SD1
Managing Northern Kentucky's
Wastewater and Storm Water

December 3, 2021

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Via U.S. Mail and
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Via U.S. Mail and
Email: Castillo.Jairo@epa.gov

RE: Updated Watershed Plan
Amended Consent Decree Civil Action No. 2:05-cv-199 (WOB)

Dear Mr. Kroeger and Mr. Castillo:

As you know, Sanitation District No. 1 ("SD1") submitted its Updated Watershed Plan to the Kentucky Department for Environmental Protection ("KDEP") and the United States Environmental Protection Agency ("EPA") on May 5, 2020 pursuant to paragraph 41 of the Amended Consent Decree captioned above. KDEP and EPA responded on March 15, 2021 with questions and comments which SD1 considered and responded to on April 16, 2021 and further discussed in a conference call on April 23, 2021. Based upon those comments and discussions, SD1 revised and resubmitted its Updated Watershed Plan on May 13, 2021.

On August 9, 2021, representatives of KDEP and EPA emailed SD1's Senior Director of Engineering a list of questions and comments. Based on those questions and comments and subsequent conversations and emails, SD1 has again revised its Updated Watershed Plan and is hereby resubmitting it for approval pursuant to paragraph 49 of the Amended Consent Decree.

SD1 looks forward to implementing its Updated Watershed Plan.

Sincerely,

Adam C. Chaney
Executive Director

cc: Michele Wetherington, Esq., EPA Region 4
Dennis Sayre, EPA Region 4
Bill Weinischke, U.S. Department of Justice
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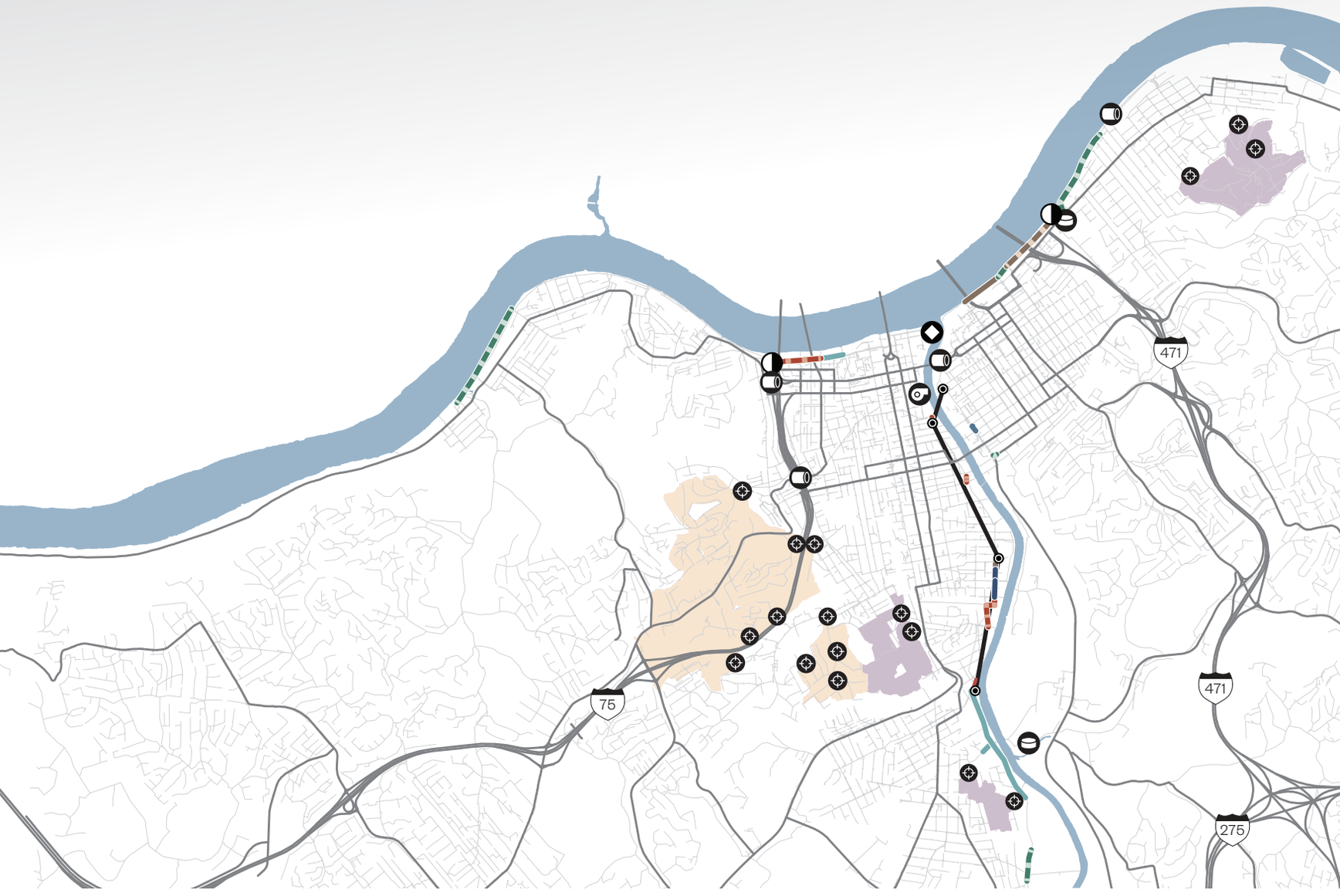







FINAL DRAFT REPORT

Updated Watershed Plan for Northern Kentucky

Sanitation District No. 1 | December 3, 2021

Sanitation District No. 1
1045 Eaton Drive
Fort Wright, Kentucky 41017



Updated Watershed Plan for Northern Kentucky

Final Draft Report

December 3, 2021

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List of Acronyms

Abbreviation	Definition
ACD	Amended Consent Decree
ADWF	Average Dry Weather Flow
BMP	Best Management Practices
CCTV	Closed Circuit Television Inspection
CD	Consent Decree
CIPP	Cured-In-Place Pipe
CSO	Combined Sewer Overflow
CSS	Combined Sewer System
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
EQ	Equalization
HDD	Horizontal Directional Drilling
HGL	Hydraulic Grade Line
HHSG	Highland Heights Silver Grove
ICM	Integrated Catchment Modeling
ILS	Inline Storage
LRS	Licking River Siphon
LTCP	Long Term Control Plan
MG	Million Gallon
NFA	No Feasible Alternatives
NKAPC	Northern Kentucky Area Planning Commission
O&M	Operations and Maintenance
ORI	Ohio River Interceptor
PDS	Planning and Development Services
PS	Pump Station
RDII	Rainfall Dependent Infiltration and Inflow
RTC	Real Time Control

Abbreviation	Definition
RWI	River Water Intrusion
SSES	Sanitary Sewer Evaluation Survey
SSO	Sanitary Sewer Overflow
SSS	Sanitary Sewer System
SSOP	Sanitary Sewer Overflow Plan
TAZ	Traffic Analysis Zone
TY	Typical Year
VFD	Variable Frequency Drive
WRF	Water Reclamation Facility
WSP	Watershed Plan
USACE	United States Army Corps of Engineers
UWSP	Updated Watershed Plan

Executive Summary

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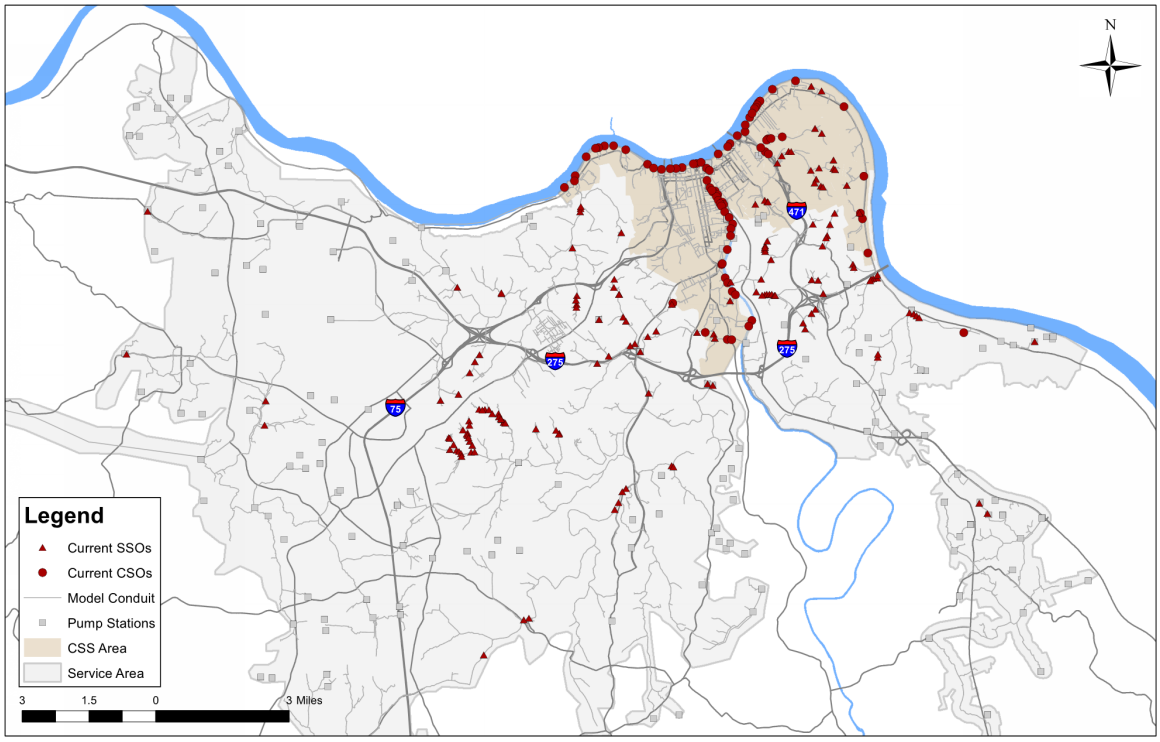
Executive Summary

Background

Sanitation District No. 1 (SD1) is responsible for managing Northern Kentucky's wastewater and stormwater, serving approximately 205,000 ratepayer accounts and partnering with over 30 local governments across Boone, Campbell and Kenton counties to provide residents with wastewater and stormwater services. SD1's sanitary service area covers approximately 190 square miles across the tri-county area, and is served by over 1,600 miles of sanitary sewers.

Figure ES-1: SD1's Service Area



As the regional wastewater and stormwater utility, SD1 plays a central role in protecting the water quality of Northern Kentucky's rivers and streams. One of the most visible risk factors associated with water quality impairment in any urban watershed is wet-weather overflows – specifically, Combined Sewer Overflows (CSOs) and Sanitary Sewer Overflows (SSOs). The locations of SD1's current overflows are shown in Figure ES-1. The causes of these overflows are complex, and the solutions can be challenging, but SD1 initiated our overflow control program over a decade ago and is committed to mitigating the impact of SSOs and CSOs on Northern Kentucky's receiving waters. This Updated Watershed Plan (UWSP) presents SD1's 20-year plan for completing the remainder of our overflow control program. The Plan is submitted with the intent of meeting all regulatory requirements. Under our adaptive management

approach, this UWSP will be further refined during implementation as new or updated information becomes available.

SD1's Consent Decree

A federal Consent Decree (CD) is a legal mechanism used by the U.S. Environmental Protection Agency (EPA) to negotiate an agreed-to improvement program with a wastewater permittee. The EPA has utilized Consent Decrees under the Clean Water Act extensively since the late 1990s, negotiating agreements with over 200 permittees, and SD1 in the early 2000s was a typical CD application – a large utility, with a legacy combined sewer system, discharging to significant waterbodies (the Ohio and Licking Rivers). Examples of other utilities in the region with negotiated CDs in the same time frame are the City of Cincinnati and Hamilton County (Ohio) and Lexington (Kentucky).

SD1's original CD, negotiated in unison with both the EPA and the Kentucky Energy and Environment Cabinet (Cabinet), became effective on April 18, 2007. Per the requirements of the original CD, SD1 prepared and submitted a Watershed Plan (WSP) in 2009 that delineated the recommended approach to address SD1's CSOs and SSOs. Following negotiation and agreed-to revision, the technical portion of the WSP was approved by EPA and the Cabinet on February 14, 2014. The original WSP and resulting Affordability Assessment identified the need to modify the original CD schedule for completion of improvements, due to the high financial burden it would place on SD1 ratepayers. With recognition from all parties that the initial schedule was unaffordable, negotiations were initiated in 2017 and ultimately resulted in an Amended Consent Decree (ACD) that became effective on May 22, 2019. The ACD laid out the revised schedule as well as required levels of overflow reduction as interim milestones.

Under the ACD, SD1 is required to develop, submit, and implement Watershed Plans, with subsequent updates, to accomplish specific goals on agreed-to timelines. These Watershed Plans are to address components of both a CSO Long-term Control Plan (LTCP) and Sanitary Sewer Overflow Plan (SSOP). This Updated Watershed Plan (UWSP) represents the first update; additional Updated Watershed Plans will be submitted for Cabinet/EPA review and joint approval at least once every ten years, until termination of the ACD.

Purpose of the Updated Watershed Plan

SD1 has developed this UWSP to meet the requirements of the ACD, meet the needs and expectations of stakeholders, and continue our mission to operate, maintain, and improve the wastewater and stormwater infrastructure of northern Kentucky. Primary amongst ACD requirements is to demonstrate achievement of CSO capture and SSO volume reduction milestones in approximately 5-year increments. The ACD-required CSO capture and SSO volume reduction milestones are as follows:

Table ES-1: CSO Percent Capture and SSO Volume Reduction ACD Milestones

Milestone Date	Typical Year CSO Percent Capture	Typical Year SSO Percentage of Baseline Volume Remaining
July 1, 2023	67%	80%
January 1, 2029	75%	25%
July 1, 2034	80%	10%
January 1, 2040	85%	0%

All reduction metrics are to be calculated relative to an agreed-to 2017 baseline established by SD1's hydraulic model, as outlined in the ACD. This UWSP provides SD1's improvement program for achieving these required milestones, with the endpoint being achievement of a minimum of 85 percent capture system-wide for CSOs and elimination of SSOs during the typical year by January 1, 2040.

Approach to Selecting Improvements

Consistent with the ACD, SD1 has developed the UWSP under our established adaptive management framework. As part of this process, all of the programs and project types recommended in the original WP have been reviewed and refined or modified as warranted based on additional information gathered over the past 5 years. Further, as specified in the ACD and in preparation for the next round of adaptive planning, the UWSP includes two levels of detail. For projects in the first 10-year portion (through 2029), project definitions are more specific and are shown with greater detail commensurate with the relative certainty of implementation to achieve the target milestones. That said, SD1 may adjust specific projects as more detailed information is obtained during the preliminary engineering phases, but in doing so will maintain achievement of the required overflow reduction metrics. For projects in the second 10-year portion (2030-2040), preliminary plans have been developed. Model simulation results for these projects indicate that they meet the ACD reduction and capture requirements, but are subject to more refinement and even significant changes in the next set of watershed plans as conditions change and technologies evolve.

SD1's mission is to protect public health, property, and the environment, and to support the economic vitality of the community we serve. SD1, EPA and the State of Kentucky have agreed on an ACD which allows SD1 to meet all of these objectives. The agreed-to parameters of the ACD place the highest priority on protection of public health and the environment. This priority is captured in the ACD's overflow reduction milestone metrics, established to ensure that regular progress is being made towards increased protection levels, with the highest emphasis placed on SSO elimination (75% reduction in first 10 years) as these pose the greatest overall threats. For both 10-year windows, projects have been selected to meet the agreed-to ACD health and environmental milestones.

Consistent with the expectations of the ACD, SD1 used its calibrated hydraulic model as the platform for evaluating and comparing candidate projects, and for ultimately sizing the selected improvements to achieve the ACD overflow reduction milestones. Where warranted, the project selection process included comparison of candidate improvements relative to project-specific selection criteria, including addressing

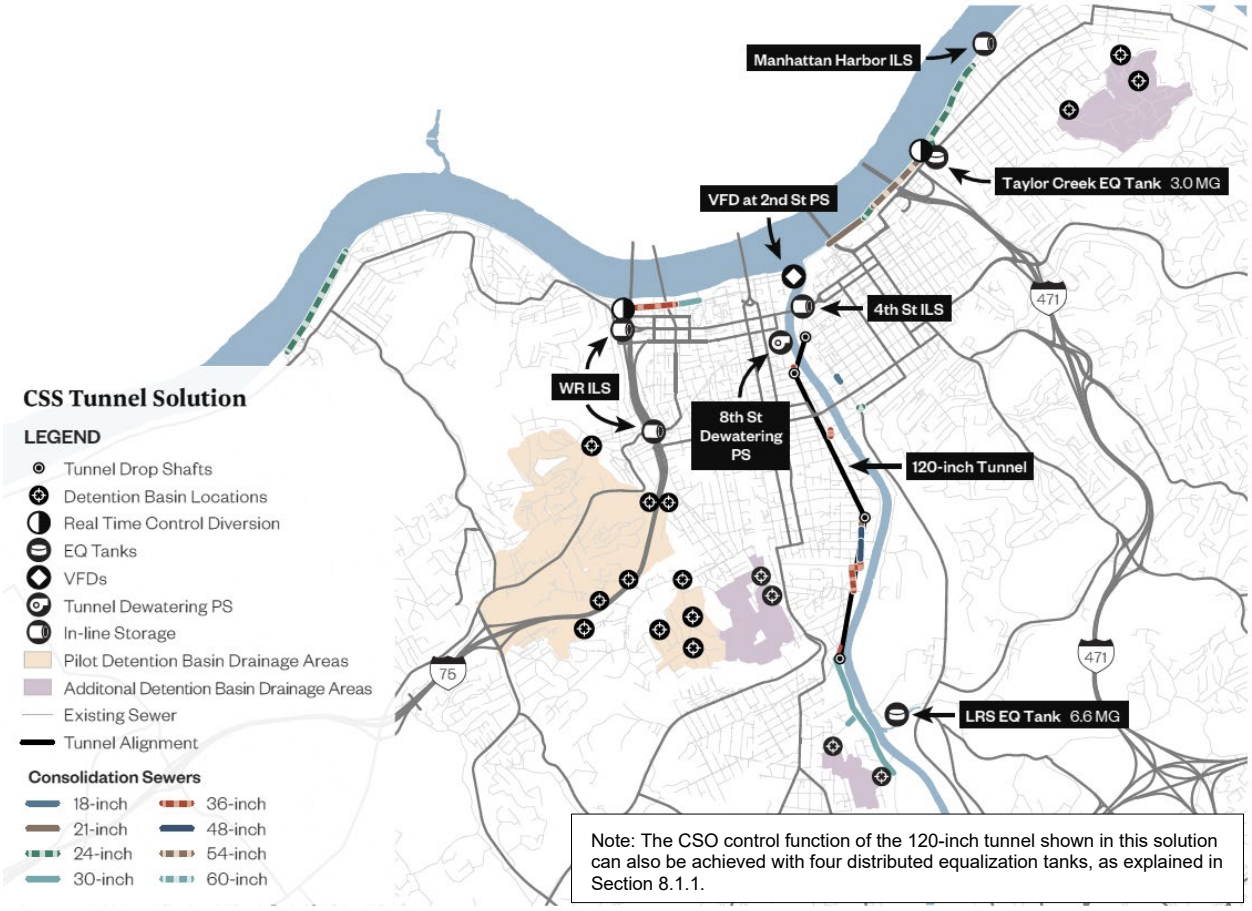
overflows in priority areas, reducing high-volume overflows, and combining overflow control with asset management needs.

Overview of the 2040 UWSP Solution

SD1's UWSP solution is made up of two components: the CSO LTCP component, and the SSO SSOP component. An overview of each of these 2040 solution components is presented below, with additional detail on projects and benefits by milestone date provided in subsequent sections.

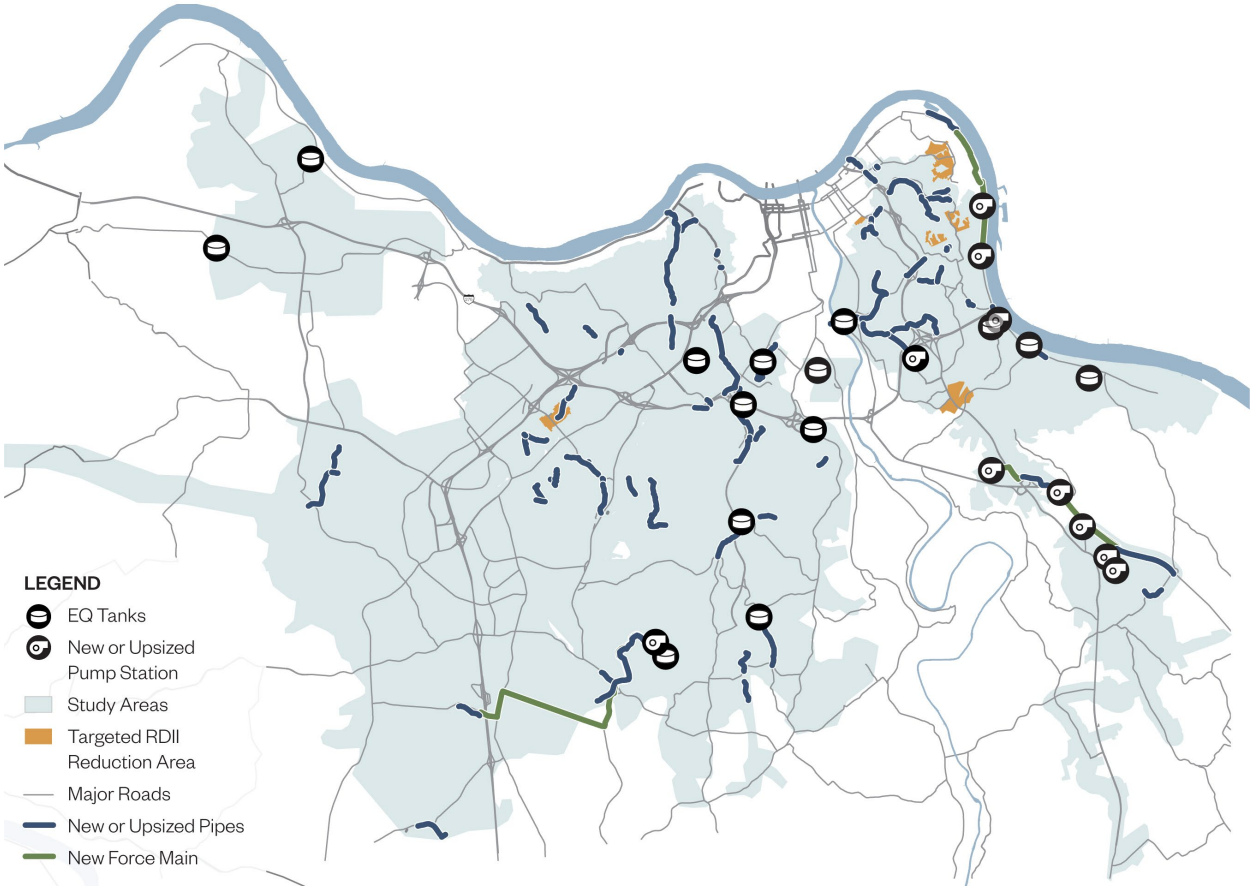
The full LTCP component (known as the 2040 CSO solution) is summarized in Figure ES-2 and combines high-impact early projects (river water intrusion mitigation, surface stormwater detention basins) followed by state-of-the-art coordinated control schemes that cost-effectively maximize the performance of existing and future infrastructure. Once the benefits of these earlier implementations are maximized, final CSO control is achieved using storage-focused gray infrastructure, again optimized in terms of size and performance using coordinated controls. These improvements are sequenced to meet the ACD 2023, 2029, 2034, and 2040 percent capture milestone requirements, culminating with 85% capture by 2040.

Figure ES-2: 2040 CSO Solution



The full SSOP component (known as the 2040 SSO Solution) is summarized in Figure ES-3 and leverages a cost-effective combination of wet-weather flow equalization, targeted Rainfall-Dependent Infiltration and Inflow (RDII) removal, and peak flow conveyance to achieve SSO elimination goals. SD1 will continue to use the RDII reduction technologies from the original WSP in targeted areas, but the UWSP is now weighted more heavily to gray solutions as SD1 has experienced the uncertainty of successful I/I removal, especially under certain conditions, in early pilot projects. These SSO improvements are sequenced to meet the ACD 2023, 2029, 2034, and 2040 SSO reduction requirements, culminating with elimination of SSOs during the typical year rainfall in accordance with the requirements of the ACD by 2040.

Figure ES-3: 2040 SSO Solution



Details on Improvements Through Time

The full UWSP solution presented above represents the endpoint of SD1's overflow control program, scheduled for completion by 2040. However, consistent with the ACD milestone approach, incremental improvements in terms of overflow control are achieved with every stage of implementation. These improvements through time are summarized below, along with further details on the specific projects included in each milestone period.

The improvements and overflow reductions presented below are in addition to improvements achieved to-date, i.e. through the 2017 baseline. SD1 began implementing projects included in the original Watershed Plan in 2005, well before formal Watershed Plan approval in 2014. As a result, SD1 has over a decade of targeted improvements already completed, with an associated reduction in CSO and SSO overflow volume. The end result of the improvements through 2017 is that SD1 has eliminated approximately 155 MG of typical year CSO discharges and approximately 124 MG of typical year SSO volume, relative to overflow levels that existed before the original CD.

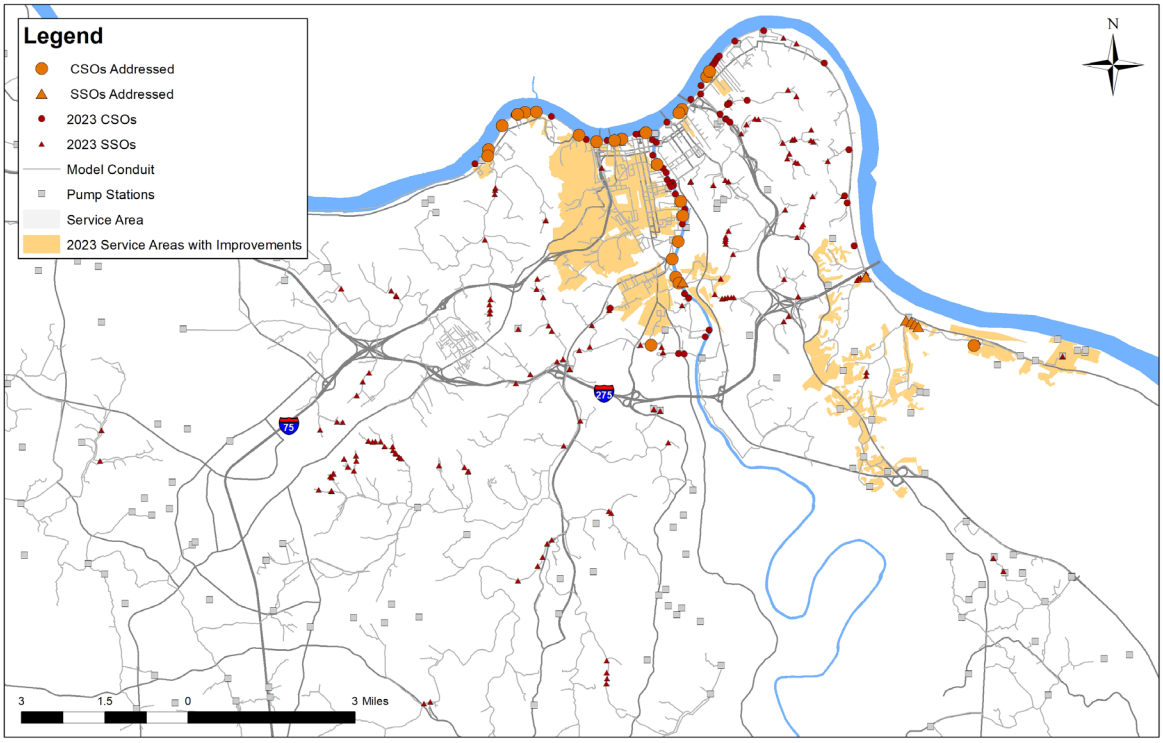
Improvements Through 2023

The 2023 improvements are proposed projects to be completed between now and 2023 and focus on several priority areas and the initial round of "low-hanging fruit" identified by SD1. In the CSO area, the improvements comprise the first two phases of river-water intrusion mitigation, targeted sewer separation, and the Ash Street Equalization (EQ) tank.

