discharge Elimination System; WWTF: wastewater treatment facility