The SSO improvements are made up of flow equalization in the priority Highland Heights/Silver Grove area and a new parallel Licking River siphon. The Licking River Siphon upgrade is a key SSO mitigation project, as it benefits the largest SSO in SD1's system.

The service areas associated with these 2023 improvements, along with the overflows that benefit from the improvements, are shown in Figure ES-4. The projected cumulative benefit of the proposed improvements through 2023 is that SD1 will eliminate approximately 41 MG of CSO volume and approximately 67 MG of SSO volume in the typical year, relative to the ACD baseline (representing 2017 conditions). These improvements will achieve a CSO percent capture of 68.6% and percentage of baseline SSO volume remaining of 42.4%, meeting required ACD milestone metrics.

Figure ES-4: Overflows and Service Areas Included in 2023 Improvements



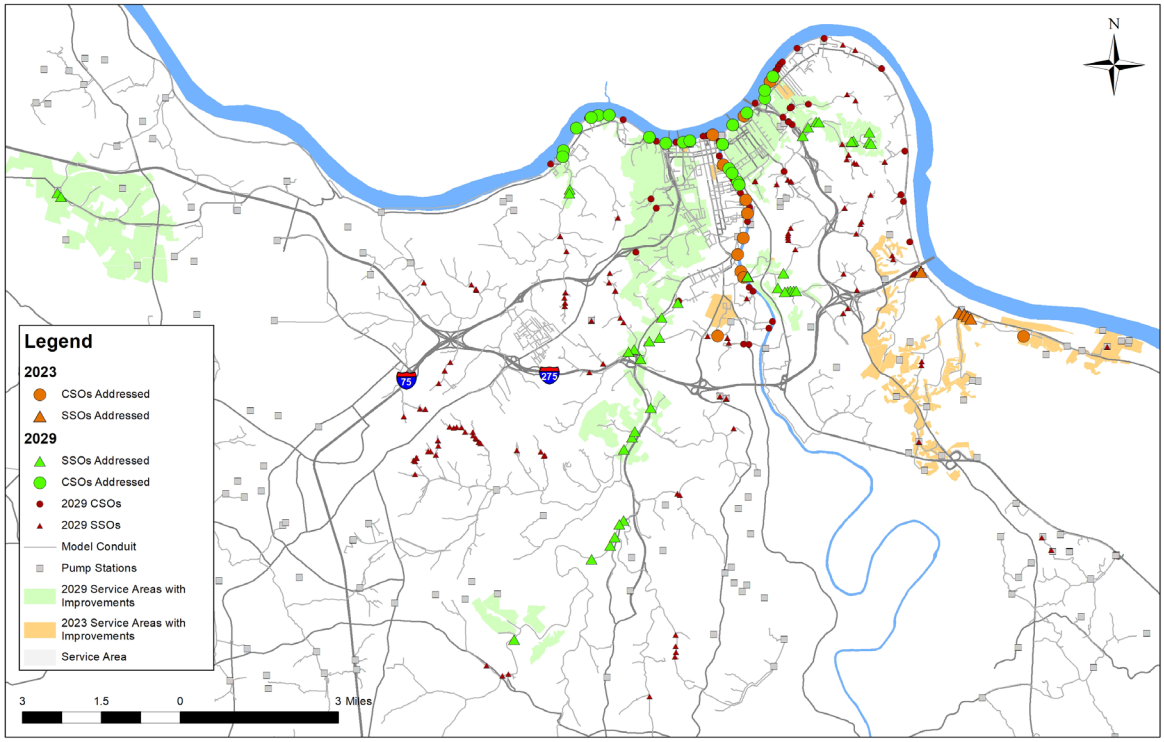
Improvements Through 2029

The 2029 improvements are proposed projects to be completed between 2023 and 2029. These projects build on the 2023 improvements and begin laying the foundation for the ultimate 2040 solution. In the CSO area, improvements comprise upgrades at Bromley Pump Station (the controlling piece of infrastructure at the downstream outlet of the combined sewer system), along with Phase III of the river water intrusion mitigation program. The CSO improvements also include an important project incorporating components of real-time control (RTC) and flood mitigation – the Willow Run Detention Basin Pilot Project. This project will use dynamic coordinated controls to provide both CSO reduction and flood mitigation, and knowledge gained through operation of these basins will play an important role in configuring additional RTC installations in the 2034 improvement program.

The SSO improvements comprise the remaining portions of the Licking River Siphon solution (bringing full control to SD1's largest SSO), installation of the Lakeview Pump Station Equalization (EQ) Tank (bringing full control to SD1's second largest SSO), and pump station, force main, and conveyance improvements throughout the system.

The service areas associated with these 2029 improvements, along with the overflows that benefit from the improvements, are shown in Figure ES-5. The projected cumulative benefit of all proposed improvements through 2029 is that SD1 will eliminate approximately 339 MG of CSO volume and approximately 87 MG of SSO volume during the typical year, relative to ACD baseline. These improvements will achieve a CSO percent capture of 75.3% and percentage of baseline SSO volume remaining of 24.8%, meeting required ACD milestone metrics.

Figure ES-5: Overflows and Service Areas Included in 2029 Improvements



Improvements Through 2034

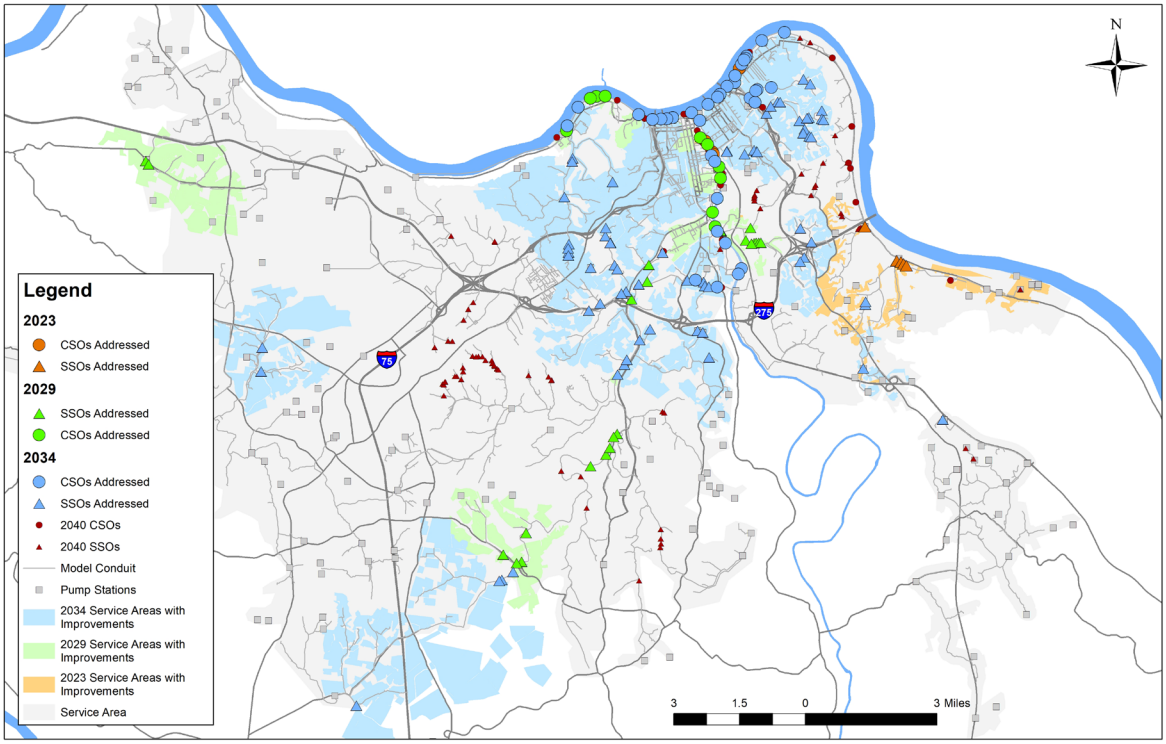
The 2034 improvements are projects that would be completed between 2029 and 2034 and have been selected to meet required overflow reduction milestones while maintaining enough flexibility to allow SD1 to optimize the ultimate 2040 solution. In the CSO area, the improvements consist of the Taylor Creek EQ Tank (a major facility that effectively anchors the CSO control program along the upper Ohio River Interceptor), additional RTC components, and seven to nine additional surface detention basins to control stormwater prior to entry into the combined sewer system. The RTC components include inline storage and flow balancing facilities with associated control features, the installation of Variable Frequency Drive pumps at the 2nd Street Pump Station, and weir adjustments at seven CSO diversions.

The SSO improvements are made up of additional conveyance and regional EQ tanks in the Lakeview study area, conveyance improvements and targeted I/I reduction in the Taylor Creek study area, the remaining conveyance improvements in the Western Regional area, the US27/AA Highway improvements, and conveyance improvements and an EQ tank in the Banklick area. The SSO improvements also include two projects that are examples of applying SD1's project-specific selection criteria: conveyance upgrades in the upper Licking River Siphon sewershed and Bromley Crescent Springs area. Both of these improvements provide multiple benefits to SD1, as they not only mitigate SSOs but also address asset management needs and/or relieve stream hydromodification concerns.

The service areas associated with these 2034 improvements, along with the overflows that benefit from the improvements, are shown in Figure ES-6. The projected cumulative benefit of all proposed

improvements through 2034 is that SD1 will eliminate approximately 584 MG of CSO volume and approximately 106 MG of SSO volume during the typical year, relative to ACD baseline. These improvements will achieve a CSO percent capture of 80.6% and percentage of baseline SSO volume remaining of 8.1%, meeting required ACD milestone metrics.

Figure ES-6: Overflows and Service Areas Included in 2034 Improvements



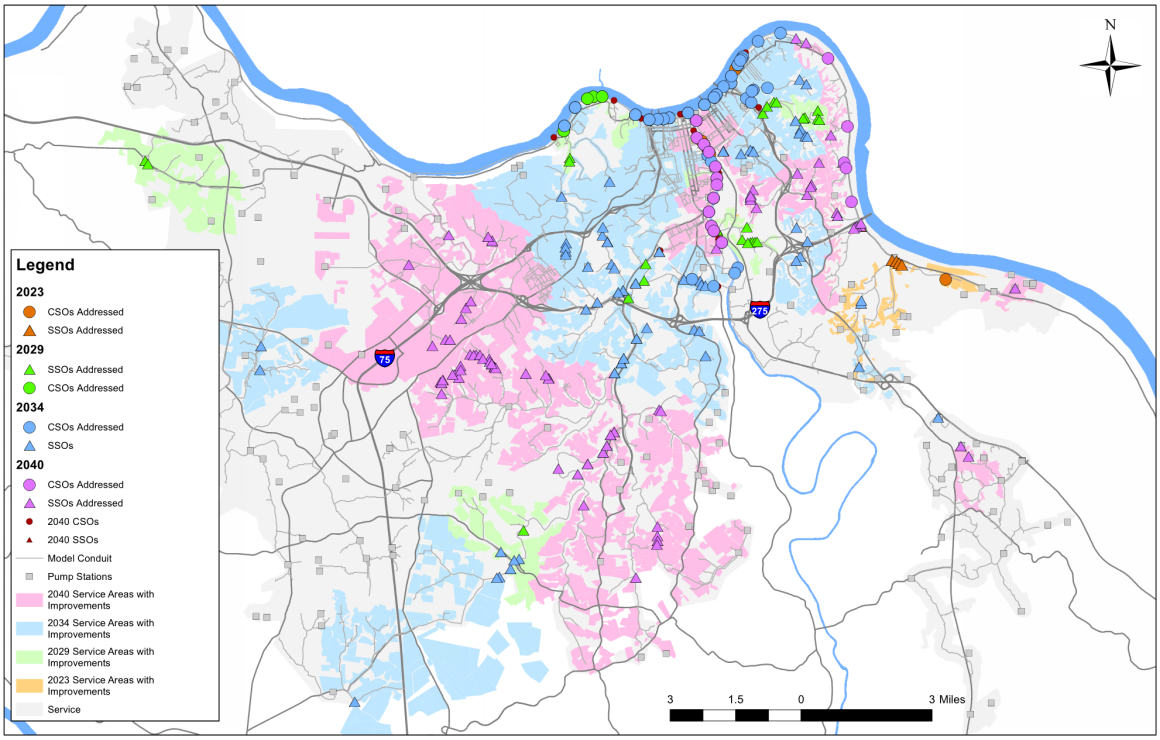
Improvements Through 2040 (Full UWSP)

The 2040 improvements are projects that would be completed between 2034 and 2040 and represent the final stage of SD1's UWSP implementation. In the CSO area, the final improvement required to meet the 2040 milestone of 85% capture is the Licking River solution. The Licking River solution is a storage solution comprising either a single deep rock storage tunnel or distributed surface EQ tanks, configured to capture remaining CSO discharges along the Licking River. Both storage options have been fully analyzed, costed, and confirmed as viable installations to achieve the necessary control objectives. SD1 will update its review and analysis for the preferred Licking storage option in future watershed planning cycles, informed by results of RTC pilots in earlier UWSP phases, public input, and the state of the industry for both tunnel and EQ tank technologies in the 2030s.

The SSO improvements are made up of the remaining conveyance improvements in the Lakeview and Licking River Siphon study areas, conveyance improvements and targeted I/I reduction in the Dry Creek study area, an EQ tank at Taylorsport PS, all remaining Highland Heights/Silver Grove (HHSG) improvements, and PS upgrades and conveyance improvements in the Eastern Regional area.

The service areas associated with these 2040 improvements, along with the overflows that benefit from the improvements, are shown in Figure ES-7. The projected cumulative benefit of all proposed improvements through 2040 is that SD1 will eliminate approximately 887 MG of CSO volume and approximately 115 MG of SSO volume during the typical year, relative to ACD baseline. These improvements will result in a CSO percent capture of 85% and SSO volume remaining of 0% based on typical year performance, thus meeting required ACD milestone metrics.

Figure ES-7: Overflows and Service Areas Included in 2040 Improvements



Estimated Costs to Complete the UWSP

SD1 has developed preliminary cost estimates for all projects included in the UWSP. These costs were prepared as Class IV planning-level capital costs in 2019 dollars and are summarized in Table ES-2 below. Costs are presented for both of the potential Licking River solutions, a single deep rock storage tunnel or distributed surface EQ tanks; as explained previously, both options have been fully analyzed, costed, and confirmed as viable installations to achieve the necessary control objectives. SD1 will update its review and analysis for the preferred Licking storage option in future watershed planning cycles.

Table ES-2: UWSP Capital Cost Summary (Total Program Costs Through 2040)

Categories of Projects	UWSP Capital Cost: LR Tunnel (2019 $M)	UWSP Capital Cost: LR EQ Tanks (2019 $M)
SSO Control Projects	$395	$395
CSO Control Projects	$284	$260
TOTAL UWSP Costs	$679	$655

The SSO control project category includes all improvements necessary to both eliminate current SSOs and prevent SSOs within SD1's existing system due to projected growth during the typical year. The CSO control project category includes all improvements necessary to achieve 85% capture during the typical year.

Conclusions

SD1's Updated Watershed Plan provides a roadmap to reduce overflows in Northern Kentucky, placing the highest priority on protection of public health and the environment through achievement of the ACD's overflow reduction milestone metrics. The UWSP represents the next iteration of the adaptive management approach incorporated in the ACD, taking advantage of additional information and improved technologies in the overflow control industry to develop a better and more efficient plan to achieve overflow reduction requirements and improve water quality conditions in Northern Kentucky. This UWSP will guide SD1's efforts for at least the next 10 years, during implementation of the 2023 and 2029 projects; these first 10-year projects have been fully developed at the planning level, and while the actual list of projects may change subject to refinement during final planning and design, the ability of the projects to meet ACD milestone metrics has been established and this ability to meet the metrics will not change. Within the next 10 years and per ACD requirements, SD1 will also develop the next update to the Watershed Plan; the next update will confirm, revise as appropriate, and further define the 2034 and 2040 projects and serve as the guide to SD1's efforts through 2040.

Section 1
Introduction

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1. Introduction

This Updated Watershed Plan (UWSP) has been developed by Sanitation District No. 1 (SD1) as required by the Amended Consent Decree (ACD) that became effective on May 22, 2019. The UWSP presents SD1's proposed program for addressing combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs), and per the ACD includes components of a CSO Long-Term Control Plan (LTCP) and a Sanitary Sewer Overflow Plan (SSOP). This UWSP updates SD1's original Watershed Plan (WSP), submitted in 2009 with subsequent U.S. Environmental Protection Agency (EPA) and Kentucky Energy and Environment Cabinet (Cabinet) approval of the technical portion on February 14, 2014.

The primary requirement for the UWSP is to demonstrate achievement of CSO capture and SSO volume reduction milestones in approximately 5-year increments. These agreed-to milestone metrics form the basis for achieving SD1's primary UWSP objective of protecting public health and the environment. The ACD-required CSO capture, and SSO volume reduction milestones are as follows:

Table 1-1: CSO Percent Capture and SSO Volume Reduction ACD Milestones

Milestone Date	Typical Year CSO Percent Capture	Typical Year SSO Percentage of Baseline Volume Remaining
July 1, 2023	67%	80%
January 1, 2029	75%	25%
July 1, 2034	80%	10%
January 1, 2040	85%	0%

All reduction metrics are to be calculated relative to an agreed-to 2017 baseline established by SD1's hydraulic model, as outlined in the ACD. The remainder of this document presents SD1's plan for achieving these milestone metrics, organized as follows:

- Section 2 presents the principles that guided SD1's selection of improvements for the UWSP. These principles are founded on SD1's responsibility and mission as the regional wastewater utility serving Northern Kentucky.
- Section 3 presents the approaches and tools used by SD1 to develop, analyze, compare, and select the preferred improvements to meet ACD requirements.
- Section 4 summarizes the improvements completed to-date (through the 2017 baseline) and associated overflow reductions. This is presented as relevant background to SD1's ongoing commitment to overflow reduction; the overflow reductions realized prior to 2017 do not enter into the achievement of ACD milestone metrics.
- Sections 5, 6, 7, and 8 provide details on the 2023, 2029, 2034, and 2040 improvements, respectively. As required by the ACD, improvements for the first 10-year program (2023 and 2029 projects) have been developed to a higher level of detail than improvements for the

second 10-year program (2034 and 2040 projects). SD1's modeling tools have been used to confirm achievement of the ACD milestone metrics with the projects as proposed, and while all projects are subject to refinement during implementation, achievement of the metrics will not change. Potential refinement of projects is especially applicable to the 2034 and 2040 improvements, as these projects will be fully re-assessed in the next Watershed Plan update cycle (required within the next 10 years per the ACD).

- Section 9 concludes the report with a discussion of other factors and considerations relevant to the UWSP.

As noted above, the District's Watershed Plans combine elements of both an LTCP and an SSOP. A detailed cross-reference between the LTCP and SSOP elements identified in Paragraph 41 of the ACD and relevant sections in this UWSP and the original WSP is provided in Appendix A.

Section 2
Guiding Principles

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2. Guiding Principles

The stated mission of SD1 is to provide the Northern Kentucky Region with wastewater and stormwater services to protect public health, property and the environment and to support the economic vitality of the community. Adherence to the underlying principles of its mission is the controlling factor in all decisions made by SD1 and is evident in the agreed-to ACD milestone metrics. The metrics were thoughtfully designed to balance progress towards public health and environmental stewardship goals with rate affordability and economic impacts to the community. The combination of these factors defined the following guiding principles used by SD1 in configuring the UWSP:

Protecting public health and the environment is the original driver for wastewater utilities in the United States and remains the primary, controlling objective for SD1 in developing the UWSP.

Achieving ACD milestones is the agreed-to mechanism by which progress toward the primary objective of protecting public health and the environment is measured. SD1 worked closely with EPA and the Cabinet to establish consensus on the overflow reduction milestones in the ACD, and achieving these milestones guided the sequencing of improvements through 2023, 2029, 2034, and 2040.

Cost effectiveness is a critical factor in selecting improvements to meet the overflow reduction milestones. Highly efficient achievement of the ACD metrics ensures that SD1 is upholding its commitment to provide affordable service to its ratepayers and furthers its mission of supporting the economic vitality of the community.

Stakeholder priorities are a key consideration for SD1 as an operating utility. SD1 put forth significant effort during the original watershed planning process to engage the public and gain stakeholder input on overflow reduction and have since continued to keep stakeholders involved in the process through ongoing public information programs.

The end result of applying these guiding principles is a cost-effective UWSP that protects public health and the environment, meets ACD requirements, and continues SD1's overflow reduction program. The impact of this program can be seen in Figures 2-1 and 2-2, which show estimated overflow reductions through time starting in 2009, the year the original WSP was initially submitted. The 2017 values represent baseline for the purpose of the ACD overflow reduction metrics. The CSO control program meets all UWSP milestones, achieves 85% capture of CSO by 2040, and results in a greater than 1-billion-gallon reduction in typical year overflow volume (cumulative since 2009). The SSO program also meets all milestones and eliminates SSOs during the typical year by 2040. Note also that the SSO program achieves its greatest reductions during the first 10 years of UWSP implementation - this reflects a high initial priority for the SSO program, in recognition of the generally higher public health risk associated with SSOs and in line with the priority sequencing outlined above.

Figure 2-1: CSO Metrics Projected Through 2040

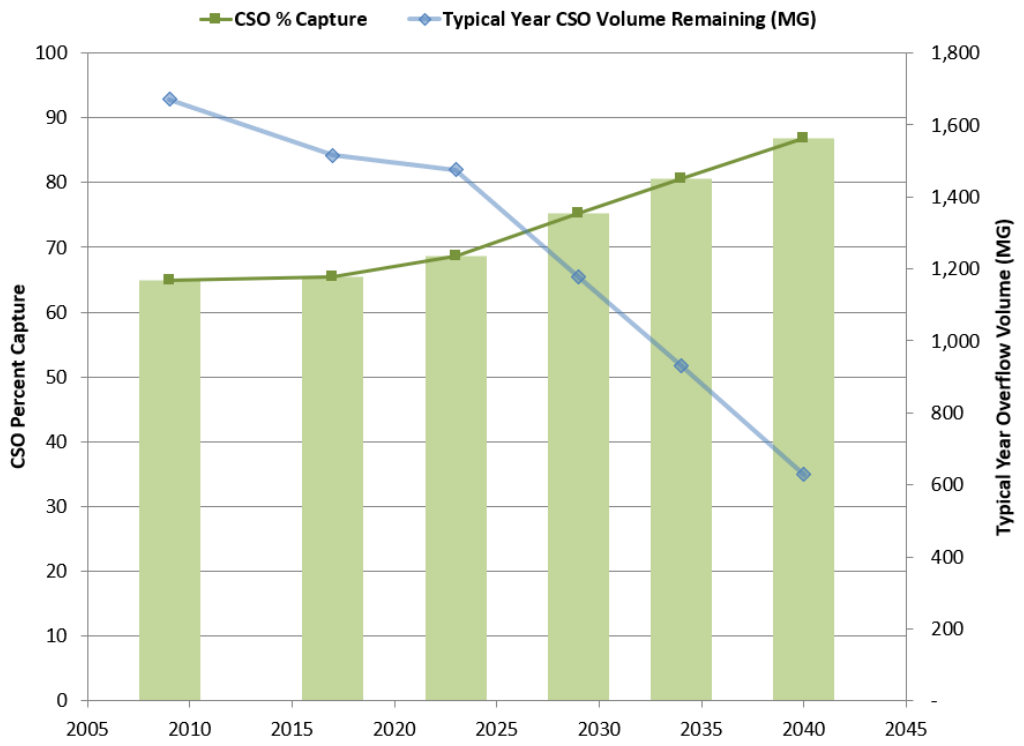
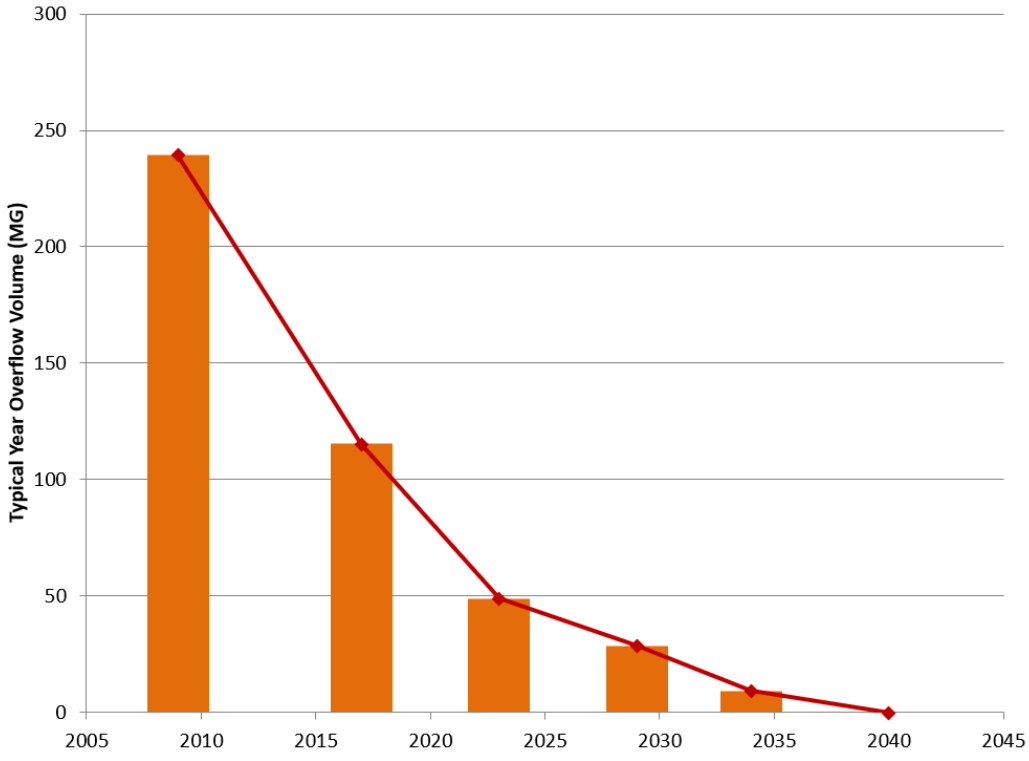


Figure 2-2: SSO Metrics Projected Through 2040



Section 3
Modeling Approach and Alternatives Evaluation Strategy

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3. Modeling Approach and Alternatives Evaluation Strategy

3.1 Modeling Background

3.1.1 Typical Year Rainfall

As described in Appendix "A" of the ACD, the typical year rainfall is defined as the rainfall events that occurred in 1970, as recorded at the Cincinnati-Northern Kentucky International Airport and is represented by hourly rainfall data applied over the sewer collection system per the areal reduction factors shown in Table 3-1 and described in Section 3.1.3 below. The typical year rainfall is utilized to evaluate collection system performance related to CSO percent capture and SSO volume reduction and associated achievement of ACD milestones.

3.1.2 Design Storm for SSO Elimination

Once SSO locations are identified using the typical year rainfall, and as described in Appendix "A" of the ACD, SSO elimination projects are sized using a design storm approach. The design storm for sizing SSO elimination projects is a rainfall event for Kentucky Region 3 with a recurrence interval of 2 years and a 6-hour duration and applied over the sewer collection system per the areal reduction factors shown in Table 3-1 and described in Section 3.1.3 below. This storm is distributed for a first quartile storm in accordance with Table 10 on page 21 of the "Rainfall Frequency Atlas of the Midwest,"[1] and assumes saturated antecedent moisture conditions.

3.1.3 Areal Reduction Factors

As described in Attachment "A" to Appendix "A" of the ACD, areal reduction factors applied to the typical year and design storm rainfall events are based on Table 21 on page 36 of the "Rainfall Frequency Atlas of the Midwest."[1] Table 3-1 below summarizes the areal reduction factors for each model area within the collection system. Table 3-1 is also included in the ACD as Attachment "B" to Appendix "A".

Table 3-1: Areal Reduction Factors as Applied to October 2017 Model Areas (1)

Model	Areal Reduction	Area (square miles)
Bromley	0.93	40.0
Dry Creek	0.91	73.4
Eastern Regional	0.97	7.0
Taylorsport	0.96	14.0

[1] Huff, Floyd A., and James R. Angel. Rainfall Frequency Atlas of the Midwest. Illinois State Water Survey, Champaign, Bulletin 71, 1992

Model	Areal Reduction	Area (square miles)
Western Regional	0.93	40.5

Notes:
(1) As explained in "Rainfall Frequency Atlas of the Midwest," areal reduction factors vary by size of tributary area; the values presented in the table are specific to 2017 model areas. For future time horizons, the factors were re-calculated to account for changes in model areas due to growth.

3.1.4 Model Updates Since 2014 WSP

Detailed descriptions of hydraulic model updates since the 2014 WSP are documented in the Quarterly and Annual Report submittals. Specifically, extensive flow monitoring projects and the associated model calibrations since 2014 have been summarized in the Annual CMOM Reports from 2014 to 2018 and in the Amended Consent Decree Annual Reports from 2019 to 2020. Appendix B includes figures of the model calibration refinement areas from these reports. Similarly, capital projects summarized in SD1's Quarterly Reports that were completed during the period between the WSP and USWP have been incorporated in the hydraulic models. These completed projects are further discussed in Section 4.0.

While model calibration hydrologic refinements have occurred since the 2014 WSP to update the model to existing conditions, the UWSP continues to use the same design assumptions and variables as the original WSP with the exception of the inclusion of areal reduction factors discussed earlier.

With regard to the water quality models, no changes have been made since the 2014 WSP, as those models were used to establish the performance goals summarized in Section 3.3.2.b of the 2014 WSP. These performance goals were then used to develop the UWSP.

3.1.5 Baseline Model

As described in Appendix "B" of the ACD, the baseline model is defined as SD1's October 2017 hydraulic model, with baseline SSO volume of 115.44 MG, and baseline CSO volume of 1,516 MG using the typical year rainfall data and areal reduction factors described herein. Compliance with the CSO Percent Capture and SSO Volume Reduction ACD milestones summarized in Paragraph 43 of the ACD and included in Table 3-2 below shall use these baseline volumes.

Table 3-2: CSO Percent Capture and SSO Volume Reduction ACD Milestones

Milestone Date	Typical Year CSO Percent Capture	Typical Year SSO Percentage of Baseline Volume Remaining
July 1, 2023	67%	80%
January 1, 2029	75%	25%
July 1, 2034	80%	10%
January 1, 2040	85%	0%

3.1.6 CSO and SSO Characterization

The KPDES permit for the Dry Creek Wastewater Treatment Plant and its companion fact sheet was issued on May 17, 2019, became effective on July 1, 2019, and is set to expire on June 30, 2024. The approved KPDES permit, and its companion fact sheet contain the characterization of the CSO outfalls, regulators, and interactions with the Flood Protection System. Appendix C includes tabular summaries of this characterization, as well as summaries from the KPDES 2019 and 2020 CSO Annual Reports related to minor modifications from routine asset management projects.

A characterization of the baseline SSO locations is included in Appendix D. There are no SSOs associated with the operation of the Flood Protection System.

3.1.7 Flood Protection System Representation

The overall operation of the system during Flood Protection System Operation for existing conditions is represented in the model based on actual SD1 operations as shown in Table 3-3 below. The sanitary pump stations associated with the combined system are explicitly modeled and their operational status dictates flow through the interceptors, to Dry Creek Wastewater Treatment Plant and out CSOs. Flood station wet weather pumps are not explicitly modeled but the model properly represents the CSO discharge volume during Flood Station System Operation, including its operation during the typical year.

The operation of the system during Flood Protection System Operation will change as a result of SD1's River Water Intrusion Mitigation (RWI) Program. Specifically, the RWI Program will allow SD1 to maintain full sanitary pump station operation at higher river levels, decreasing discharge to the rivers and increasing flow to the Dry Creek WRF during wet weather conditions. As explained further in Sections 5 and 6, the RWI Program will be implemented in two phases, one as part of 2023 improvements and the other as part of 2029 improvements. The increase in action river levels (i.e. river levels that trigger modified operations at SD1 pump stations during Flood Protection System operation) associated with each improvement phase is also shown in Table 3-3.

Table 3-3: Typical Year Flood Protection System Operational Rules as Incorporated in Model

Pump Station	Action	Existing Operation River Stage	2023 Operation River Stage	2029 Operation River Stage
Silver Grove	Turn down to two pumps	38'	38'	38'
8th Street, Patton Street	Turn Station OFF	41'	47'	47'
2nd Street	Turn Station OFF	41'	41'	47'
Bromley	Turn down to two small (300 HP) pumps	41'	47'	47'
Banklick	Turn Station OFF	43'	43'	43'

As noted in the 2014 WSP (Section 7.3.1), the elevated river stages that activate the Flood Protection System are due to wet weather conditions in the Ohio River drainage basin; these elevated stages rarely

result from local rainfall. Therefore, typical year simulations used actual river levels measured during the 1970 typical year as the river boundary condition, as these measured levels inherently capture all relevant hydrologic processes in the tributary Ohio River drainage basin. Given the use of actual river levels in model simulations, the areal reduction factors described above do not impact typical year river levels.

3.1.8 CSO Percent Capture Calculation

As described in Appendix "B" of the ACD, compliance with the ACD combined system milestones will be quantified by the "Percent Capture" calculation shown below.

$$Percent\ Capture = \frac{(TCF - CSO)}{TCF} \times 100 \text{ , where}$$

Combined Sewer Overflow (CSO) = the typical year overflow volume from the combined sewer system that does not receive the minimum treatment specified in Section II.C.4.a of the CSO Policy.

Total Combined Flow (TCF) = the sum of flow in the CSS in the typical year due to rainfall derived inflow and infiltration (RDII), rainfall/runoff, the typical dry weather flow that enters the CSS during wet weather, and any flow that has been eliminated from the CSS through separation or other means since April 18, 2007.

$$TCF = RDII + rainfall/runoff + dry\ weather\ flow + eliminated\ flow$$

For the eliminated flow term, a separate analysis was conducted to estimate the amount of flow eliminated from the CSS from separation projects that have been constructed between April 2007 – October 2017. This eliminated flow was determined to equal 26 MG. Where model solutions described in this report involve additional separation projects to be constructed to meet ACD milestones, this eliminated flow term is updated to incorporate the amount of flow that is expected to be removed from the CSS via the planned separation project.

The following summarizes the percent capture calculation for the baseline October 2017 hydraulic model with a CSO volume of 1,516 MG as described in Section 3.1.4.

Table 3-4: Baseline Model Percent Capture Calculation

Category	Typical Year Annual Volume (MG)
Storm water entering combined system	2,570
Sanitary flow during wet weather	1,818
Eliminated Flow	26
Total Combined Flow (TCF)	4,414
Untreated CSO (CSO)	1,516
Percent Capture [(TCF)-(CSO)]/(TCF)	**65.7%**

Note that the UWSP uses the same approach to calculating percent capture as the 2014 WSP. This approach was presented in the 2014 WSP document and further explained in a July 15, 2013, SD1 letter providing responses to comments as presented in a May 13, 2013 EPA and Cabinet letter.

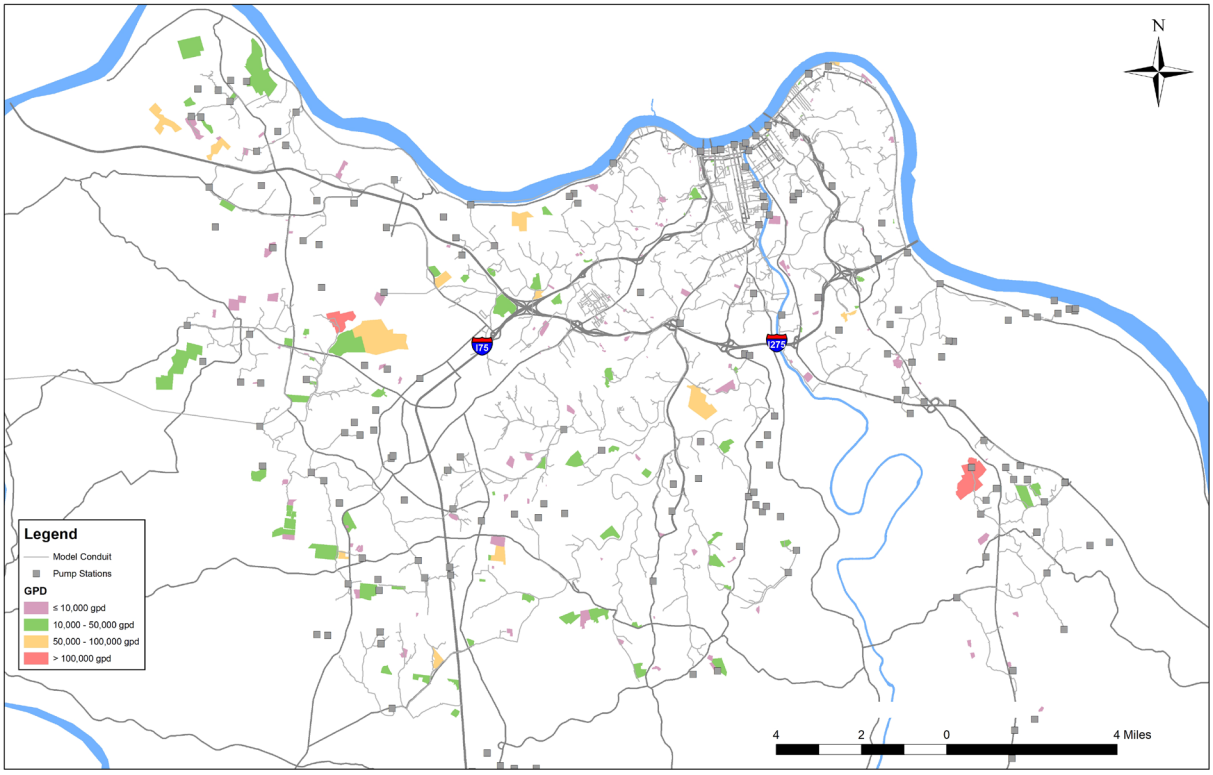
3.2 Future Growth Projections

As outlined in Table 3-2, SD1's ACD mandates CSO percent capture and SSO volume reduction goals at future time horizons. As such, the future growth anticipated at these time horizons must be accounted for in the UWSP, as the additional flow generated by the growth will impact the selection and sizing of solutions. This section summarizes the process used to develop the future growth projections for 2023, 2029 and 2040.

3.2.1 2023 Future Growth Projections

For near term growth, SD1's current capacity reservations were assumed to provide a reasonable representation of development expected to occur by 2023. These capacity requests represent an approximate 5-year development horizon and therefore were used to create the 2023 development conditions model. These areas are shown in Figure 3-1.

Figure 3-1: 2023 Development Areas



The capacity reservations shown in Figure 3-1 represent approximately 4,722 new taps over the next five years at an average rate of approximately 944 new taps/year. Since 2001, the annual average tap rate across SD1's service area is approximately 1,100 new taps, with periods of slow growth (~600 taps/year), and periods of fast growth (> 2,000 taps/year). Thus, the projected tap rate from capacity reservations over the next five years is generally consistent with the historical annual average tap rate. Given this correlation, formal capacity requests represent a reasonable prediction of future growth through 2023 and will add an average dry weather flow (ADWF) of approximately 3.6 mgd to SD1's collection system. The ADWF includes sanitary flow and base infiltration. Table 3-5 below depicts the breakdown of projected future flows by model area and by Water Reclamation Facility (WRF).

Table 3-5: Projected ADWF Increase by Model Area

Model	ADWF (MGD)
Bromley	0.62
Dry Creek	1.21
Taylorsport	0.45
Subtotal Dry Creek WRF	**2.28**
Western Regional WRF	0.99
Eastern Regional WRF	0.30
TOTAL	**3.57**

3.2.2 2029 and 2040 Future Growth Projections

Since less was known about future growth beyond 2023, a more detailed analysis was required to develop realistic projections based on best available information. The tasks associated with this analysis are described below, beginning with a comprehensive review of several sources of background information.

3.2.2.1 Information Review

3.2.2.1.1 SD1 Information

This task included a review of the 2030 models developed for the current Watershed Plan, the Western Regional Master Plan, and historical SD1 tap records. The tap records provided historical insight into development patterns across SD1's service area. This review is summarized in Appendix E.

3.2.2.1.2 County (Boone, Kenton, Campbell) Information

This included a review of the latest comprehensive plans for each county, and available current and future land-use shapefiles. The latest Comprehensive Plans (for Boone, Kenton, and Campbell Counties) were reviewed in preparation for face-to-face County meetings to discuss future conditions. These meetings are

described in more detail in Section 3.2.2.2. Current and future land-use shapefiles, along with additional relevant shapefiles, were obtained from each County after the meetings and provided important resources for this effort.

3.2.2.1.3 Regional Information

This included a review of the following:

- Pertinent planning shapefiles from the Planning and Development Services of Kenton County and the Boone County Planning Commission.
- Traffic Analysis Zone (TAZ) data.
- Kentucky State Data Center 2016 report (projects populations in Kentucky through 2040).

Third-party regional information has always been an important resource in SD1's planning efforts. Projections and data from the Planning and Development Services of Kenton County (formerly the Northern Kentucky Area Planning Commission (NKAPC)) and Kentucky State Data Center were used in the original watershed planning process. Current projections from these agencies were reviewed, including Traffic Analysis Zone (TAZ) data. The conclusions reached from these reviews are described in more detail in Appendix E.

3.2.2.2 County Meetings (Campbell, Kenton, and Boone Counties)

Meetings were held with the planning agencies/departments from each county to gain insight on County future growth perspectives and identify/discuss areas most likely to develop over the next 10 and 20 years. These face-to-face meetings proved useful as a mechanism to obtain each County's perspective on growth areas. Two categories of information were particularly useful:

- Updated and current GIS files obtained directly from appropriate County specialists.
- County perspectives on the specific location for future growth, along with the associated drivers, helped inform the delineation of future growth areas.

A summary of key input from the County meetings and how it was used is included in Appendix E.

3.2.2.3 Future Growth Definition

The purpose for the information review and County meetings described in previous sections was to provide the background necessary to define future growth areas at the 2029 and 2040 time horizons. This definition relied on three key components:

- *Population projections* – how many additional people will live in SD1's service area in 2029 and 2040.
- *Number of new taps* – how many new houses will those people live in.

- *Growth areas* – where will the new taps/houses be, along with associated commercial/industrial growth.

Table 3-6 summarizes how SD1 used various information categories to characterize these three components.

Table 3-6: Applying Information Categories to Characterize Future Growth Components

Key Future Growth Component	Information Category Applied		
	Regional Population Projections	Historical SD1 Tap Records	County Input
Population	✓		
Number of Taps		✓	
Growth Areas		✓	✓

Note that while Table 3-6 identifies the primary linkage between an information category and a growth component, there was often overlap between the information categories regarding important data – in these cases, secondary linkages were used to confirm the reasonableness of a given assumption.

The endpoint of this process was a GIS-based map showing residential and commercial/industrial growth by location for 2029 and 2040. These maps are included in Figure 3-2 (2029) and Figure 3-3 (2040), with more detailed study area maps included in Appendix E. In addition, the detailed process used to define the growth areas, as well as the proposed extent of growth as shown in Figures 3-2 and 3-3 is summarized in Appendix E.

Figure 3-2: 2029 Projected Future Growth Map

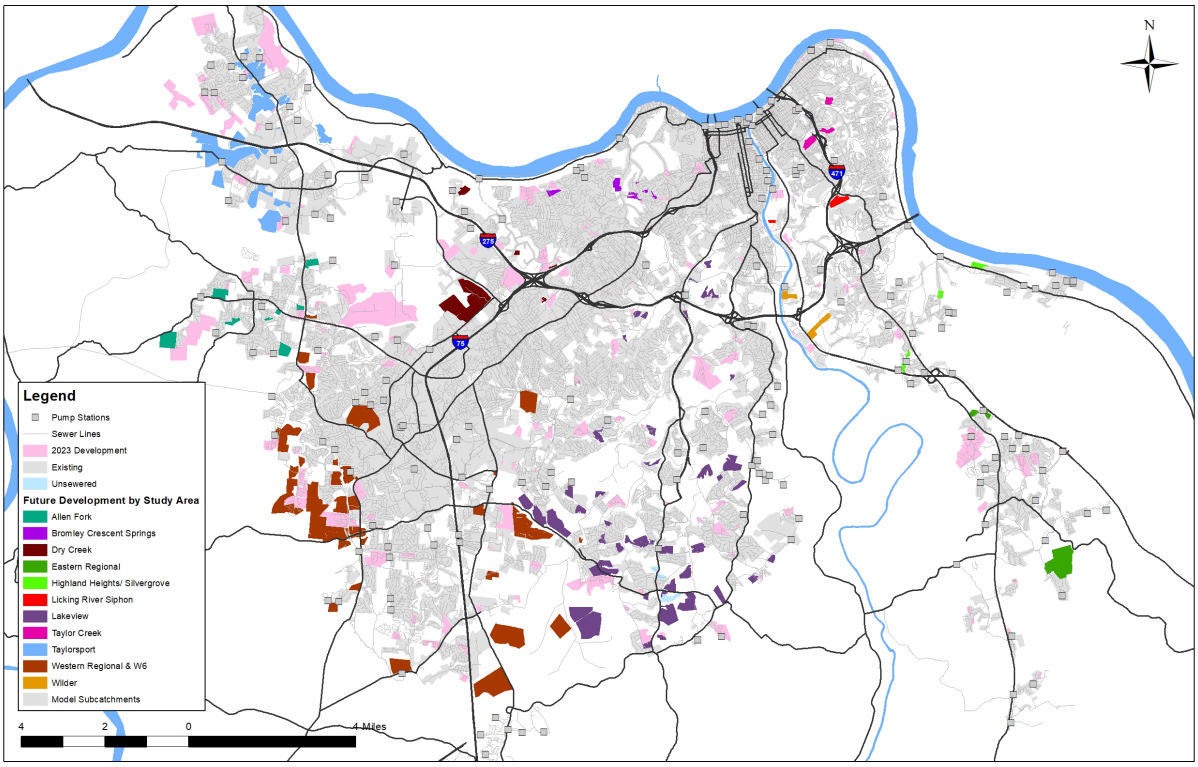
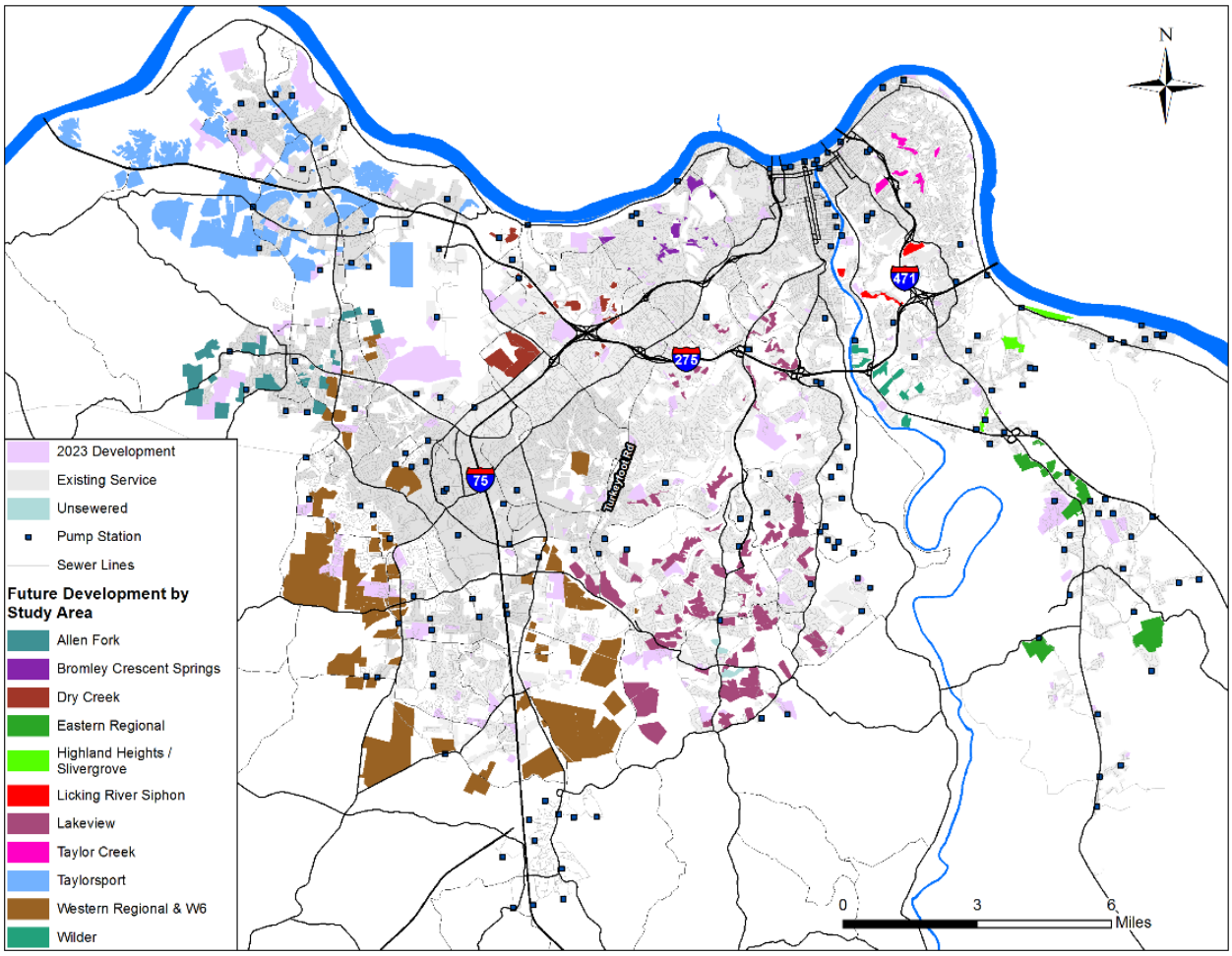


Figure 3-3: 2040 Projected Future Growth Map



3.2.2.4 Future Development Dry and Wet Weather Flows

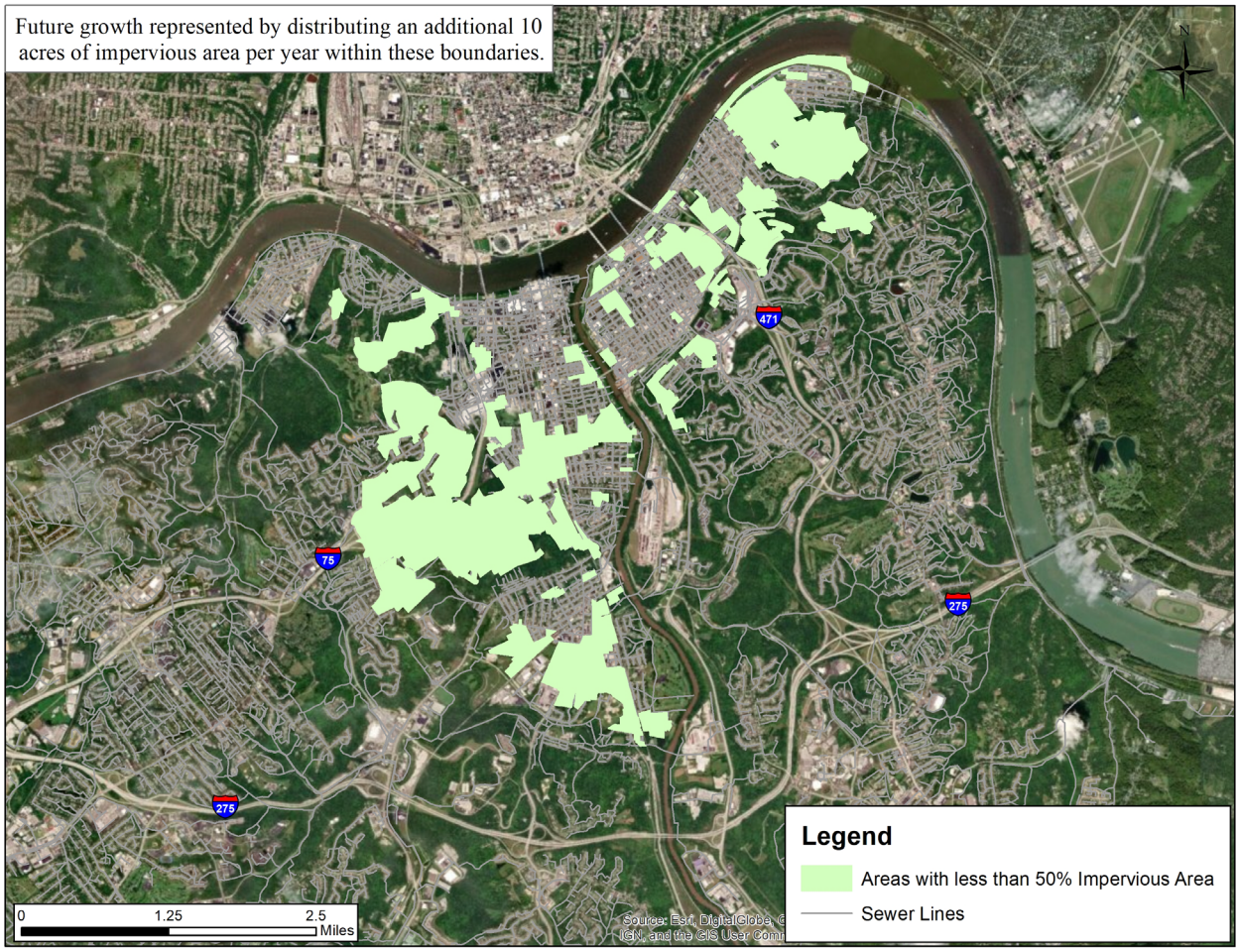
Future residential dry weather flows were assigned 200 gpd/home based on a review of average winter water usage data and flow monitoring data for recent residential development in SD1's service area (see Appendix F). This number includes sanitary flow and base infiltration. Non-residential dry weather flows were assigned 400 gpd/acre, based on a review of water usage rates.

Wet weather flows in separate sanitary areas were generated using SD1's new development I/I parameters. These parameters were developed by analyzing flow monitoring data from a selection of recent developments across SD1's service area and verified with more recent flow data. When applying the parameters, a standard methodology was incorporated in the model to ensure that consistent peaking factors were used, with the resulting values compared against industry ranges to confirm reasonableness.

3.2.2.5 Combined System Development

Growth in the CSS is expected to be relatively minor (given that the CSS is already highly urbanized) and so will not have a significant impact on solution sizing; however, it is still important to account for the growth. To begin, an assumption of 10 additional impervious acres per year was used to represent growth in the CSS, with that growth distributed in areas that currently have less than 50% impervious cover. This assumption is consistent with the original WSP, and also with current capacity reservations – capacity reservations project an additional 51 acres of CSS development over the next five years, or approximately 10 acres per year. Further, to match current SD1 stormwater regulations, the additional impervious area was modeled with volume control for the first 0.8" of rainfall, with this volume dewatered back to the CSS in 36 hours.

Figure 3-4: CSS Future Growth Areas



3.2.2.6 Summary of 2029 and 2040 Future Development Model Assumptions

The information review and associated analyses described above were used to develop a number of key assumptions for the 2029 and 2040 future condition models. These assumptions are summarized in Table 3-7 below.

Table 3-7: Summary of Assumptions for Building Future Condition Models

Metric	Recommendation for Updated Watershed Plan	Source
2029 population	433,234	Kentucky State Data Center, 2016
2040 population	463,697	Kentucky State Data Center, 2016
Taps/year	1,200	SD1 tap records, 2001-2018, confirmed as consistent with population projections
Tap distribution	Distribute taps to study areas based on historical trends	
2029 increase in residential area (from 2023)	4,535 acres	County future land use GIS files (current as of 2019) combined with projected growth areas
2040 increase in residential area (from 2023)	11,768 acres	
2029 increase in non-residential area (from 2023)	2,092 acres	County future land use GIS files (current as of 2019) combined with projected growth areas
2040 increase in non-residential area (from 2023)	5,161 acres	
Combined system development	10 acres/year	Original Watershed Plan assumption, confirmed with 2018-2023 capacity reservations
Residential DWF	200 gpd/home	Completed 2017 analysis (by Hazen and Sawyer for SD1)
Non-residential DWF	400 gpd/acre	Water consumption records for 1,421 commercial and industrial accounts, 2017-2018 (12-month period)
Sanitary system WWF	Use established new development I/I parameters	Ongoing SD1 modeling work, confirmed with recent flow monitoring data
Combined system WWF	Control runoff per SD1 Stormwater Regulations	SD1 Stormwater Regulations

3.3 Model Development

The section describes the process used to develop the future condition models for the UWSP, using the growth projections described above. These future condition models served as the platform for the system performance analysis and the evaluation of improvements.

3.3.1 2023 Model

Each new development area shown in Figure 3-1 was represented by a new subcatchment in the model with an area assigned based on the development footprint. Dry weather flow for non-residential and multi-family residential land use was assigned to each subcatchment based on the projected development flow specified on the capacity request form submitted to SD1. Single family residential developments

added a dry weather flow of 200 gpd/home as well as an equivalent subcatchment area of 2.3 homes/acre for wet-weather responses, based on prior flow meter analysis of new residential development (see Appendix E). Dry weather flows were assigned an appropriate diurnal curve in the model (i.e. residential, commercial, or industrial) depending upon development land use. Wet weather flow was represented by SD1's new development runoff parameters, which were developed based on historical flow data from numerous locations downstream of newer development (see Appendix F).

3.3.2 2029 and 2040 Models

With the future growth areas as shown in Figures 3-2 and 3-3, and the key assumptions summarized in Table 3-7, development of the 2029 and 2040 models moved through the following steps:

- Use the delineated future growth areas (Figures 3-2 and 3-3) to define model catchments.
- Use the population, tap, and flow assumptions (Table 3-7) to load the model catchments with appropriate parameters.
- Use existing infrastructure to capture future flows in areas already served by SD1.
- Assume 2023 improvements are in place.
- Define conceptual infrastructure (pipes, manholes, and pump stations) in currently undeveloped areas (e.g. large sections of Western Regional) to convey future flows to the 2023 system.

These steps led to numerous growth metrics being incorporated in the models, along with new explicit model components, as summarized in Table 3-8.

Table 3-8: Additions to Future Growth Models

Growth Metric	Additions to 2029 Model	Additions to 2040 Model
Residential service area (acres)	4,535	11,768
Non-residential service area (acres)	2,092	5,161
Residential taps	7,200	20,400
Non-residential taps	2,100	5,150
Explicit Model Component	**2029 Model**	**2040 Model**
Number of residential catchments	383	702
Number of non-residential catchments	105	215
Feet of pipe(1)	245,450	507,644
Number of pump stations(1)	5	13

Notes:
(1) Additional conveyance from future growth locations to the 2023 piping network was conceptual and meant to provide accurate timing of flows to the collection system, and do not represent actual new assets to be built as part of this plan.

3.4 Future Development System Performance Analysis

Once the 2029 and 2040 development models were built as described in Section 3.3, a typical year (TY) simulation was performed with each model. The purpose of these simulations was to begin identifying deficiencies and quantifying potential overflow volumes due to the increase in flows from future growth assuming no new system improvements (beyond 2023). It is fully expected that the future growth will cause an increase in flows and therefore new overflow locations if nothing else is done. This is intentional, as it will allow SD1 to identify the timing and order of improvements needed to meet the Consent Decree performance requirements at each interim milestone.

Summaries of key metrics from these simulations are provided in Table 3-9. The location and volume of CSOs and SSOs from these simulations are detailed in Sections 3.5 and 3.6. Note that these results include updates to the baseline October 2017 model discussed further in Section 4.3.

Table 3-9: Summary of 2029 TY and 2040 TY Results

Performance Metric	2029 Model	2040 Model
SSO volume (MG)	61.5	241.7
Number of dry-weather overflows	0	5
CSO volume (MG)	1,527	1,556
Total Combined Flow (MG)	4,756	4,807
Percent Capture (%)	67.9%	67.6%

As Table 3-9 shows, there is a modest increase in CSO volume between 2029 and 2040 (consistent with the limited CSS growth potential as described in Section 2.3), but a significant increase in predicted SSO volume. The increase in SSO volume is due primarily to dry-weather capacity constraints that would appear between 2029 and 2040 if no additional improvements were constructed and development occurs as projected. These dry-weather capacity constraints are prevented by the proposed projects in the 2029 and 2034 improvements plans summarized in Section 6 and Section 7, respectively.

3.5 CSO Locations

The following figures and tables summarize the 2029 and 2040 CSO locations and typical year volume, assuming future growth but no improvements beyond 2023.

Figure 3-5: 2029 CSO Locations (With Future Growth and 2023 Improvements Only)

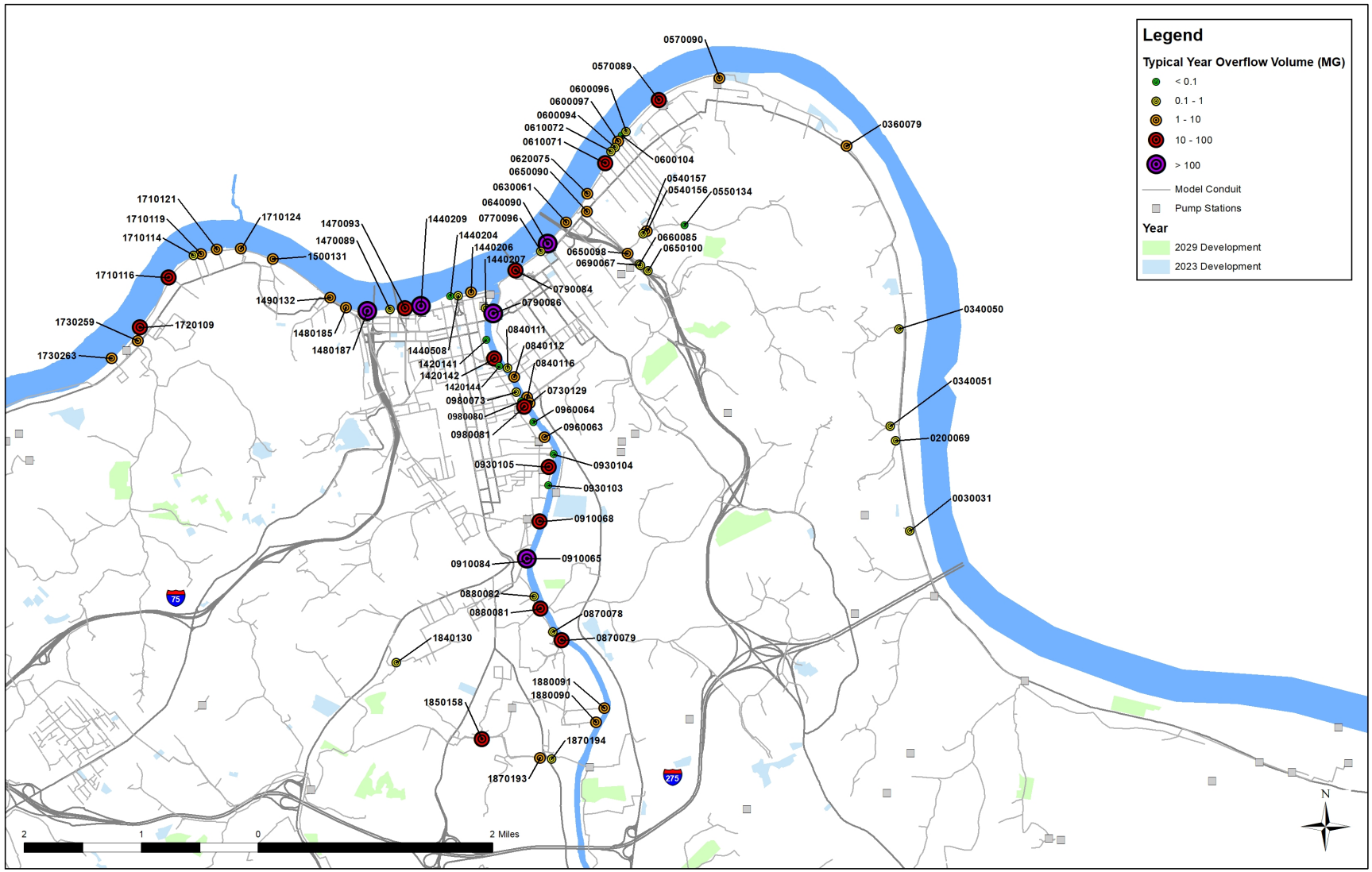


Table 3-10: 2029 CSO Volume Summary (With Future Growth and 2023 Improvements Only)

As Predicted by the ICM Model

CSO ID	Overflow Volume (MG)
0030031	0.83
0200069	0.84
0340050	0.46
0340051	0.20
0360079	2.15
0540156	1.37
0540157	0.88
0550134	0.06
0570089	24.48
0570090	3.42
0600094	0.50
0600096	0.12
0600097	3.96
0600104	0.07
0610071	18.95
0610072	0.56
0620075	8.48
0630061	1.15
0640090	234.39
0650090	9.18
0650098	4.96
0650100	0.16
0660085	0.45
0690067	0.14
0730129	1.60
0770096	0.39
0790084	16.94
0790086	107.64
0840111	0.14
0840112	2.59
0840116	6.00
0870078	0.36
0870079	24.54
0880081	52.67
0880082	0.56
0910065	167.01
0910068	43.31

CSO ID	Overflow Volume (MG)
0910084	0.25
0930103	0.06
0930104	0.05
0930105	27.36
0960063	2.35
0960064	0.01
0980073	0.14
0980080	0.02
0980081	50.94
1420141	0.01
1420142	56.52
1420144	0.04
1440204	0.10
1440206	3.07
1440207	0.24
1440209	102.31
1440508	0.51
1470089	0.25
1470093	62.11
1480185	1.51
1480187	405.55
1490132	1.18
1500131	7.77
1710114	0.32
1710116	11.37
1710119	4.56
1710121	1.73
1710124	2.64
1720109	13.33
1730259	1.95
1730263	1.85
1840130	0.97
1850158	18.77
1870193	1.20
1870194	0.21
1880090	2.23
1880091	1.56

Figure 3-6: 2040 CSO Locations (With Future Growth and 2023 Improvements Only)

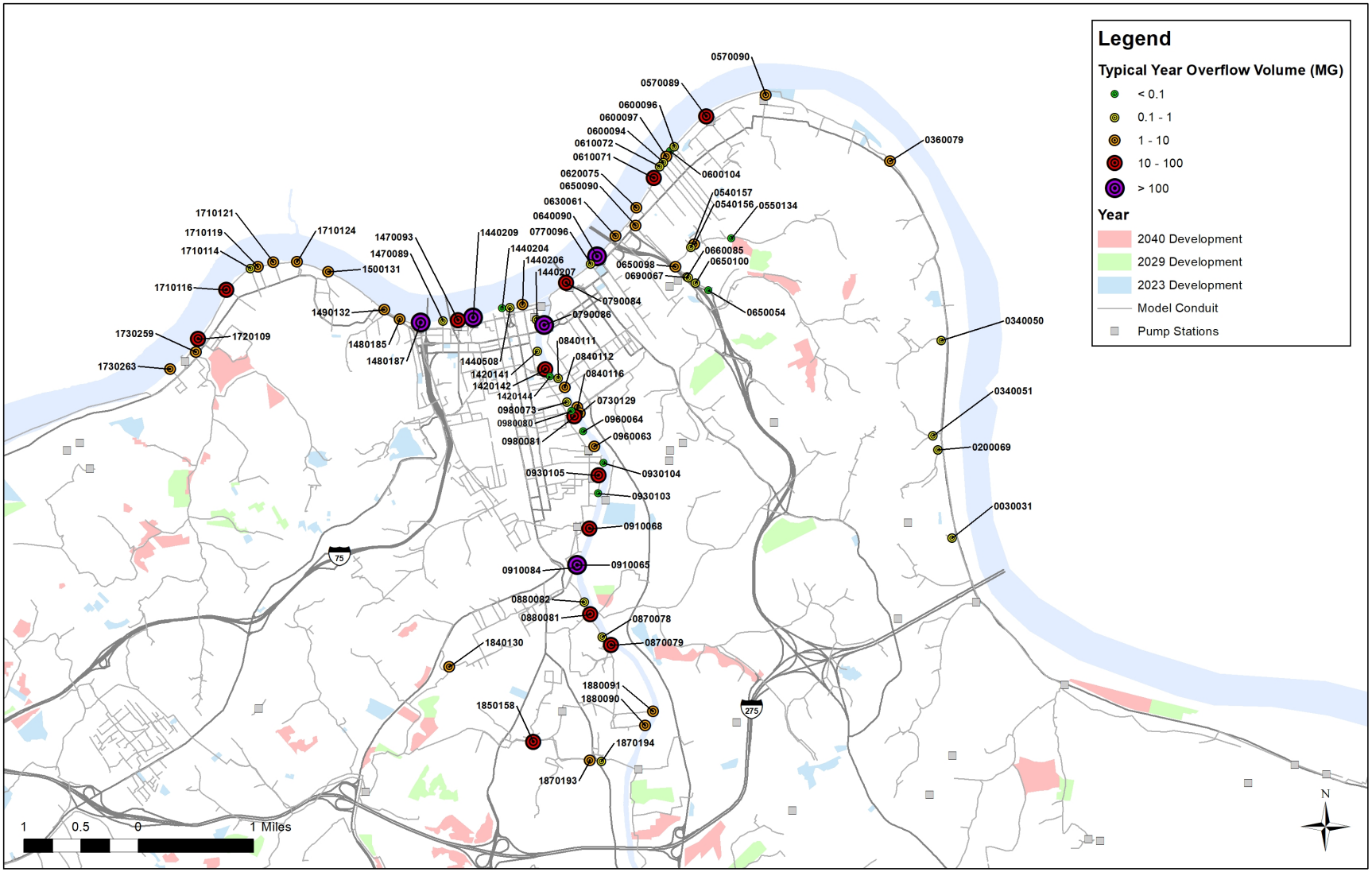


Table 3-11: 2040 CSO Volume Summary (With Future Growth and 2023 Improvements Only)

As Predicted by the ICM Model

CSO ID	Overflow Volume (MG)
0030031	0.83
0200069	0.85
0340050	0.46
0340051	0.20
0360079	2.17
0540156	1.36
0540157	0.88
0550134	0.06
0570089	25.29
0570090	3.46
0600094	0.50
0600096	0.12
0600097	4.02
0600104	0.07
0610071	19.58
0610072	0.58
0620075	8.51
0630061	1.38
0640090	239.31
0650054	0.01
0650090	9.37
0650098	5.12
0650100	0.25
0660085	0.43
0690067	0.14
0730129	1.63
0770096	0.37
0790084	17.06
0790086	111.21
0840111	0.14
0840112	2.74
0840116	5.99
0870078	0.36
0870079	24.54
0880081	53.74
0880082	0.58
0910065	169.95
0910068	43.79

CSO ID	Overflow Volume (MG)
0910084	0.23
0930103	0.07
0930104	0.05
0930105	27.54
0960063	2.52
0960064	0.01
0980073	0.15
0980080	0.02
0980081	50.97
1420141	0.14
1420142	56.60
1420144	0.05
1440204	0.10
1440206	3.06
1440207	0.24
1440209	104.17
1440508	0.51
1470089	0.25
1470093	63.91
1480185	1.51
1480187	413.13
1490132	1.20
1500131	7.77
1710114	0.32
1710116	11.52
1710119	4.69
1710121	1.79
1710124	2.72
1720109	13.40
1730259	1.96
1730263	1.85
1840130	1.10
1850158	19.59
1870193	1.46
1870194	0.20
1880090	2.21
1880091	1.72

3.6 SSO Locations

The following figures and tables summarize the 2029 and 2040 SSO locations and typical year volume, assuming future growth but no improvements beyond 2023.

Figure 3-7: 2029 SSO Locations (With Future Growth and 2023 Improvements Only)

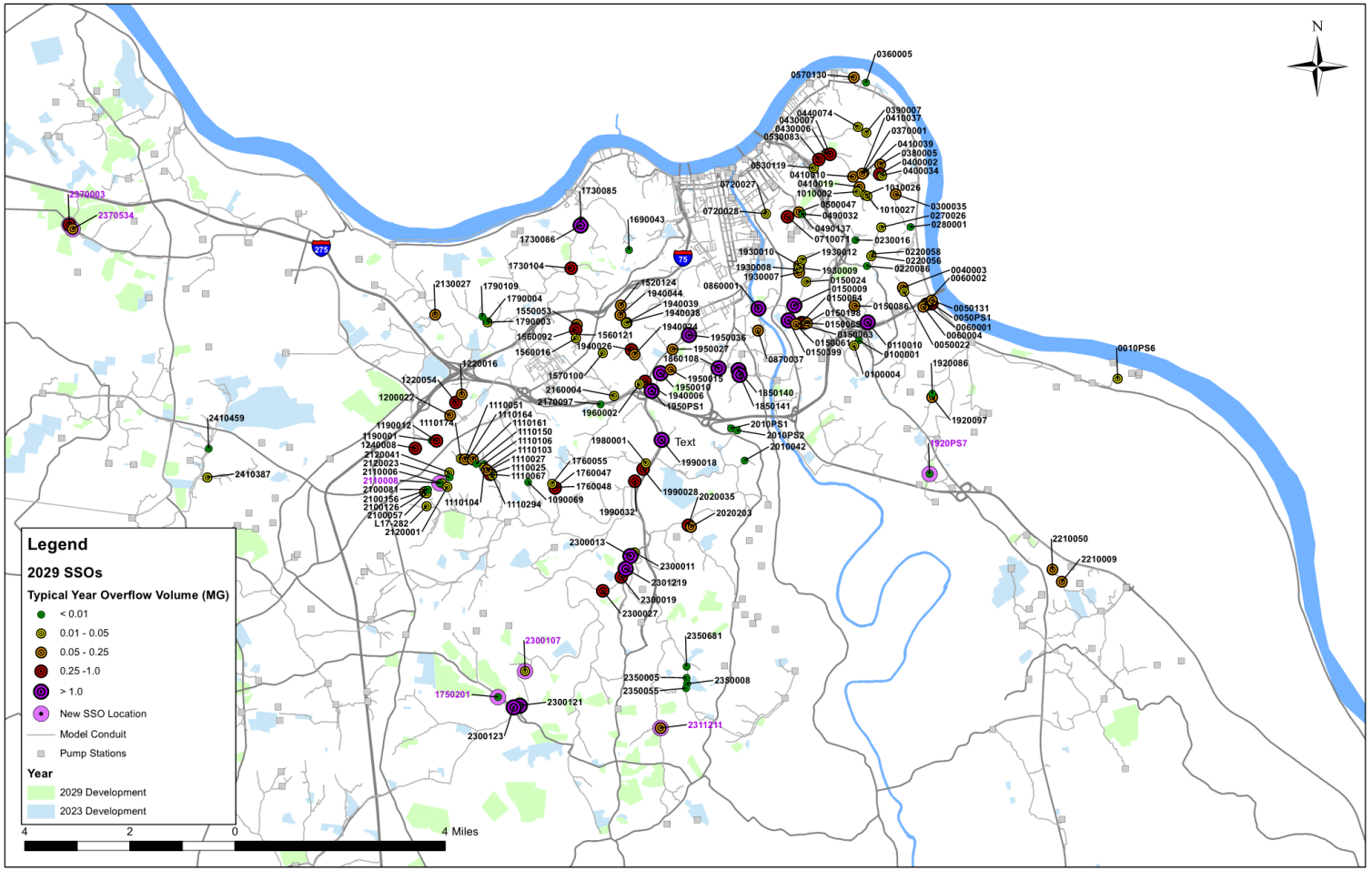


Table 3-12: 2029 SSO Volume Summary (With Future Growth and 2023 Improvements Only)

As Predicted by the ICM Model

Manhole ID	Overflow Volume (MG)
0010PS6	0.01
0040003	0.09
0050022	0.02
0050131	0.07
0050PS1	0.27
0060001	0.70
0060002	0.18
0060004	0.15
0100001	< 0.01
0100004	0.02
0110010	1.32
0150009	1.13
0150024	0.02
0150061	0.24
0150063	0.01
0150064	0.45
0150065	0.35
0150086	0.13
0150198	0.08
0150399	2.69
0220056	0.02
0220058	< 0.01
0220086	< 0.01
0230016	< 0.01
0270026	0.02
0280001	< 0.01
0300035	0.08
0360005	< 0.01
0370001	0.03
0380005	0.09
0390007	0.01
0400002	0.65
0400034	0.02
0410010	0.09
0410019	0.18
0410037	0.13
0410039	0.01

Manhole ID	Overflow Volume (MG)
1560121	< 0.01
1570100	0.03
1690043	< 0.01
1730085	0.02
1730086	1.31
1730104	0.76
1750201	< 0.01
1760047	0.33
1760048	0.21
1760055	0.02
1790003	0.02
1790004	< 0.01
1790109	< 0.01
1850140	7.12
1850141	2.69
1860108	1.29
1920086	< 0.01
1920097	0.10
1920PS7	< 0.01
1930007	0.05
1930008	0.07
1930009	0.04
1930010	0.13
1930012	0.02
1940006	0.43
1940024	0.06
1940026	0.41
1940038	0.03
1940039	0.19
1940044	0.12
1950010	1.79
1950015	0.07
1950027	0.18
1950036	2.26
1950PS1	1.96
1960002	0.03
1980001	0.01

Manhole ID	Overflow Volume (MG)
0430006	0.15
0430007	0.33
0440074	0.02
0490032	< 0.01
0490137	< 0.01
0500047	0.10
0530083	0.49
0530119	0.03
0570130	0.06
0710071	0.33
0720027	< 0.01
0720028	0.02
0860001	4.87
0870037	0.18
1010002	0.05
1010026	0.02
1010027	0.01
1090069	< 0.01
1110025	< 0.01
1110027	0.09
1110051	0.18
1110067	0.39
1110103	0.11
1110104	0.02
1110106	< 0.01
1110150	< 0.01
1110161	0.06
1110164	0.03
1110174	0.02
1110294	0.05
1190001	< 0.01
1190012	0.43
1200022	0.23
1220016	0.12
1220054	0.49
1240008	0.43
1520124	0.13
1550053	0.18
1560016	0.02
1560092	0.45

Manhole ID	Overflow Volume (MG)
1990018	1.89
1990028	0.36
1990032	0.36
2010042	< 0.01
2010PS1	< 0.01
2010PS2	< 0.01
2020035	0.49
2020203	0.07
2100057	0.03
2100081	< 0.01
2100126	0.10
2100156	< 0.01
2110006	0.04
2110008	< 0.01
2120001	0.02
2120023	< 0.01
2120041	0.03
2130027	0.11
2160004	0.01
2170097	< 0.01
2210009	0.08
2210050	0.19
2300011	0.04
2300013	2.05
2300019	0.38
2300027	0.89
2300107	0.01
2300121	4.74
2300123	1.14
2301219	6.11
2311211	0.08
2350005	< 0.01
2350008	< 0.01
2350055	< 0.01
2350681	< 0.01
2370003	0.90
2370534	0.05
2410387	0.03
2410459	< 0.01
L17-282	0.02

Figure 3-8: 2040 SSO Locations (With Future Growth and 2023 Improvements Only)

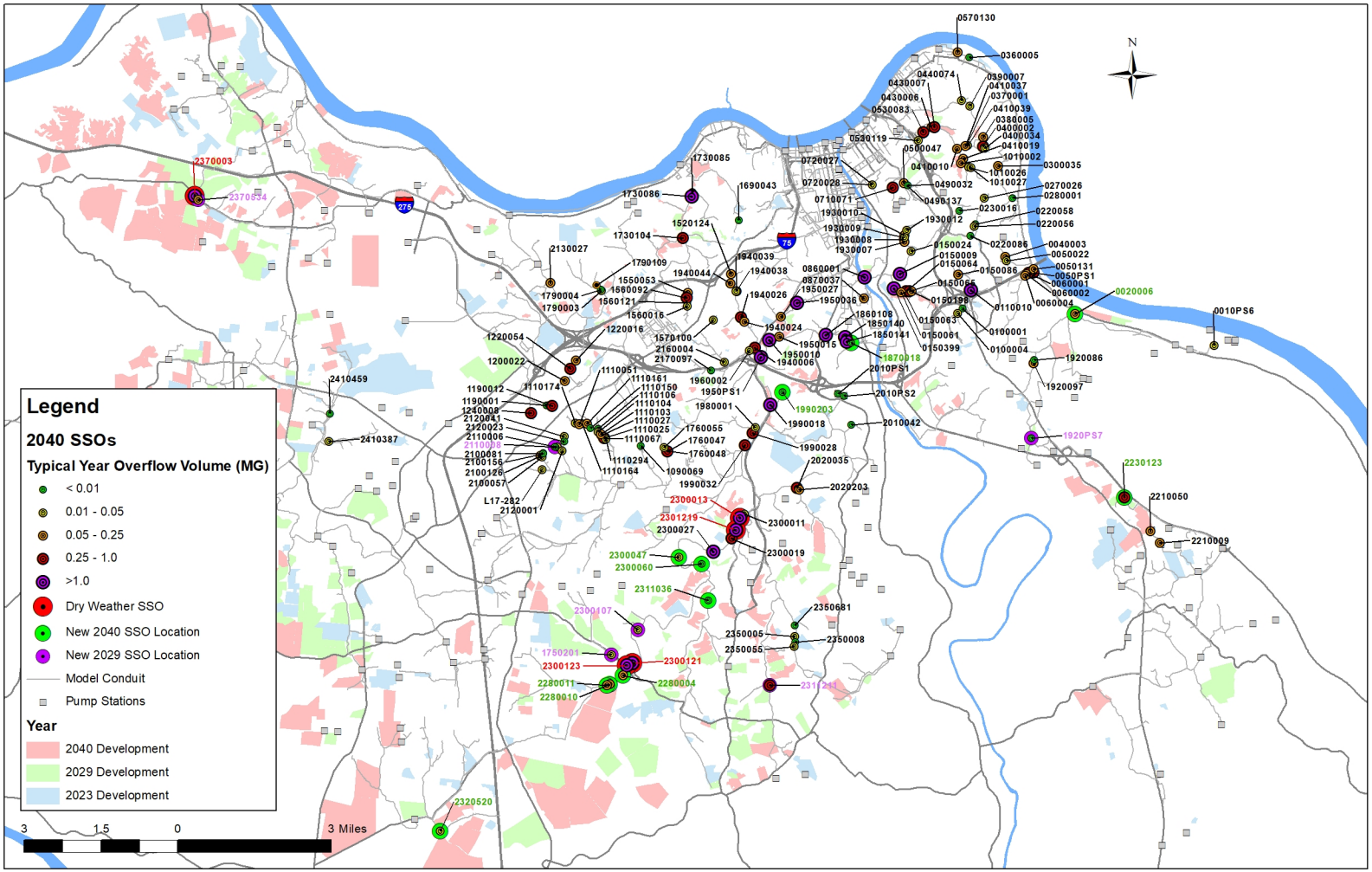


Table 3-13: 2040 SSO Volume Summary (With Future Growth and 2023 Improvements Only)

As Predicted by the ICM Model

Manhole ID	Overflow Volume (MG)
0010PS6	0.01
0020006	0.06
0040003	0.09
0050022	0.02
0050131	0.07
0050PS1	0.28
0060001	0.70
0060002	0.18
0060004	0.15
0100001	< 0.01
0100004	0.02
0110010	1.32
0150009	1.14
0150024	0.02
0150061	0.25
0150063	0.02
0150064	0.49
0150065	0.38
0150086	0.13
0150198	0.10
0150399	2.78
0220056	0.02
0220058	< 0.01
0220086	< 0.01
0230016	< 0.01
0270026	0.02
0280001	< 0.01
0300035	0.08
0360005	< 0.01
0370001	0.04
0380005	0.09
0390007	0.01
0400002	0.66
0400034	0.02
0410010	0.10
0410019	0.19
0410037	0.13

Manhole ID	Overflow Volume (MG)
1730104	0.83
1750201	0.05
1760047	0.33
1760048	0.21
1760055	0.02
1790003	0.02
1790004	< 0.01
1790109	< 0.01
1850140	7.39
1850141	2.86
1860108	1.32
1870018	< 0.01
1920086	< 0.01
1920097	0.11
1920PS7	< 0.01
1930007	0.05
1930008	0.07
1930009	0.04
1930010	0.13
1930012	0.02
1940006	0.47
1940024	0.06
1940026	0.45
1940038	0.03
1940039	0.19
1940044	0.12
1950010	2.16
1950015	0.09
1950027	0.22
1950036	2.68
1950PS1	2.32
1960002	0.04
1980001	0.02
1990018	2.18
1990028	0.47
1990032	0.37
1990203	< 0.01

Manhole ID	Overflow Volume (MG)
0410039	0.01
0430006	0.16
0430007	0.37
0440074	0.02
0490032	< 0.01
0490137	< 0.01
0500047	0.10
0530083	0.51
0530119	0.05
0570130	0.13
0710071	0.33
0720027	< 0.01
0720028	0.02
0860001	5.00
0870037	0.18
1010002	0.06
1010026	0.02
1010027	0.02
1090069	< 0.01
1110025	< 0.01
1110027	0.09
1110051	0.18
1110067	0.39
1110103	0.11
1110104	0.02
1110106	< 0.01
1110150	< 0.01
1110161	0.06
1110164	0.03
1110174	0.02
1110294	0.05
1190001	< 0.01
1190012	0.43
1200022	0.23
1220016	0.12
1220054	0.49
1240008	0.43
1520124	0.13
1550053	0.18
1560016	0.03

Manhole ID	Overflow Volume (MG)
2010042	< 0.01
2010PS1	< 0.01
2010PS2	< 0.01
2020035	0.66
2020203	0.14
2100057	0.03
2100081	< 0.01
2100126	0.10
2100156	< 0.01
2110006	0.04
2110008	< 0.01
2120001	0.02
2120023	< 0.01
2120041	0.03
2130027	0.14
2160004	0.01
2170097	< 0.01
2210009	0.08
2210050	0.19
2230123	0.41
2280004	0.18
2280010	0.24
2280011	0.06
2300011	0.05
2300013	3.35
2300019	0.67
2300027	2.08
2300047	0.03
2300060	< 0.01
2300107	0.02
2300121	80.50
2300123	59.82
2301219	24.39
2311036	< 0.01
2311211	0.52
2320520	0.02
2350005	0.02
2350008	< 0.01
2350055	0.02
2350681	< 0.01

Manhole ID	Overflow Volume (MG)
1560092	0.44
1560121	< 0.01
1570100	0.03
1690043	< 0.01
1730085	0.03
1730086	1.44

Manhole ID	Overflow Volume (MG)
2370003	20.85
2370534	0.13
2410387	0.03
2410459	< 0.01
L17-282	0.02

3.7 Prioritization Strategy

The recommended projects through each improvement timeframe (2023, 2029, 2034, and 2040) to be described in the following sections were selected based on a combination of achieving the primary objective of protecting public health and the environment (as measured by ACD milestone metrics) and cost effectiveness, while also considering the following additional project-specific selection criteria:

- Identified as an Interim Project in Appendix "C" of the ACD
- Within a priority area identified in the original WSP
- Reduce a high-volume overflow(s)
- Address asset management needs
- Mitigate stream hydromodification concerns
- Support ancillary flood mitigation objectives
- Inform decisions on subsequent improvements, by providing operational and performance information on pilot technologies
- Provide capacity for future development
- Required to fully utilize new facility improvements
- Avoid costly conveyance improvements

The linkage between individual UWSP projects and these additional project-specific criteria is presented in detail in Appendix G.

In addition to guiding project selection for inclusion in the UWSP, these criteria also had a significant influence on project sequencing, in terms of both placement in a major milestone window (e.g. 2029 vs 2040) and sequencing within each milestone window. The following general approaches were used to apply the criteria to sequencing decisions:

- The opportunity to reduce high-volume overflows was always given a high sequencing priority, given that high-volume overflows can create the greatest potential for human health risk (due to increased opportunity for exposure) and water quality impacts.

- Once a project was identified as a preferred option for CSO control, the ability to provide additional benefits in terms of addressing asset management needs, relieving stream hydromodification concerns, or mitigating surface flooding provided justification for sequencing the project earlier in the program.
- Projects involving pilot technologies (e.g. surface stormwater detention basins and RTC installations) were sequenced early, in order to serve the underlying purpose of a pilot project, i.e. to inform decisions on subsequent solution options.
- The projected timing of new growth within SD1's service area controlled the sequencing of certain projects, to ensure adequate capacity for that growth.

3.8 Evaluation of Alternatives and Selection of Optimized Solutions

SD1 performed a comprehensive alternatives evaluation for both the combined sewer system and separate sewer system during the original watershed planning process, as summarized in the approved technical component of the original 2014 WSP. That process remains fundamentally valid for this updated watershed plan, as SD1's collection systems and priority areas, along with available wet-weather control technologies, have not changed dramatically in the past 5 years. As such, it was not necessary to repeat every step of the evaluation process; rather, the evaluation of alternatives focused on selecting optimized configurations of the solution types already identified as viable for SD1's program.

The optimization process was performed using state-of-the-art Optimatics' Optimizer™ software. Optimizer™ is an outcome-driven analytics platform that determines the most cost-effective combination of improvement strategies to achieve the required ACD metrics. Improvement strategies can be any combination of applicable technologies, such as conveyance, EQ tanks, weir adjustments, or RTC logic. With available technologies, costs, and constraints defined by the user, Optimizer™ software utilizes meta-heuristic optimization and high-performance cloud computing to iterate through literally thousands of solution options to find plans that minimize cost and hydraulic performance penalties.

Optimizer™ was applied to a number of alternative 2040 configurations, in both the combined system and the separate system, and to a more limited number of 2029 configurations, as most of the potential 10-year configurations were already well defined and constrained. Every application, however, followed the following template, provided as an example of how Optimizer™ is used to analyze alternatives.

Conveyance upgrades are a universal technology, with application in both the combined system and separate system. Conveyance options are formulated within Optimizer™ by defining conduits within the target area that could be potentially replaced with pipes with a greater conveyance capacity. Additionally, new conduit alignments for consolidation sewers and larger diameter storage conduits are input into the software for evaluation. These conduit decisions are then grouped into unique decision groupings (reflecting groups of decisions that are related to each other) within Optimizer™. Each conduit decision references a table of pipe diameters ranging from the smallest practical size to the largest practical size. As part of the decision, conduits could either remain unchanged or upsize to larger diameters; downsizing was not allowed. Unit costs for conveyance pipe were taken from the SD1 costing tool and accounted for pipe depth and diameter.

Storage upgrades are evaluated in a similar fashion, by arranging decisions to apply various storage array tables to predetermined model nodes representing potential storage sites. As with the conduit option, each site is given a range of viable storage volume options. Costs associated with each storage location and size option are estimated and included in the decision within Optimizer™.

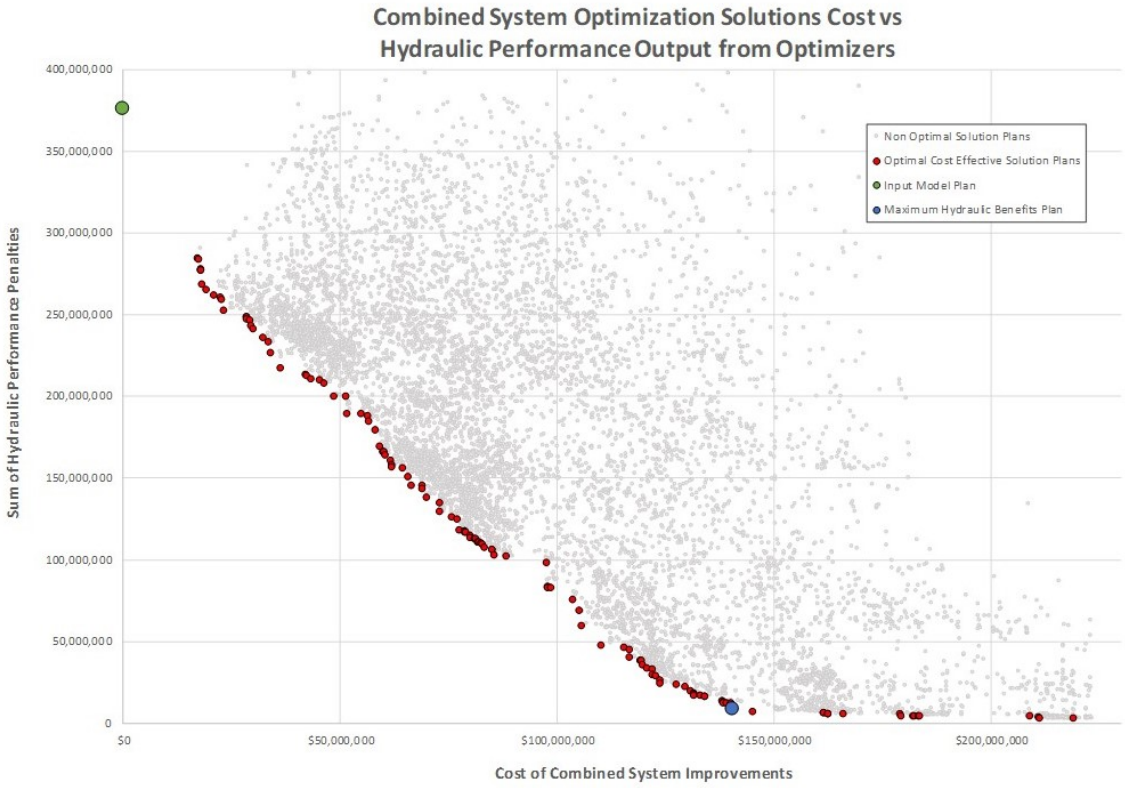
Other improvements available as options within a given alternative such as RTC logic, weir crest adjustments, flow restricting orifice sizing, and pumping capacities are all formatted in a very similar fashion as the conveyance and storage decisions described above. Each decision references a single model element or group of model elements that have a finite amount of predetermined improvement options, with an associated cost.

The final step in defining an Optimizer™ configuration is to define hydraulic performance metrics. These metrics represent real-world performance metrics, such as CSO overflow volume or SSO activations. Once defined, these metrics are added together to give a total hydraulic performance "penalty" value associated with each candidate configuration. It should be noted that while the penalty is presented in dollars, the monetized penalties are not reflective of real costs; rather they are used drive the optimization to eliminate solutions that have poor hydraulic performance. The hydraulic performance penalty is used as an objective in the optimization; the goal is to find the solution that provides the most cost-effective ratio between (minimized) penalty and (minimized) cost.

A fully defined set of candidate solution components, with size ranges and costs defined, combined with a fully defined penalty function, represent an optimization run. Each optimization run is processed on a cloud-based network to evaluate approximately 10,000 unique combinations of improvements. An example of the results is shown in Figure 3-9; this is for a real combined system optimization run but is used here for demonstration purposes only. Every point on the chart shown in the figure represents a plan with a unique combination of decision options within the optimization analysis. Each plan has been generated by Optimizer™, run through the ICM hydraulic model, evaluated against hydraulic performance criteria and penalized when not meeting performance targets, and costed based on its various improvement options. The following provides an explanation of additional key information provided by the figure:

- The green point is the input model plan – this represents the 'do nothing' scenario of taking no action within the basin. Note how the input model plan incurs a high level of hydraulic penalties but no cost.
- Red points represent plans with the best performing solution for a given cost. Note that the penalty costs shown are not real dollars, but penalty values assigned to each combination.
- The most cost-effective plan is shown by the blue dot on the plot. Investments beyond this level generate diminishing returns and do not result in significant hydraulic improvement in the network.

Figure 3-9: Example Cost-Benefit Curve From Optimization Run



The figure shows that for this example, when considering various improvement solutions within the basin, a very significant improvement in hydraulic performance can be achieved for approximately $140 million. Note that this is the estimated construction cost based on the curves input into the Optimizer™ software; the final construction costs include additional refinement and review. It is also important to note that the most cost-effective plan emerging from Optimizer™, shown by the blue point, is not considered a final answer – Optimizer™ is a powerful tool for quickly analyzing thousands of configurations, but it does not replace engineering judgement. The Optimizer™-recommended configurations were subsequently subjected to a full engineering review, as part of making the final improvement upgrade decisions for the target system.

Results across all applications of Optimizer™ demonstrated that the tool could a) assess a much larger set of alternatives than the traditional trial-and-error approach, and b) find an initial definition of the optimized cost-benefit point more quickly than the traditional trial-and-error approach. These advantages made Optimizer™ an important analysis support tool in evaluating alternatives during the updated watershed planning process.

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Section 4
Completed Projects (2005 to 2017)

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4. Completed Projects (2005 to 2017)

4.1 Summary of Improvements Completed to Date – 2005-2017

SD1 began completing projects included in the original Watershed Plan in 2005, well before formal Watershed Plan approval in 2014. As a result, SD1 has over 10 years of targeted improvements already completed, with an associated reduction in CSO and SSO overflow volume.

Completed improvements have focused on initial high-impact projects such as:

- Initial Watershed Program projects as set out in Exhibit D of the original CD. These projects included many significant conveyance improvements in the Eastern Regional and Western Regional study areas which significantly reduced SSO volume and provided much needed capacity for future growth.
- System-wide projects from the IWSP (i.e. original WSP) Five-Year Program which included Green Programs and Demonstration projects. Key projects completed as part of these programs include:
    - Green infrastructure improvements in Covington (Terraced Reforestation, 12th Street Bioswale, Madison Avenue Rain Garden, Mary Ann Morgan Branch Library Rain Gardens and Permeable Pavement).
    - Detention Basin Retrofits (St. Elizabeth, KYTC Basin, Notre Dame Academy)
    - Prisoner's Lake Rainwater Harvesting
    - Banklick Creek Regional Wetlands
- Specific basin projects from the IWSP Five-Year Program. Key projects completed include:
    - Rainfall-dependent infiltration and inflow (RDII) source removal in the Vernon Lane and Lakeside Park areas.
    - Sewer improvements in Lakeside Park (Van Deren and Avon Drive) and Bellevue (Riviera Drive)
    - Church Street Phase 1 Sewer Separation
- Other committed projects from the IWSP Five-Year Program:
    - Multiple sewer projects in Bellevue and Newport (Donnermeyer Improvements, Newport Pavilion Improvements, Bellevue Relief Sewer, Covert Run, Wilson/Waterworks Road)
- Pump station upgrades as set out in Exhibit E of the original CD.

- Standardization of operations and maintenance (O&M) procedures to generate ongoing system benefit.
- CSO Diversion adjustments associated with the Inline Storage Program and the Solids and Floatables Control Program.
- Additional Projects for CSO Control, which included the following key projects:
    - Covington Detention Basins
    - Sewer Separation Projects (Hazen Street, Jacob Price Phase 1, Park Hills, Latonia, SR9 Southern Phase, Catch Basin Retrofits, Victory Ave)
    - River's Edge Improvements
- Additional Projects for SSO Control, which included the following key projects:
    - Burlington Sewer Re-route
    - Wolpert PS Storage
    - Sand Run/Hebron Improvements
    - Crestview PS, Equalization, Gravity Sewer Upgrades

Many of the completed improvements described above were an important commitment of the original WSP, and as intended their results have informed selection of projects in the UWSP (as discussed where appropriate in subsequent sections).

The end result of the improvements through 2017 is that SD1 has eliminated approximately 155 MG of typical year CSO discharges and approximately 124 MG of typical year SSO volume, relative to overflow levels that existed before the original CD.

4.2 Exhibit C Status Update

The table below lists the projects that are included in Appendix "C" of the ACD, and what phase is required to be completed by 12/31/20. As the table shows, many projects have already been completed by SD1, or are in the process of being completed on schedule. SD1 has decided to no longer pursue several of these projects, for the reason provided. In each instance, there is a good reason for this change and a replacement project(s) has been identified to provide the same overflow reduction benefit.

Table 4-1: ACD Appendix "C" Project Status

Project Title	Phase to Be Completed Prior to 12/31/20	Current Status	Reason Removed
Jacob Price Sewer Separation	Construction	Complete	
Aqua on the Levee Sewer Separation	Construction	Complete	

Project Title	Phase to Be Completed Prior to 12/31/20	Current Status	Reason Removed
Church Street Sewer Separation	Construction	Complete	
River Water Intrusion Program Phase I	Construction	On Schedule	
Covington 8th Street Sewer Separation	Design	Removed	More effective and constructible projects identified to achieve ACD milestones
Saratoga and Washington Sewer Separation	Design	On Schedule	
Bromley PS Capacity Increase – Mechanical and Electrical Control Upgrade	Design	On Schedule	
River Water Intrusion Program Phase II	Design	On Schedule	
River Water Intrusion Program Phase III	Planning	On Schedule	
River Water Intrusion Program Phase IV	Planning	On Schedule	
Bromley PS Capacity Increase – Additional Pumps	Planning	Removed	More effective and constructible projects identified to achieve ACD milestones
Lakeside Park Sewer Capacity Upgrade	Construction	Complete	
Bullitsville Force Main Capacity Upgrade	Construction	Complete	
Richwood Pump Station & Force Main	Construction	Complete	
Elsmere Corridor Capacity Upgrade	Construction	On Schedule	
Wilder Pump Station Capacity Upgrade	Construction	Complete	
Allen Fork Pump Station Capacity Upgrade	Construction	Complete	
New Bristow Road Pump Station & Force Main	Planning	On Schedule	
US 27/AA Highway Improvements – Phase I	Planning & Design	On Schedule	
US 27/AA Highway Improvements – Phase II	Planning	On Schedule	
US 27/AA Highway Improvements – Phase III	Planning	On Schedule	
Bullitsville Pump Station Capacity Upgrade & Storage EQ	Design	On Schedule	
Ash Street PS & Force Main	Construction (By 05/01/2021)	Removed	Replaced with Ash Street EQ Project

4.3 Baseline Model Update

As summarized in Section 4.2, SD1 has recently completed many projects ahead of the schedule required in ACD Appendix "C." Given that many of these projects were not included in the baseline October 2017 model, a revised model was created that included all projects with a "complete" current status in Table 4-1. The Elsmere Corridor Capacity Upgrade was also included as construction was nearing completion. Additional discussion of the completed projects included in the updated model is provided in Section 5. In addition to these projects, model calibration refinement areas through 2019 were included in the revised model as shown in Appendix B. As a result of creating this revised model, the following baseline SSOs (summarized in Appendix D) were eliminated as shown in Table 4-2. This updated model was used in the analysis of improvements summarized in Sections 5 – 8.

Table 4-2: Eliminated Baseline SSOs

SSO MH ID	Eliminated By
0110002	2018 Calibration Refinement - NKU
0260002	Vernon Lane I/I Removal
1950016	2017 Calibration Refinement – North Lakeview
2070019	Elsmere Corridor Capacity Upgrade
2090008	Elsmere Corridor Capacity Upgrade
2090063	Elsmere Corridor Capacity Upgrade
2100002	Elsmere Corridor Capacity Upgrade
2100036	Elsmere Corridor Capacity Upgrade
2100106	Elsmere Corridor Capacity Upgrade
2100129	Elsmere Corridor Capacity Upgrade
2110001	Elsmere Corridor Capacity Upgrade
2110002	Elsmere Corridor Capacity Upgrade
2280023	Richwood Pump Station & Force Main
2390002	Allen Fork Pump Station Capacity Upgrade

Section 5
2023 Improvements

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5. 2023 Improvements

This section presents the improvements planned for implementation by 2023. These improvements represent the first phase of the projects to be implemented in the next ten (10) years, and so per the requirements of the ACD are presented to a higher level of detail than the 2034 and 2040 improvements in Sections 7 and 8. The 2023 improvements are projected to achieve the required 2023 ACD overflow reduction milestones. The resulting facility sizing is based on the best information available and based on the model projections and assumed growth as outlined in Section 3. Both project type and sizing may be adjusted during final planning and design in order to meet ACD metrics, based on updated information available at that time.

The section begins with a presentation of the selected CSO improvements and SSO improvements, then demonstrates how they meet the 2023 overflow reduction milestones and concludes with a presentation of the preliminary implementation schedule for the proposed projects. In addition to this section, these improvements are included in a comprehensive project list in Appendix H which summarizes project name, cost, volume reduction, proposed completion date, and SSO(s) eliminated or CSO(s) addressed by project for all UWSP projects presented in Sections 5 – 8.

5.1 2023 CSO Improvements

The 2023 CSO improvements comprise the following project groupings:

- River water intrusion mitigation program
- Targeted sewer separation
- Ash Street EQ Tank

Details on each of these project groupings are provided below, in the form of a narrative description, a table of overflows addressed by overflow ID, and a detailed project summary sheet showing the local collection systems and extent of improvements.

Note that the projected CSO volume reduction presented on the project summary sheets represents the effect of each project as an individual solution; the net CSO volume reduction from groupings of projects is typically lower than the sum of the individual projections due to the interaction between projects and the effect of system dynamics. All percent capture calculations use the net CSO volume reduction at each milestone to properly represent the effect of proposed improvements.

5.1.1 River Water Intrusion Mitigation Program

SD1's combined sewer system is impacted on a regular basis by high river levels, on both the Ohio River and Licking River. This is not uncommon in combined sewer systems, but is especially pronounced in SD1's case given that many of the CSO outfalls were constructed prior to construction of the Markland Dam in the mid-1960s (located downstream from SD1's service area) which raised the pool elevation to 25.4 feet, reaching very close to the elevation of many diversions. River water intrusion has the effect of

increasing flows in the CSS during high-river stage conditions, resulting in earlier triggering of CSOs during rainfall events, an increase in CSO volume when flood stations are activated, and utilization of treatment plant capacity to treat river water.

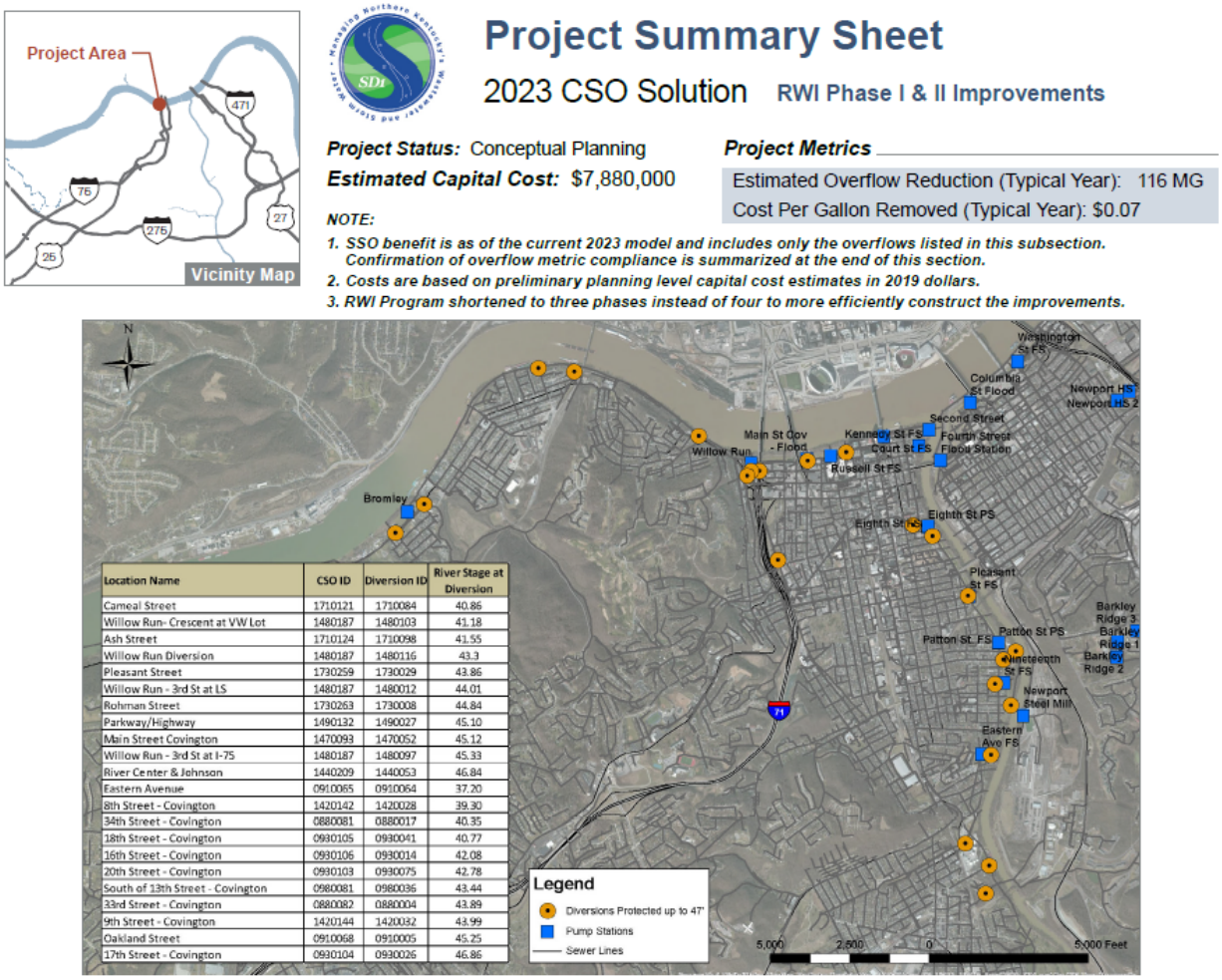
To mitigate the effects of river water intrusion, SD1 has developed a multi-phase program to prevent river water intrusion up to a design river elevation. Originally presented in ACD Appendix "C," SD1's program has been refined during development of the UWSP based on detailed model simulations and constructability considerations. Specifically, volume estimates have been improved, and implementation will occur in three phases rather than four phases. Phases I & II will be implemented by 2023, and include the installation of a flap gate or check valve on 19 CSO outfalls along the Ohio River and Licking River as shown on the project sheet in Figure 5-1. Once complete, this project will allow Bromley PS, 8th Street PS, and Patton Street PS to remain in normal operation up to a river stage of 47 feet. Currently, Bromley PS turns down to 2 small pumps for river levels above 41 feet, and 8th Street and Patton Street shut down completely due to significant river water intrusion. By protecting the CSS from river water intrusion for river levels up to 47 feet, these pump stations can remain in operation and not inundate Dry Creek WRF with river water and highly dilute sewage. Above this point, the Ohio River Interceptor must be shut down in accordance with USACE protocols, and the system switches to flood protection mode. Note that this project also includes work on the Willow Run outfall sewer discharge in Goebel Park, to increase the Willow Run Flood Station action level from 45.9' to 47.0'.

To protect these 19 CSOs, a new check valve or flap gate was assumed to be installed at the CSO outfall headwall, or in a new chamber on the outfall. The one exception is the Willow Run CSO (1480187), where protection was assumed at the four diversions. A new check valve was assumed at diversions 1480012, 1480097, 1480103, and a new bending weir at diversion 1480116. A listing of the CSOs addressed by this project is provided in Table 5-1.

Table 5-1: List of CSOs Addressed by River Water Intrusion Mitigation Program

CSO ID
0880081
0880082
0910065
0910068
0930105
0960063
1420142
1440206
1440209
1470093
1480187
1490132
1710116
1710119
1710121
1710124
1720109
1730259

Figure 5-1: River Water Intrusion Mitigation Program By 2023 – Phase I & II



5.1.2 Targeted Sewer Separation

Sewer separation is a traditional CSO mitigation technology and has been proven effective in numerous applications. However, it is also well known based on experience in the industry that it is not universally cost-effective, as the effectiveness of separation varies based on the relative relationship of numerous factors in any given sewershed. Therefore, SD1 is applying sewer separation strategically and opportunistically, and only in those areas where it is a cost-effective component of the overall CSO mitigation approach.

SD1 has identified six opportunistic sewer separation projects in the combined system as part of the 2023 improvements. The Jacob Price Phase 2, Church Street Phase 2, Water's Edge, Aqua on the Levee (initial phase), and RiverCenter separation projects have already been completed, and separated approximately 65 acres of pervious and impervious area. These projects removed approximately 36 million gallons of runoff from the combined system in the typical year. The Washington/Saratoga (second Aqua on the Levee phase) project will be completed in 2021 and will separate approximately 6 acres of pervious and impervious area, removing approximately 4 million gallons of runoff from the combined system in the

typical year. All six separation projects are projected to reduce CSO volume by approximately 40 million gallons in the typical year.

These areas are shown in Figure 5-2 and are all scheduled to be completed by 2021. A listing of the CSOs addressed by this project is provided in Table 5-2.

Table 5-2: List of CSOs Addressed by Targeted Sewer Separation

CSO ID
0610071
0620077
0640090
0770096
1420142

CSO ID
1470093
1850158
1870193
1880090

Figure 5-2: Sewer Separation Areas

Project Summary Sheet

2023 CSO Solution

Targeted Sewer Separation

Project Status: In Construction - Washington/ Saratoga; Complete - RiverCenter, Jacob Price PH2,Church St PH2, Water's Edge, Aqua on the Levee

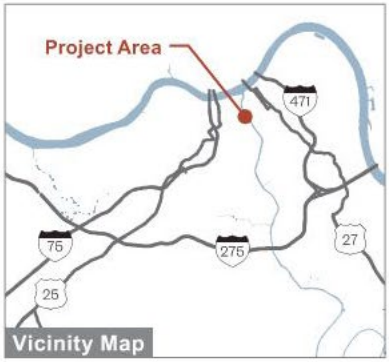
Estimated Capital Cost: $1,130,000 (In Construction)

Primary Improvement

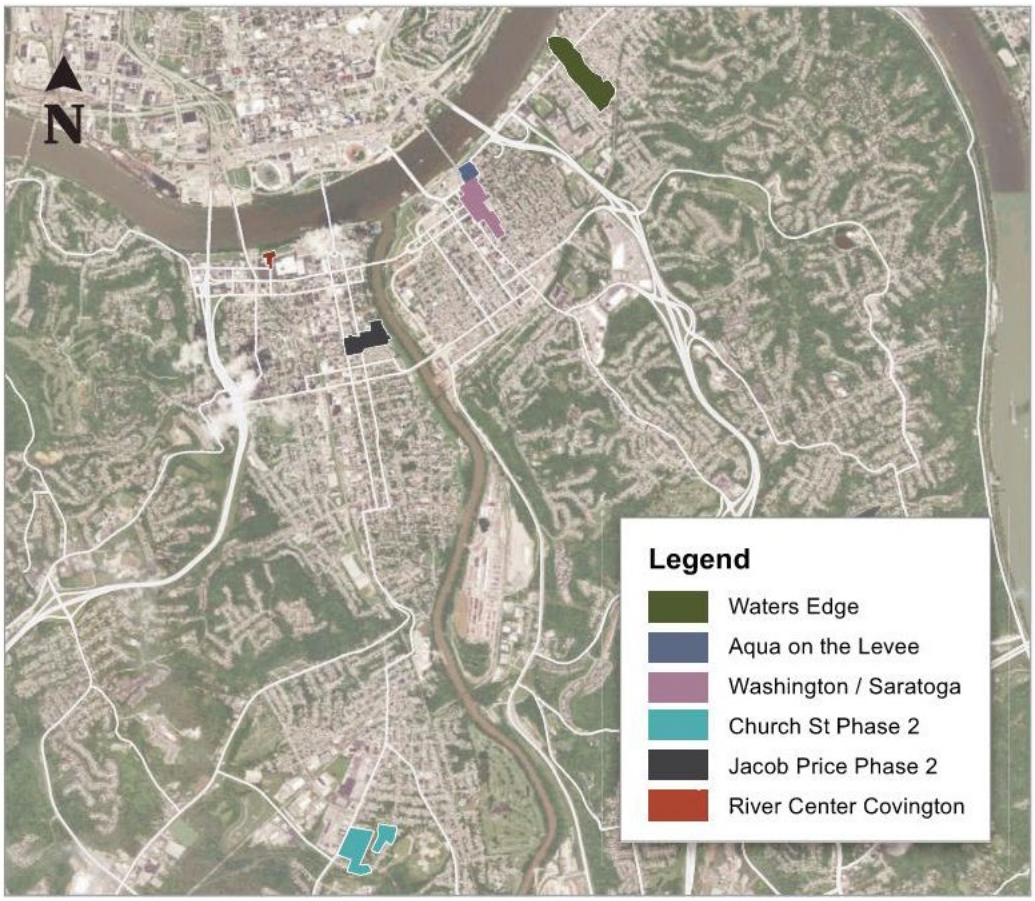
Conveyance ☐ Sewer Separation ■ PS & Force Main ☐

Project Metrics

Est. Overflow Reduction (Typ. Year): 7.0 MG (In Construction)
Cost Per Gallon Removed (Typ. Year): $0.16



NOTES:
1. ***CSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



5.1.3 Ash Street EQ Tank

The Ash Street EQ tank project includes a 0.41 million gallon buried tank to be constructed in Silver Grove southwest of the intersection of Mary Ingles Highway and Ash Street to store CSO in excess of the downstream sewer capacity. Flow would be diverted by gravity to the buried tank, and subsequently dewatered by gravity through a drain vault with control valve back to the combined sewer system, at a rate up to 0.25 mgd.

An overview of the 2023 Ash Street solution is shown on the project sheet in Figure 5-3, and a listing of the CSOs addressed by this project is provided in Table 5-3.

Table 5-3: List of CSOs Addressed by Ash Street EQ Tank

CSO ID
0010220

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 5-3: Ash Street 2023 Improvements

Project Summary Sheet

2023 CSO Solution

Ash Street EQ Tank

Project Status: Conceptual Planning

Estimated Capital Cost: $2,190,000

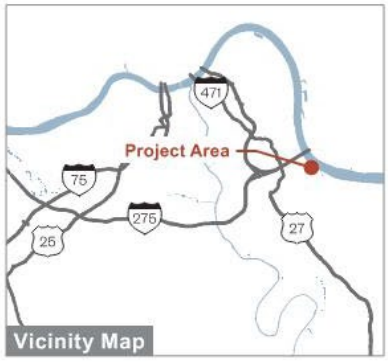
Primary Improvement

Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Ash St Storage Volume: 0.41 MG

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.5 MG
Cost Per Gallon Removed (Typical Year): $1.46



NOTES:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***Pursuant to the Ash Street Pump Station Replacement Project approval letter dated February 10, 2020, the completion date for this project is December 1, 2021.***



5.2 2023 SSO Improvements

The 2023 SSO improvements comprise the following projects:

- Vernon Lane RDII Removal
- Elsmere Corridor Capacity Upgrade
- Richwood Pump Station and Force Main
- Allen Fork Pump Station Capacity Upgrade
- Highland Heights/Silver Grove EQ Tanks
- Licking River Double Siphon

Details on each of these project groupings are provided below, in the form of a narrative description, a table of overflows addressed by overflow ID, and a detailed project summary sheet showing the local collection systems and extent of improvements. With the exception of the Highland Heights Silver Grove EQ Tanks, and the Licking River Double Siphon, all other projects are complete.

5.2.1 Vernon Lane RDII Removal

In 2018, SD1 completed RDII removal in the Vernon Lane area, located in the upstream portion of the Licking River Siphon sewershed. This project included both public and private source RDII removal over a 67-acre area and included removal of numerous direct connections from downspouts and area drains. The project included the installation of approximately 2,600 feet of 8-inch to 18-inch sanitary sewer, approximately 650 feet of 6-inch lateral piping, and approximately 1,300 feet of 12-inch to 24-inch storm sewer. This project was one of SD1's completed pilot RDII removal projects that was recommended as part of the original WSP, and is further discussed in Section 7.2.1 and Appendix I.

An overview of the project is shown on the project sheet in Figure 5-4, and a listing of the SSOs addressed by this project is provided in Table 5-4.

Table 5-4: List of SSOs Reduced or Eliminated by Vernon Lane RDII Removal

SSO ID
0150009
0150024
0150063
0150399
0220056
0220058
0220086
0260002
0270026
0860001

Figure 5-4: Vernon Lane 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Vernon Lane RDII Removal

Project Status: Complete

Primary Improvement

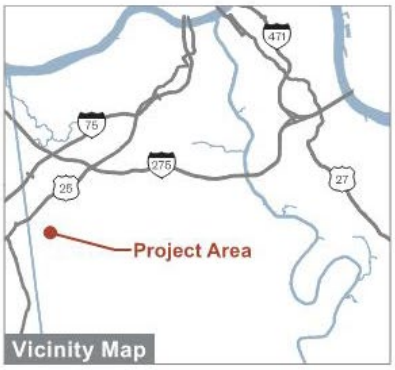
RDII Removal ☒ EQ Storage ☐ PS and Force Main ☐

8-inch to 16-inch: 0 LF
18-inch to 24-inch: 0 LF
27-inch to 42-inch: 0 LF
48-inch and Greater: 0 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 4.4 MG

NOTES: *1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.*





5.2.2 Elsmere Corridor Capacity Upgrade

In 2020, SD1 completed this project which consisted of approximately 8,040 feet of 18-inch through 24-inch upsizing as shown in the project summary sheet. The 18-inch upsizing extended from manhole 2110001 to manhole 2090025 on the trunk line, with 24-inch upsizing of the main trunk line from manhole 1060005 upstream to manholes 2070062 and 2100007. This conveyance upsizing will convey additional flow once additional conveyance upgrades are completed upstream as part of the 2040 Lakeview sanitary sewershed improvements (see Section 8.2.2).

The completed improvements are shown in Figure 5-5, and a listing of the SSOs addressed by this project is provided in Table 5-5.

Table 5-5: List of SSOs Reduced or Eliminated by Elsmere Corridor Capacity Upgrade

SSO ID
2070019
2090008
2090063
2100002
2100036
2100057
2100106
2100129
2110001
2110002
2120001

Figure 5-5: Elsmere Corridor 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Elsmere Corridor Capacity Upgrade

Project Status: Complete

Primary Improvement

Conveyance ■ EQ Storage ☐ PS and Force Main ☐

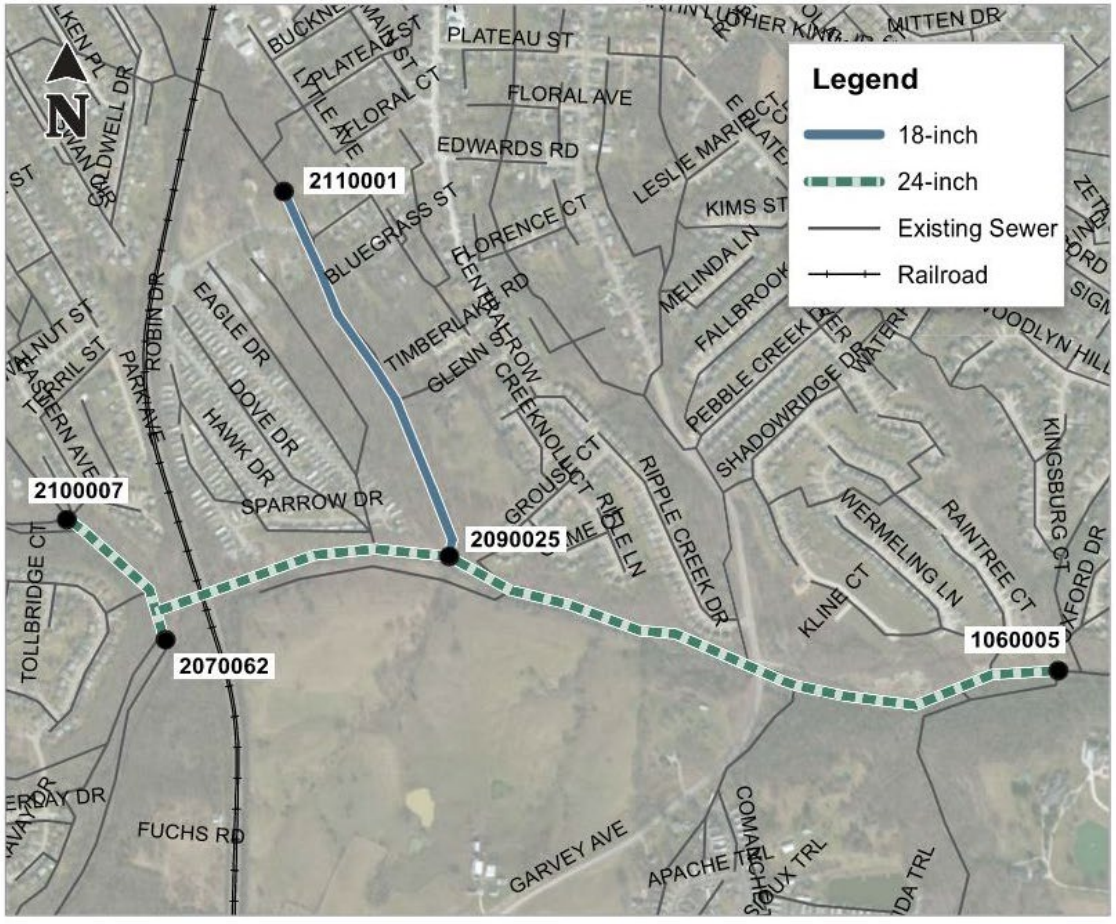
8-inch to 16-inch:	0 LF	27-inch to 42-inch:	0 LF
18-inch to 24-inch:	8,040 LF	48-inch and Greater:	0 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 3.5 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





5.2.3 Richwood Pump Station and Force Main

In 2018, SD1 completed construction of the new Richwood pump station and force main which redirected flows away from the capacity limited Southern Kenton Interceptor and towards the Western Regional Union Sewer. This project was conceived years ago and was included in the IWSP to maximize the investment SD1 made in the Western Regional WRF and associated conveyance tunnel which was designed to accommodate these diverted flows. The project consisted of a new 7.5 mgd (firm-capacity) pump station and approximately 18,600 feet of 20-inch through 24-inch force main discharging to manhole 2421186 near US Highway 42.

The completed improvements are shown in Figure 5-6, and a listing of the SSOs addressed by this project is provided in Table 5-6.

Table 5-6: List of SSOs Reduced or Eliminated by Richwood Pump Station and Force Main

SSO ID
1940006
1950010
1950036
1990018
2280023
2300011
2300013
2300019
2300121
2300123
2301219
1950PS1

Figure 5-6: Richwood 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Richwood Pump Station and Force Main Improvements

Project Status: Complete

Primary Improvement

Conveyance ☐ EQ Storage ☐ PS and Force Main ■

8-inch to 16-inch: 0 LF 27-inch to 42-inch: 0 LF

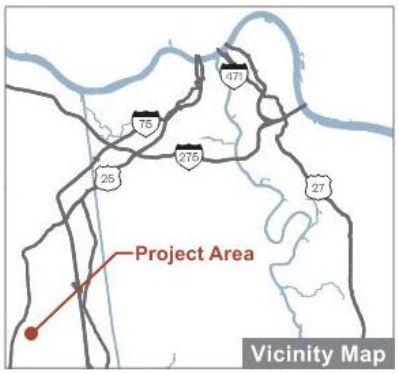
18-inch to 24-inch: 18,600 LF 48-inch and Greater: 0 LF

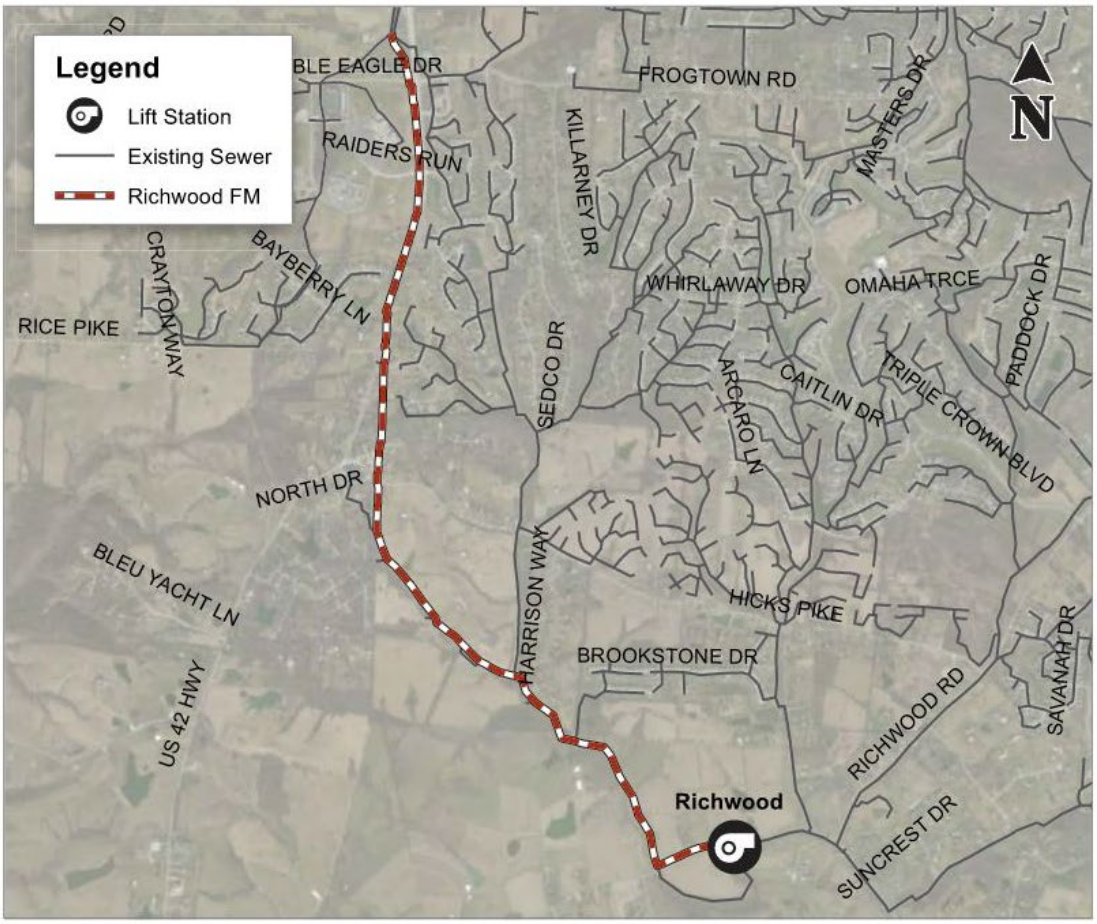
New Lift Station Capacity: 7.5 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 3.6 MG

NOTES: *1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.*





5.2.4 Allen Fork Pump Station Capacity Upgrade

In 2018, SD1 completed pump replacements at the Allen Fork pump station to address persistent maintenance issues and provide additional capacity. The pump replacements were designed to increase the station's firm capacity from 2.5 mgd to 3.4 mgd.

The completed improvements are shown in Figure 5-7, and a listing of the SSOs addressed by this project is provided in Table 5-7.

Table 5-7: List of SSOs Reduced or Eliminated by Allen Fork Pump Station Capacity Upgrade

SSO ID
2390002

Figure 5-7: Allen Fork 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Allen Fork Pump Station Capacity Upgrade

Project Status: Complete

Primary Improvement

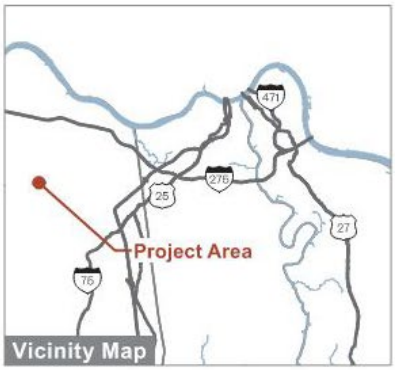
Conveyance ☐	EQ Storage ☐	PS and Force Main ■	
8-inch to 16-inch:	0 LF	27-inch to 42-inch:	0 LF
18-inch to 24-inch:	0 LF	48-inch and Greater:	0 LF

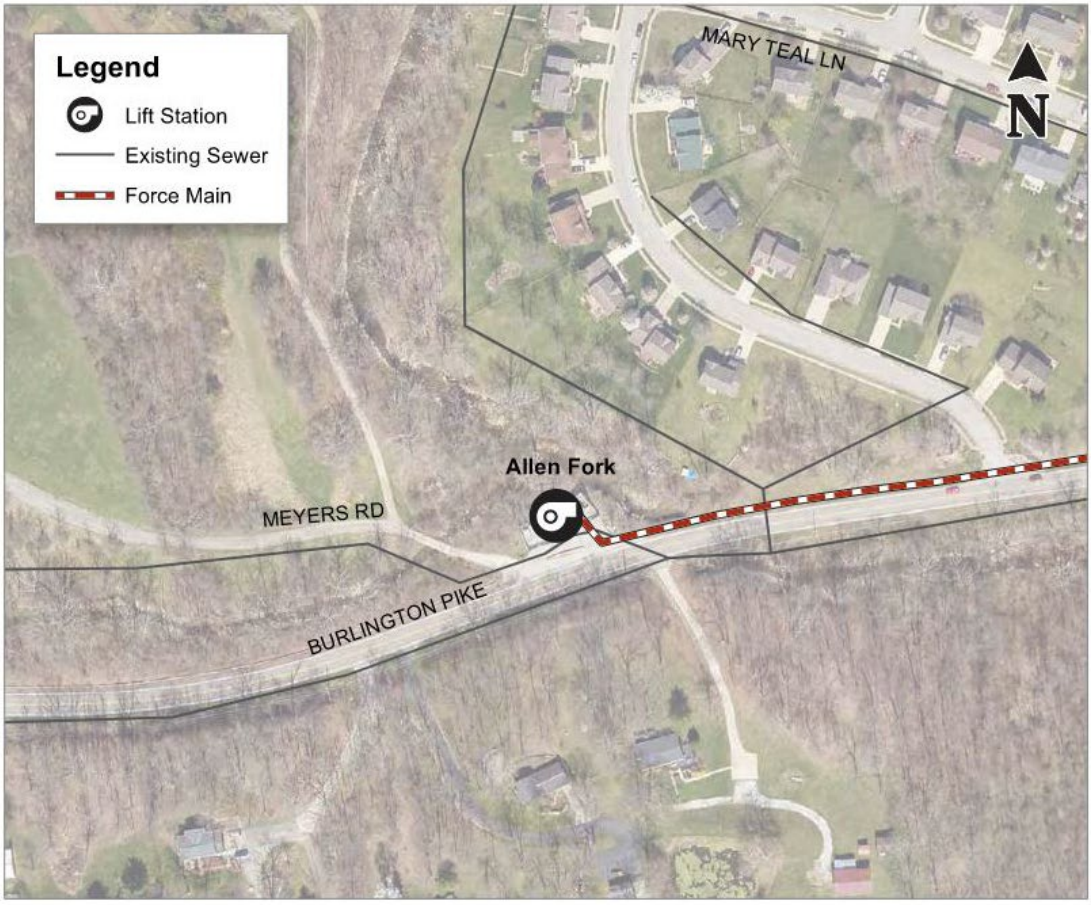
New Lift Station Capacity: 3.4 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 0.01 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





5.2.5 Highland Heights/Silver Grove EQ Tanks

The Highland Heights/Silver Grove study area is located in the southeast portion of SD1's service area, upstream of the combined sewer system, and includes one of the four highest priority public health risk areas identified in the original WSP. SD1 has identified multiple planning-level options to achieve required goals; while the presented solution is considered the most viable option given current information, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

This project includes two EQ tanks constructed just upstream of the existing Silver Grove and Highland Heights pump stations. Currently, inflows in the typical year to both stations exceed pumping capacities, creating SSOs in the typical year. These EQ tanks will temporarily store this volume and release flow as capacity becomes available. A 1.6 million gallon tank is proposed at Silver Grove, and 1.4 million gallon tank at Highland Heights. Both facilities will utilize a wet weather pump station to pump flow to an above ground tank, and include a controlled gravity drain back to the collection system. Both tanks are sized with future improvements by 2040 in mind which includes additional conveyance upstream, redirected flow to the Eastern Regional WRF, and an upgraded Highland Heights PS.

An overview of the 2023 Highland Heights/Silver Grove solution is shown on the project sheet in Figure 5-8, and a listing of the SSOs addressed by this project is provided in Table 5-8.

Table 5-8: List of SSOs Reduced or Eliminated by Highland Heights/Silver Grove EQ Tanks

SSO ID
0020006
0020007
0020008
0020032
0050PS1

Figure 5-8: Highland Heights/Silver Grove 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Highland Heights/Silver Grove EQ Tanks

Project Status: In Construction

Estimated Capital Cost: $15,020,000

Primary Improvement

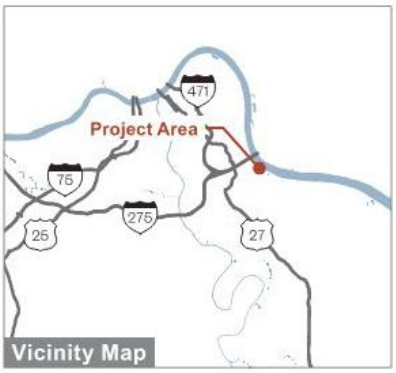
Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Highland Heights Storage Volume: 1.4 MG

Highland Heights EQ Pumping Rate: 7.9 MGD

Silver Grove Storage Volume: 1.6 MG

Silver Grove EQ Pumping Rate: 7.5 MGD



Project Metrics

Estimated Overflow Reduction (Typical Year): 22.0 MG

Cost Per Gallon Removed (Typical Year): $0.68

NOTES:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***EQ tank volumes shown are less than the sizes provided in the February 10, 2020 Ash Street Pump Station Replacement Project approval letter. Additional flow monitoring was performed in the Highland Heights/Silver Grove project area. The information gained from this flow monitoring exercise was utilized in sizing the EQ facilities currently under construction.***
4. ***Pursuant to the Ash Street Pump Station Replacement Project approval letter dated February 10, 2020, the completion date for this project is December 1, 2021.***



5.2.6 Licking River Double Siphon

The Licking River Siphon is the location of the largest SSO in SD1's collection system. Controlling this significant overflow requires a multi-phase approach, the first of which is the installation of a second siphon pipe under the Licking River (directly downstream of the SSO) to provide more outlet capacity.

This project will include the installation of a second 12-inch siphon under the Licking River to the combined system. This project works in conjunction with the LRS EQ tank (part of the 2029 solution) to eliminate the LRS SSO (0860001), and is required to accommodate future conveyance improvements in the Licking River Siphon (LRS) sewershed. To construct the parallel 12-inch siphon, Horizontal Directional Drilling (HDD) was identified as the most efficient option due in part to the length of crossing, ground surface, river elevation profile, and required diameter of the carrier pipe. This project alone will reduce SSO volume by 42 million gallons at 0860001 (under 2023 conditions), but the LRS EQ tank included as part of the 2029 improvements is required to fully eliminate this SSO, and offset CSO impacts downstream of the double siphon.

An overview of the Licking River Siphon 2023 solution is shown on the project sheet in Figure 5-9, and a listing of the SSOs addressed by the Licking River Siphon projects is provided in Table 5-9.

Table 5-9: List of SSOs Reduced or Eliminated by Licking River Double Siphon

SSO ID
0860001

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 5-9: Licking River Siphon 2023 Improvements

Project Summary Sheet

2023 SSO Solution

Licking River Double Siphon

Project Status: Conceptual Planning

Estimated Capital Cost: $1,150,000

Primary Improvement

Conveyance ■ EQ Storage □ PS and Force Main □

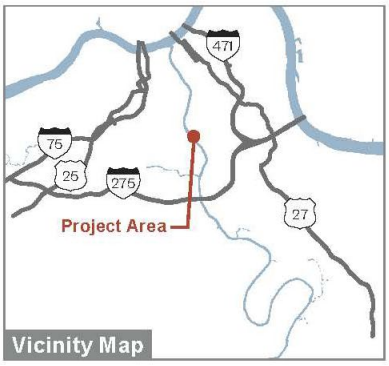
8-inch to 16-inch: 1,345 LF 30-inch to 42-inch: 0 LF

18-inch to 27-inch: 0 LF 48-inch and Greater: 0 LF

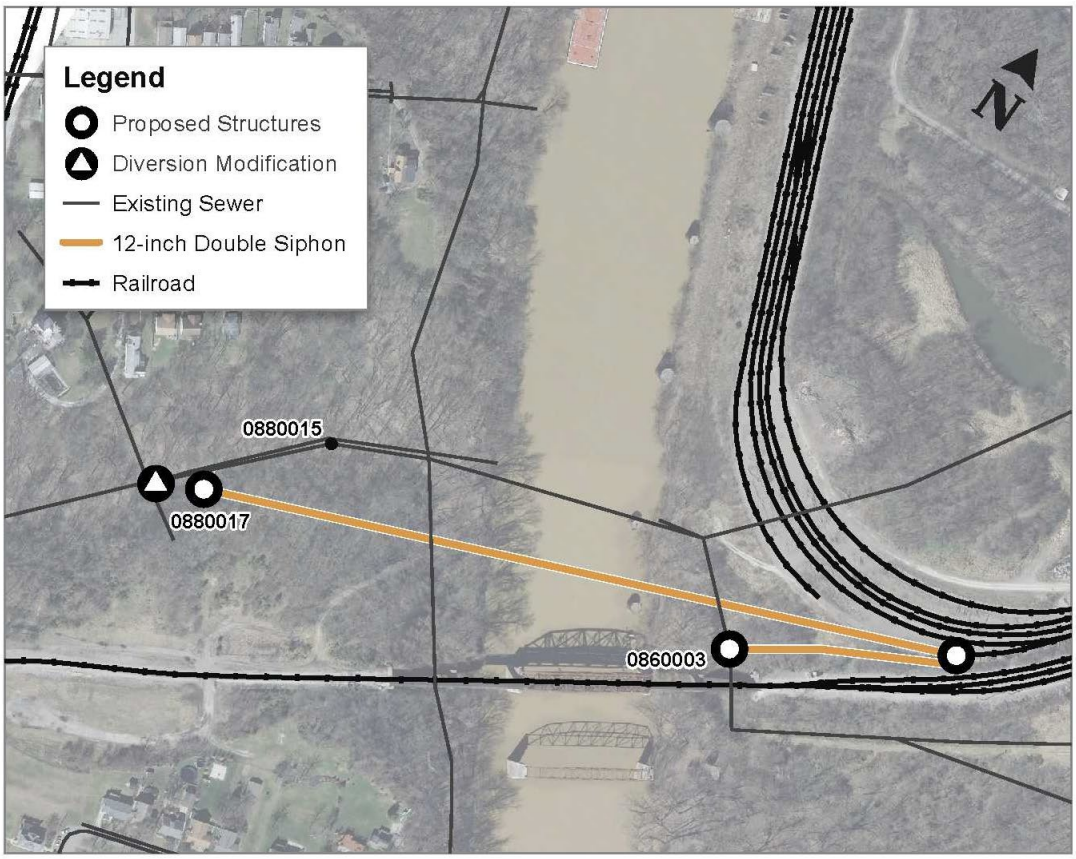
Project Metrics

Estimated Overflow Reduction (Typical Year): 42.0 MG

Cost Per Gallon Removed (Typical Year): $0.03



NOTES:
1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



5.3 Achieving Consent Decree Metrics

As explained in Section 3.7, a fundamental sequencing criterion was to assemble projects to meet the overflow reduction milestone dates required by the ACD. Tables 5-10 and 5-12 demonstrate that the improvements presented above, sequenced properly for the 2023 timeframe, meet or exceed all ACD milestones. Note that for the CSS, a higher percent capture represents a greater overflow reduction, while for the SSS, a lower percentage of baseline SSO volume remaining represents a greater overflow reduction.

Table 5-10: 2023 CSS Improvements

Project	Remaining CSO Volume (MG)	Total Combined Flow (MG)	Percent Capture	Required ACD Milestone
RWI Mitigation Phases I & II	1,475	4,704	68.6%	67%
Targeted Sewer Separation				
Ash St EQ (completion 12/1/21)				

The percent capture value in Table 5-10 above is based on the calculation in Table 5-11:

Table 5-11: 2023 Percent Capture Calculation

Category	Typical Year Annual Volume (MG)
Storm water entering combined system	2,740
Sanitary flow during wet weather	1,898
Eliminated Flow	66
Total Combined Flow (TCF)	4,704
Untreated CSO (CSO)	1,475
Percent Capture [(TCF)-(CSO)]/(TCF)	**68.6%**

Table 5-12: 2023 SSS Improvements

Project	Remaining SSO Volume (MG)	Percentage of Baseline SSO Volume Remaining	Required ACD Milestone Volume Remaining
SG/HH EQ (completion 12/1/21)	48.8	42.4%	80%
LRS Double Siphon			

Tables 5-13 and 5-14 below provide detailed by-overflow volume information for CSOs and SSOs remaining in 2023, with the proposed improvements in place, as predicted by the SD1's hydraulic model. Table 5-13 lists annual volume by CSO, and Table 5-14 lists annual volume by SSO.

Table 5-13: Remaining Volume by CSO Location with 2023 Improvements

As Predicted by the ICM Model

Outfall ID	Annual Volume (MG)
0030031	0.79
0200069	0.85
0340050	0.44
0340051	0.19
0360079	2.13
0540156	1.46
0540157	0.88
0550134	0.06
0570089	24.00
0570090	3.39
0600094	0.48
0600096	0.12
0600097	3.93
0600104	0.07
0610071	18.55
0610072	0.56
0620075	8.47
0630061	1.03
0640090	230.10
0650090	9.01
0650098	4.82
0650100	0.12
0660085	0.46
0690067	0.14
0730129	1.58
0770096	0.37
0790084	16.85
0790086	100.75
0840111	0.11
0840112	3.23
0840116	6.01
0870078	0.36
0870079	24.85
0880081	51.44
0880082	0.53
0910065	162.35
0910068	42.78
0910084	0.28
0930103	0.06
0930104	0.05
0930105	27.04
0960063	2.15
0960064	0.01
0980073	0.14
0980080	0.03
0980081	51.40
1420141	<0.01
1420142	55.66
1440204	0.10
1440206	3.06
1440207	0.24
1440209	97.86
1440508	0.51
1470089	0.23
1470093	57.13
1480185	1.51
1480187	386.61
1490132	1.05
1500131	7.77
1710114	0.30
1710116	10.44
1710119	3.69
1710121	1.37
1710124	2.16
1720109	12.92
1730259	1.95
1730263	1.85
1840130	0.89
1850158	18.36
1870193	1.27
1870194	0.11
1880090	2.28
1880091	1.46

Table 5-14: Remaining Volume by SSO Location with 2023 Improvements

As Predicted by the ICM Model

Manhole ID	Overflow Volume (MG)
0010PS6	0.01
0040003	0.09
0050022	0.02
0050131	0.07
0050PS1	0.27
0060001	0.70
0060002	0.18
0060004	0.15
0100001	<0.01
0100004	0.02
0110010	1.32
0150009	1.08
0150024	0.01
0150061	0.25
0150063	<0.01
0150064	0.45
0150065	0.35
0150086	0.13
0150198	0.08
0150399	2.66
0220056	0.02
0220058	<0.01
0220086	<0.01
0230016	<0.01
0270026	0.02
0280001	<0.01
0300035	0.08
0360005	<0.01
0370001	0.03
0380005	0.09
0390007	0.01
0400002	0.66
0400034	0.02
0410010	0.09
0410019	0.18
0410037	0.13
0410039	0.01

Manhole ID	Overflow Volume (MG)
1550053	0.18
1560016	0.02
1560092	0.45
1560121	<0.01
1570100	0.03
1690043	<0.01
1730085	0.02
1730086	1.24
1730104	0.74
1760047	0.34
1760048	0.21
1760055	0.02
1790003	0.02
1790004	<0.01
1790109	<0.01
1850140	7.11
1850141	2.58
1860108	1.34
1920086	<0.01
1920097	0.10
1930007	0.05
1930008	0.07
1930009	0.04
1930010	0.13
1930012	0.02
1940006	0.38
1940024	0.06
1940026	0.41
1940038	0.03
1940039	0.19
1940044	0.12
1950010	1.59
1950015	0.05
1950027	0.14
1950036	2.05
1950PS1	1.62
1960002	0.02

Manhole ID	Overflow Volume (MG)
0430006	0.15
0430007	0.33
0440074	0.02
0490032	<0.01
0490137	<0.01
0500047	0.10
0530083	0.45
0530119	0.01
0570130	0.04
0710071	0.33
0720027	<0.01
0720028	0.03
0860001	5.02
0870037	0.53
1010002	0.05
1010026	0.02
1010027	0.01
1090069	<0.01
1110025	<0.01
1110027	0.09
1110051	0.18
1110067	0.39
1110103	0.11
1110104	0.02
1110106	<0.01
1110150	<0.01
1110161	0.06
1110164	0.03
1110174	0.02
1110294	0.05
1190001	<0.01
1190012	0.43
1200022	0.23
1220016	0.12
1220054	0.49
1240008	0.43
1520124	0.13

Manhole ID	Overflow Volume (MG)
1980001	<0.01
1990018	1.61
1990028	0.35
1990032	0.31
2010042	<0.01
2010PS1	0.01
2010PS2	<0.01
2020035	0.42
2020203	0.05
2100057	0.03
2100081	<0.01
2100126	0.10
2100156	<0.01
2110006	0.04
2120001	0.02
2120023	<0.01
2120041	0.03
2130027	0.06
2160004	0.01
2170097	<0.01
2210009	0.08
2210050	0.19
2300011	0.04
2300013	1.11
2300019	0.22
2300027	0.20
2300121	0.79
2300123	0.13
2301219	2.38
2350005	<0.01
2350008	<0.01
2350055	<0.01
2350681	<0.01
2410387	0.03
2410459	<0.01
L17-282	0.02

5.4 Project Sequencing

Tables 5-15 and 5-16 below presents the proposed sequencing of 2023 improvements. SD1 is presenting these detailed schedules as part of a complete plan, to confirm that projects can be completed as required while accounting for implementation practicalities and engineering sequencing requirements. Interim dates and the timing of individual projects may change during design and implementation. Any such schedule refinements will not impact the ability of the project groupings to meet the ACD milestone metrics.

Table 5-15: 2023 CSO Improvements Schedule

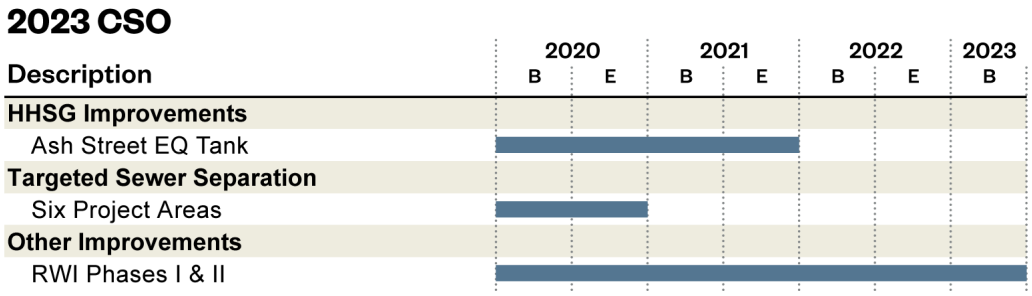
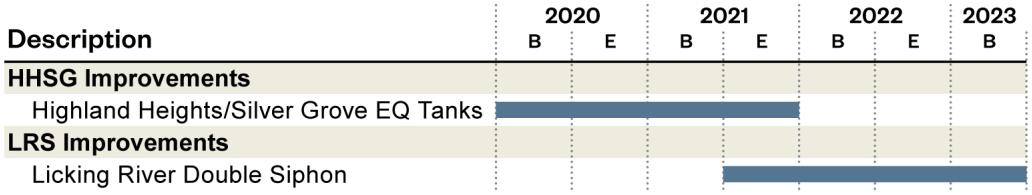


Table 5-16: 2023 SSO Improvements Schedule



Section 6
2029 Improvements

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6. 2029 Improvements

This section presents the improvements planned for implementation between 2023 and 2029. These improvements represent the remaining projects (beyond 2023) to be implemented in the next ten (10) years, and per the requirements of the ACD are presented to a higher level of detail than the 2034 and 2040 improvements in Sections 7 and 8. The 2029 improvements are projected to achieve the required 2029 ACD overflow reduction milestones. The resulting facility sizing is based on the best information available and based on the model projections and assumed growth as outlined in Section 3. Both project type and sizing may be adjusted during final planning and design in order to meet ACD metrics, based on updated information available at that time.

The section begins with a presentation of the selected CSO improvements and SSO improvements, and then demonstrates how those improvements meet the 2029 overflow reduction milestones. The section concludes with a presentation of the implementation schedule for the proposed projects. In addition to this section, these improvements are included in a comprehensive project list in Appendix H which summarizes project name, cost, volume reduction, proposed completion date, and SSO(s) eliminated or CSO(s) addressed by project for all UWSP projects presented in Sections 5-8.

6.1 2029 CSO Improvements

The 2029 CSO improvements were made up of the following project groupings:

- Surface detention basins to control stormwater prior to entry into the CSS
- River water intrusion mitigation program
- Bromley Pump Station improvements

Details on each of these project groupings are provided below, in the form of a narrative description, a table of overflows addressed by overflow ID, and a detailed project summary sheet showing the local collection systems and extent of improvements.

Note that the projected CSO volume reduction presented on the project summary sheets represents the effect of each project as an individual solution; the net CSO volume reduction from groupings of projects is typically lower than the sum of the individual projections due to the interaction between projects and the effect of system dynamics. All percent capture calculations use the net CSO volume reduction at each milestone to properly represent the effect of proposed improvements.

6.1.1 Surface Stormwater Detention Basins

The UWSP alternative evaluation process placed special emphasis on the potential for using surface stormwater detention basins as part of the CSO solution. Surface detention basins were proposed in the original watershed plan as part of the green infrastructure component, but at that time were subject to additional evaluation and pilot testing prior to decisions on degree of implementation. Since that time, SD1 has recognized that while explicit green infrastructure applications remain an option for any installed

basin, these basins also provide two independent benefits – detention of stormwater with subsequent delayed release into the CSS (reducing CSO volume) and surface flooding mitigation (by detaining peak flows). These two benefits alone warrant inclusion of selected surface detention basins in the solution, even while the potential benefits of green infrastructure are further evaluated during plan implementation.

With these benefits in mind, SD1 conducted a full evaluation of candidate surface detention basin sites in the combined sewer area. Based on the results of that evaluation, SD1 will be implementing the Willow Run Detention Basin Pilot Project by 2029. This project includes the installation of controls on 10 detention basins (9 existing and 1 proposed) in the Willow Run sewershed. This project would have a total drainage area of approximately 717 acres which represents approximately 38 percent of the entire Willow Run drainage area and have a total storage capacity of approximately 43.4 million gallons. Each of these detention basins have enough capacity to completely store and detain a significant amount of runoff volume corresponding with the typical year rainfall events that currently contribute to CSO discharges.

This pilot project would incorporate dynamic coordinated controls on these basins to reduce CSO volume. Discharge from each basin would be controlled based on detention basin level and available capacity at the downstream Willow Run regulator. Controls would throttle an outlet valve to store as much stormwater as possible just prior to a CSO overflow event at the regulator and drain each basin as capacity becomes available at the regulator. For large storm events, predictive weather capabilities can be employed to actively drain each basin prior to the storm event, to maximize flooding reduction benefit.

As a pilot project, the Willow Run Detention Basins will play a strategic role in informing SD1 decisions on RTC and coordinated control in subsequent UWSP phases. The locations of the surface detention basins included in the Willow Run Pilot Project are shown in Figure 6-1. Table 6-1 lists the CSOs addressed by this project in the typical year. Note that given the integrated nature of the combined system, some of the CSO locations benefit from multiple projects. Therefore, CSO IDs for this solution may be repeated from analogous tables in previous sections.

Table 6-1: List of CSOs Addressed by Surface Stormwater Detention Basins

CSO ID
1480187

Figure 6-1: Willow Run Surface Detention Basins Included in 2029 Improvements

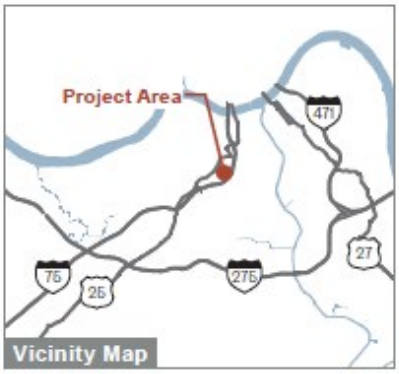
Project Summary Sheet

2029 CSO Solution

Willow Run Pilot Detention Basins

Project Status: Conceptual Planning
Estimated Capital Cost: $1,780,000
Primary Improvement
Conveyance ☐ Detention Basins ■ PS & Force Main ☐
Storage Surface Area: 13.3 Acres
Storage Volume: 43.4 MG

Project Metrics
Estimated Overflow Reduction (Typical Year): 154.0 MG
Cost Per Gallon Removed (Typical Year): $0.01



NOTES:
1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***Controls on all the basins will be implemented as one project.***



6.1.2 River Water Intrusion Mitigation Program

As previously mentioned, SD1's combined sewer system is impacted on a regular basis by high river levels, on both the Ohio River and Licking River. To mitigate the effects of river water intrusion, SD1 has developed a multi-phase program. As described in Section 5.1.1, the original program included in ACD Appendix "C" has been refined during development of the UWSP based on detailed model simulations and constructability considerations. Specifically, volume estimates have been improved, and implementation will occur in three phases rather than four phases. Phases I and II will be completed by 2023 and will protect 19 CSO outfalls along the Ohio River and Licking River. Phase III builds upon this work and will protect an additional 8 CSO outfalls along the Ohio River and Licking River as shown in Figure 6-2. This final phase of protection will allow the 2nd Street Pump Station to remain in normal operation up to a river stage of 47 feet. Currently, this pump station shuts down above 41 feet due to significant river water intrusion.

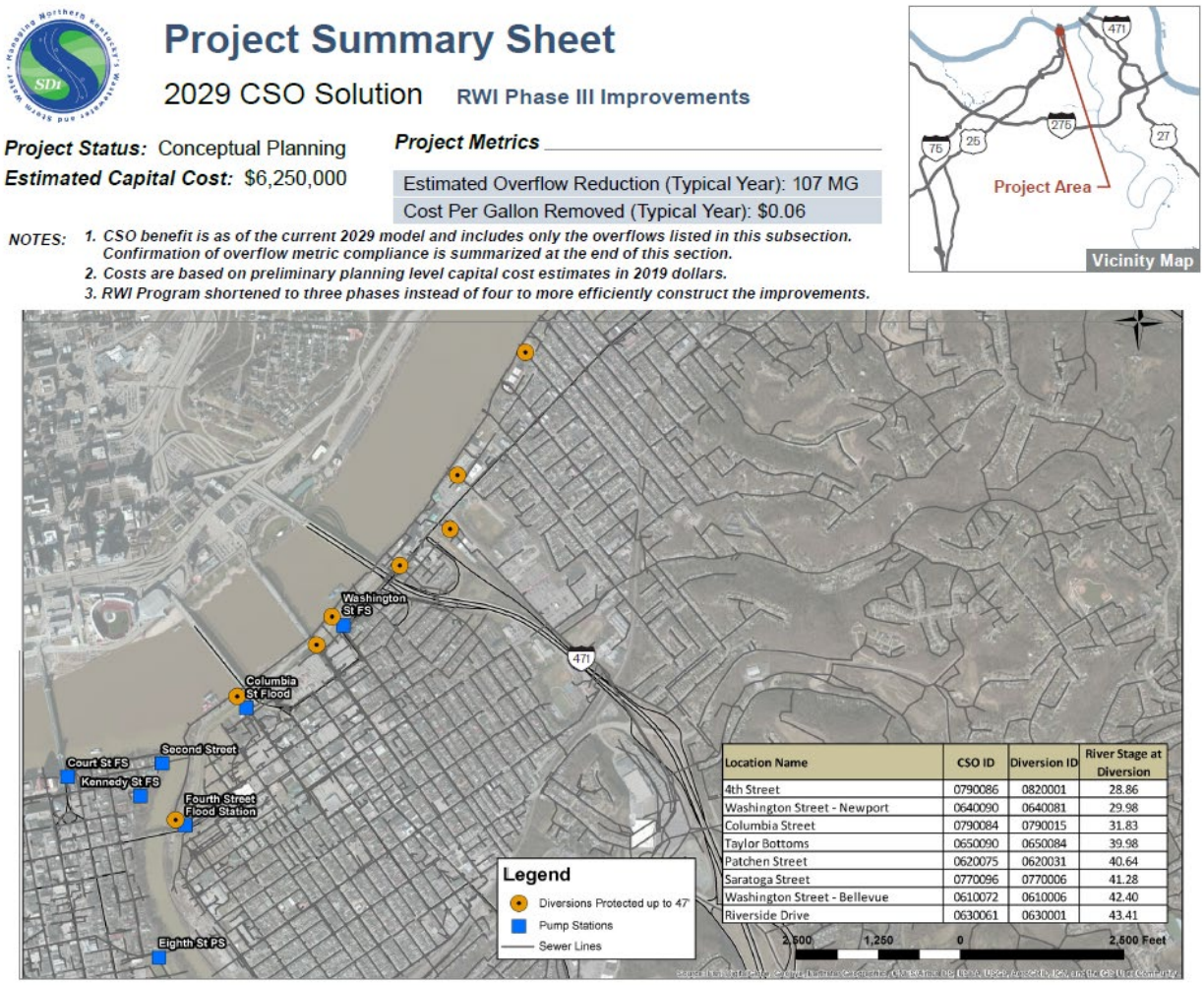
To protect these 8 CSOs, a new check valve or flap gate was assumed to be installed at the CSO outfall headwall, or in a new chamber on the outfall. Additional detail on the project location is shown in Figure 6-2. Table 6-2 lists the CSOs addressed by this project in the typical year. Note that given the integrated nature of the combined system, some of the CSO locations benefit from multiple projects. Therefore, CSO IDs for this solution may be repeated from analogous tables in previous sections.

Table 6-2: List of CSOs Addressed by River Water Intrusion Mitigation Program

CSO ID
0790086
0570089
1480187
1440206
1470093
1710116
1710119
1710121

CSO ID
1710124
1720109
0610071
0620075
0640090
0650090
0790084
0840112

Figure 6-2: River Water Intrusion Mitigation Program By 2029 – Phase III



Location Name	CSO ID	Diversion ID	River Stage at Diversion
4th Street	0790086	0820001	28.86
Washington Street - Newport	0640090	0640081	29.98
Columbia Street	0790084	0790015	31.83
Taylor Bottoms	0650090	0650084	39.98
Patchen Street	0620075	0620031	40.64
Saratoga Street	0770096	0770006	41.28
Washington Street - Bellevue	0610072	0610006	42.40
Riverside Drive	0630061	0630001	43.41

6.1.3 Bromley Pump Station Improvements

The Bromley Pump Station is the single downstream control on the entire combined sewer system, pumping combined flows to the Dry Creek WRF. Therefore, the capacity and reliability of the pump station are fundamental to the performance of the combined sewer system and CSO activity.

This project consists of process/mechanical, control, and electrical improvements at the pump station to allow two large pumps to run concurrently, which will increase the total pumping capacity of the pump station to approximately 45 mgd. These improvements will also increase the reliability, redundancy, functionality, and longevity of the pump station. Revised level settings are also proposed, which will turn on the pumps sooner, and further reduce CSO volume upstream. An overview of the improvements are shown on the project sheet in Figure 6-3 and Table 6-3 lists the CSOs addressed by this project in the typical year. Note that given the integrated nature of the combined system, some of the CSO locations benefit from multiple projects. Therefore, CSO IDs for this solution may be repeated from analogous tables in previous sections.

Table 6-3: List of CSOs Addressed by Bromley Pump Station Improvements

CSO ID
1440209
1470093
1480187
1490132
1710116
1710119
1710121
1710124
1720109
1730259

Figure 6-3: Bromley Pump Station 2029 Improvements

Project Summary Sheet

2029 CSO Solution

Bromley Pump Station Improvements

Project Status: Conceptual Planning

Estimated Capital Cost: $1,820,000

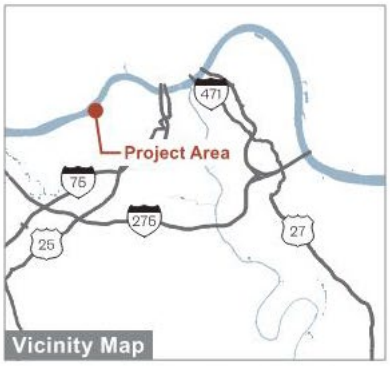
Primary Improvement

Conveyance ☐ EQ Storage ☐ PS and Force Main ■

Upgraded Lift Station Capacity: 45 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 60 MG
Cost Per Gallon Removed (Typical Year): $0.03



NOTES:
1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.1.4 State Route 9 (SR9) Sewer Separation

In addition to the six opportunistic sewer separation projects in the combined system identified as part of the 2023 improvements, SD1 has identified the SR9 sewer separation project as another strategic opportunity. This project includes sewer separation in Newport, Ky along the State Route 9 corridor, separating a total of approximately 32 acres of pervious and impervious area and removing approximately 15 million gallons of runoff from the combined system in the typical year. In conjunction with the Kentucky Transportation Cabinet's (KYTC) State Route 9 Realignment project, approximately 9,700 feet of 15-inch through 66-inch separate storm sewer has already been installed, with the remaining work including installation of approximately 400 feet of 66-inch storm sewer through the earthen levee to discharge separated stormwater to the Licking River.

The area to be separated is shown in Figure 6-4, along with a listing of CSOs addressed by this project provided in Table 6-4.

Table 6-4: List of CSOs Addressed by SR9 Sewer Separation

CSO ID
0730129
0790084
0790086
0840111
0840112
0840116

Figure 6-4: SR9 Sewer Separation Area

Project Summary Sheet

2029 CSO Solution

SR9 Sewer Separation

Project Status: Conceptual Planning

Estimated Capital Cost: $1,850,000

Primary Improvement

Sewer Separation ■ EQ Storage ☐ PS and Force Main ☐

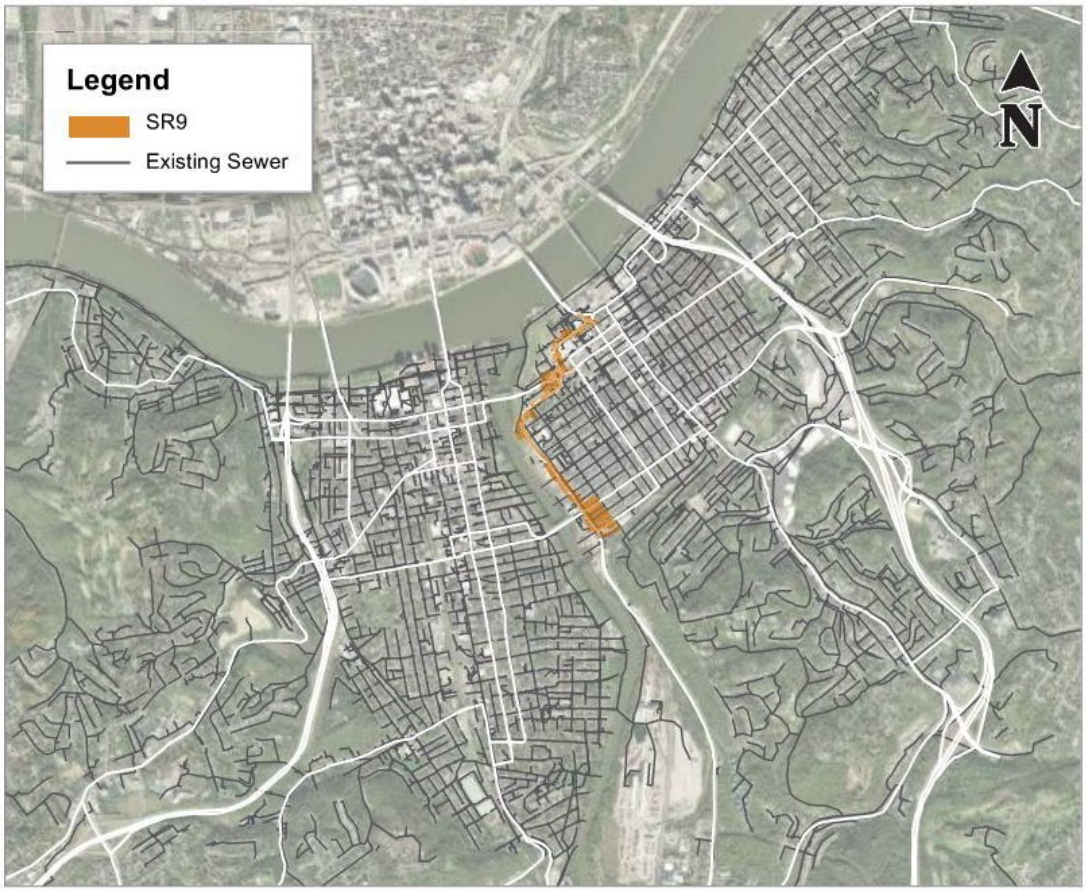
Project Metrics

Estimated Overflow Reduction (Typical Year): 10 MG
Cost Per Gallon Removed (Typical Year): $0.19



NOTES:

1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2 2029 SSO Improvements

The 2029 SSO improvements are grouped by geographic study area, as follows:

- Licking River Siphon
- Lakeview
- W6 Pump Station
- Bullitsville Pump Station
- Waterworks Road
- Bromley Crescent Springs

Details on each of these project groupings by study area are provided below, in the form of a narrative description, a table of overflows addressed by overflow ID, and a detailed project summary sheet showing the local collection systems and extent of improvements.

6.2.1 Licking River Siphon

Building upon the 2023 double siphon improvement described in section 5.3.2, the 2029 improvements in the Licking River Siphon sewershed are as follows:

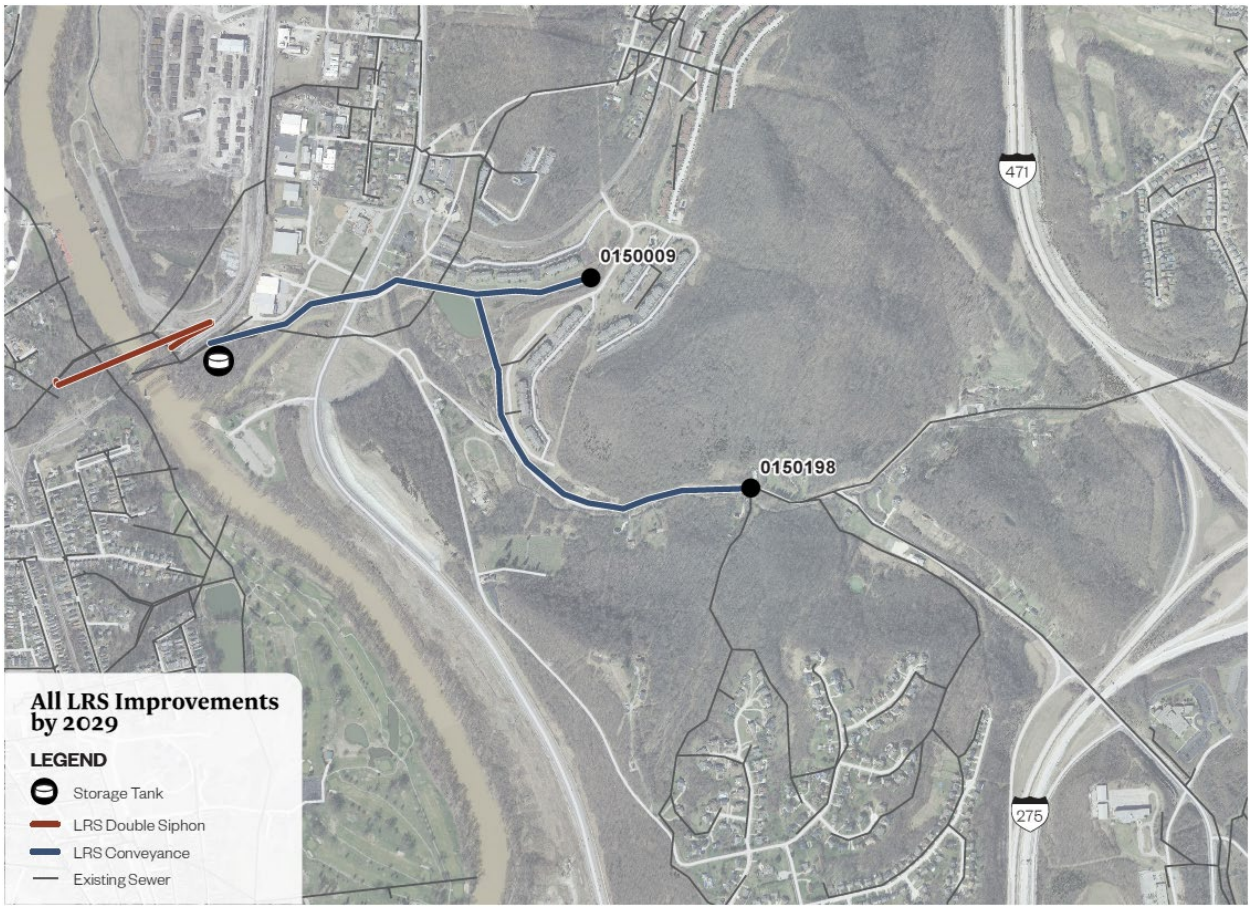
- Installation of an EQ tank to control peak flows.
- Conveyance improvements directly upstream of the new EQ tank, to convey flows to the EQ tank.

An overview of the Licking River Siphon 2029 solution is shown in Figure 6-5, with detailed Project Summary Sheets for each project grouping included in the following subsections. A listing of SSOs addressed by the Licking River Siphon projects is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 6-5: List of SSOs Reduced or Eliminated by Licking River Siphon Improvements

SSO ID
0150009
0150061
0150063
0150064
0150065
0150198
0150399
0860001

Figure 6-5: Licking River Siphon 2029 Improvements



6.2.1.1 LRS EQ Tank

The Licking River Siphon (LRS) EQ tank project includes a 6.6 million gallon above ground tank to be constructed near Andrews Way and Threemile Creek, to store flows in excess of the Licking River Siphon downstream. This project works with the Licking River double siphon project (included in the 2023 improvements) by lowering the hydraulic grade line in the existing sewers, mitigating CSO impacts, and eliminating the LRS SSO. The tank is sized to accommodate additional flow from conveyance projects upstream to be completed by 2040. As shown in the project summary sheet, flow would be diverted to a 22.4 mgd wet weather pump station, which would pump flow into the tank. Flow would be dewatered by gravity through a drain vault with control valve back to the sanitary sewer system, at a flow rate of up to 3.0 mgd. The tank and wet weather pump station would be accessed via Andrews Way.

Figure 6-6: Licking River Siphon EQ Tank Included in 2029 Improvements

Project Summary Sheet

2029 SSO Solution

Licking River Siphon EQ Tank

Project Status: Conceptual Planning

Estimated Capital Cost: $20,510,000

Primary Improvement

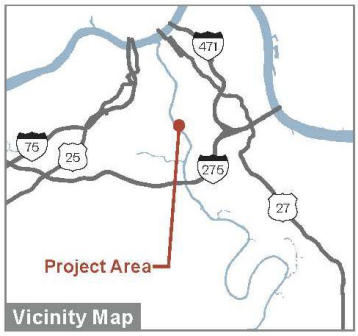
Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Storage Volume: 6.6 MG

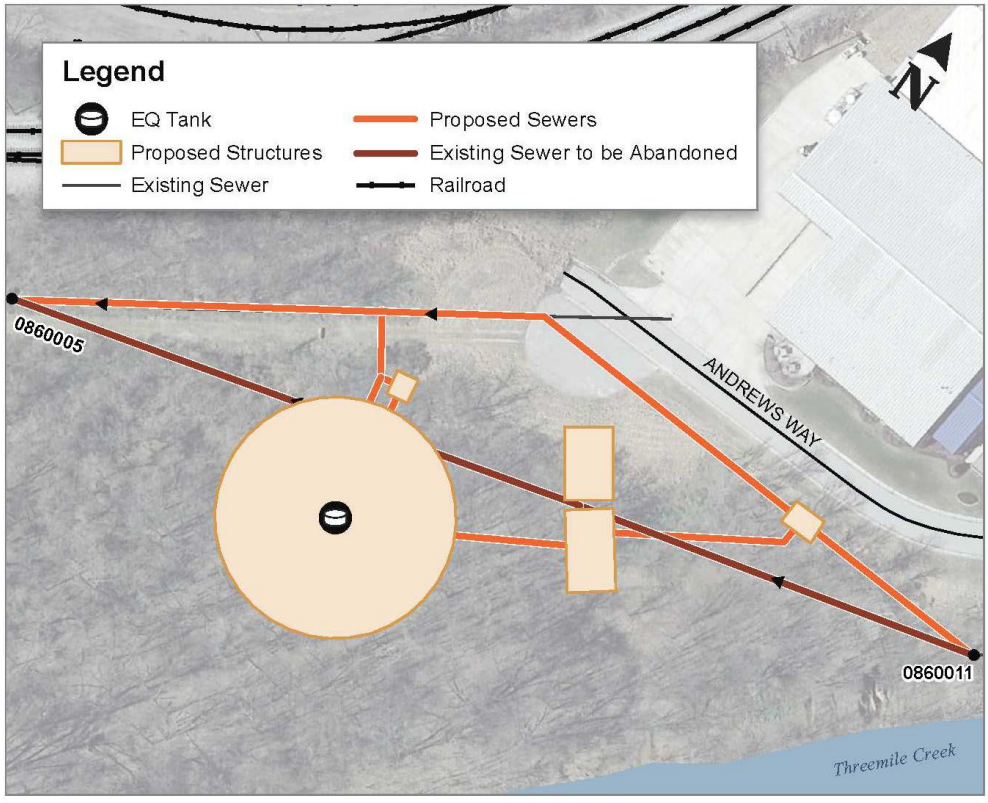
Pumping Rate: 22.4 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year):	5.0 MG
Cost Per Gallon Removed (Typical Year):	$4.10



NOTES:
1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2.1.2 LRS Conveyance Piping

This project consists of 6,050 feet of 24-inch through 48-inch sanitary sewer upsizing as shown in the project summary sheet. The upsizing would begin at manhole 0860011 and would extend upstream to manholes 0150009 and 0150198. The sewer would be installed via open cut installation, with a bore required beneath Licking Pike. In addition, portions of the 24-inch and 36-inch sewers will be installed beneath Three Mile Road. This conveyance upsizing will convey additional flow to the LRS EQ Tank and is sized for additional upstream improvements to be constructed by 2040.

Figure 6-7: Licking River Siphon Conveyance Piping Included in 2029 Improvements

Project Summary Sheet

2029 SSO Solution

Licking River Siphon Conveyance

Project Status: Conceptual Planning

Estimated Capital Cost: $7,380,000

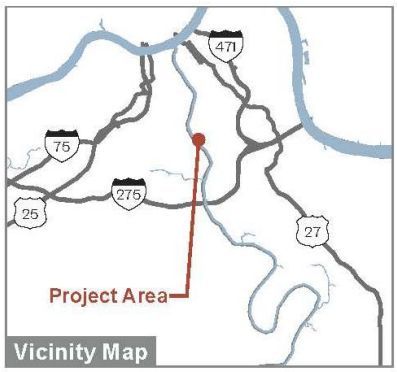
Primary Improvement

Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

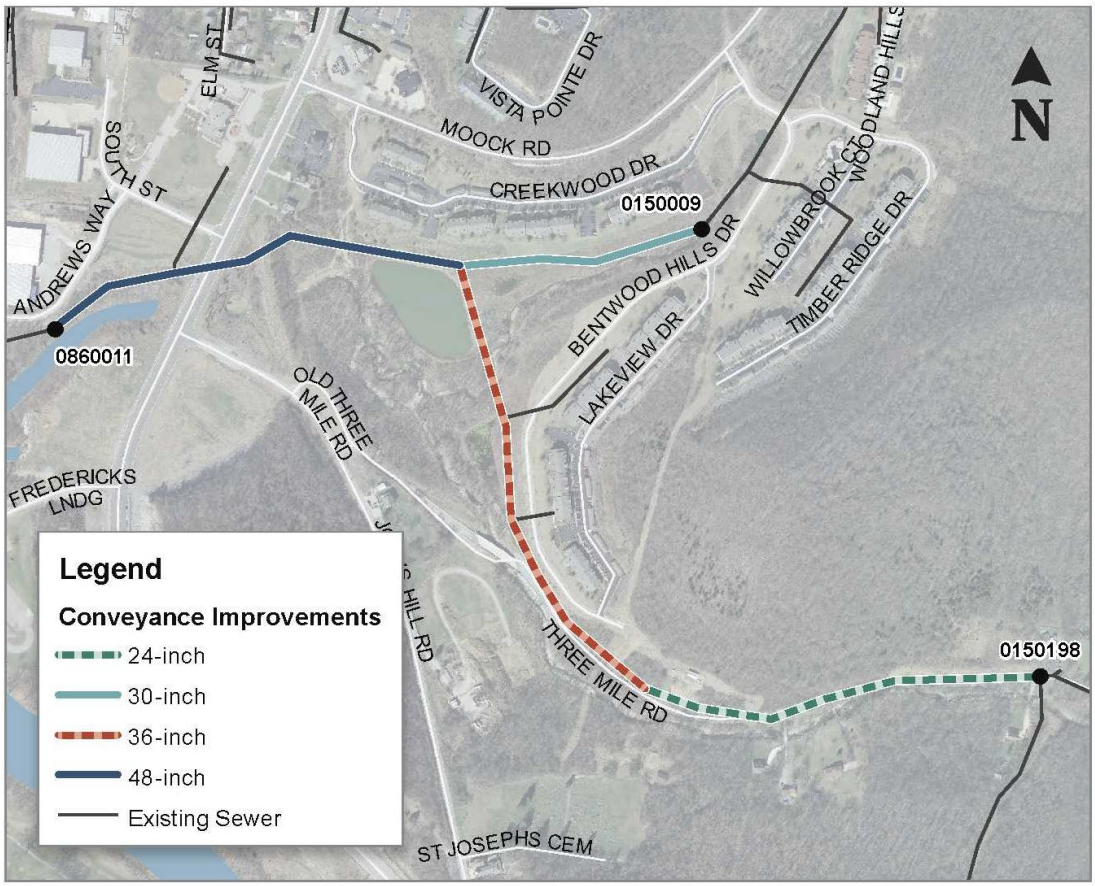
8-inch to 16-inch:	0 LF	30-inch to 42-inch:	2,790 LF
18-inch to 27-inch:	1,600 LF	48-inch and Greater	1,660 LF

Project Metrics

Estimated Overflow Reduction (Typical Year):	5.0 MG
Cost Per Gallon Removed (Typical Year):	$1.48



NOTES:
1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2.2 Lakeview

The Lakeview service area represents the second largest SSO sewershed in SD1's system by total volume, after the Licking River Siphon sewershed presented above. Given the complexity of the underlying issues and vast size, this area requires a multi-phase approach, with the first phase installed as part of the 2029 improvements and the remaining phases installed as part of the 2034 and 2040 improvements. The 2029 improvement is the Lakeview EQ tank, an 8.6 million gallon above ground tank to store flows in excess of the downstream Lakeview PS capacity. The tank is located on SD1 maintenance yard property adjacent to I-275 and Madison Pike and is sized to accommodate additional flow from storage and conveyance projects upstream to be completed by 2040. As shown in the project summary sheet, flow would be diverted from the Lakeview Interceptor near 1990005 to a 36 mgd wet weather PS, which would pump flow into the tank. Flow would be dewatered by gravity through a drain vault with control valve back to the sanitary system, at a flow rate of up to 5.0 mgd.

The proposed configuration of the 2029 Lakeview EQ solution is shown in Figure 6-8, and a listing of the SSOs addressed by this project is provided in Table 6-6.

Table 6-6: List of SSOs Reduced or Eliminated by Lakeview Improvements

SSO ID
1940006
1950010
1950015
1950036
1950027
1960002
1980001
1990018
1990028
1990032
1950PS1

Figure 6-8: Lakeview 2029 Improvements

Project Summary Sheet

2029 SSO Solution

Lakeview EQ

Project Status: Conceptual Planning

Estimated Capital Cost: $24,070,000

Primary Improvement

Conveyance ☐ EQ Storage ■ PS and Force Main ☐

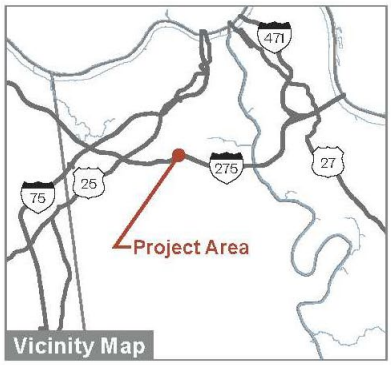
Storage Volume: 8.6 MG

Pumping Rate: 36 MGD

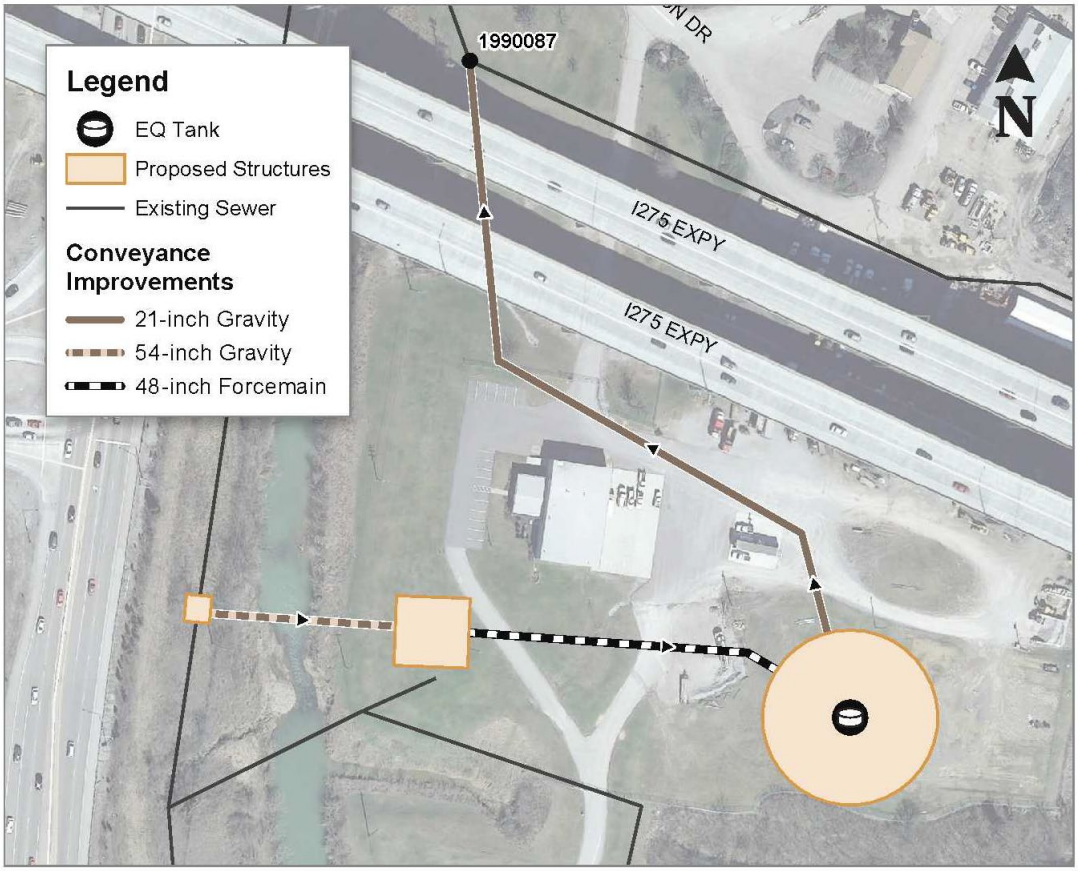
Project Metrics

Estimated Overflow Reduction (Typical Year): 6.5 MG

Cost Per Gallon Removed (Typical Year): $3.70



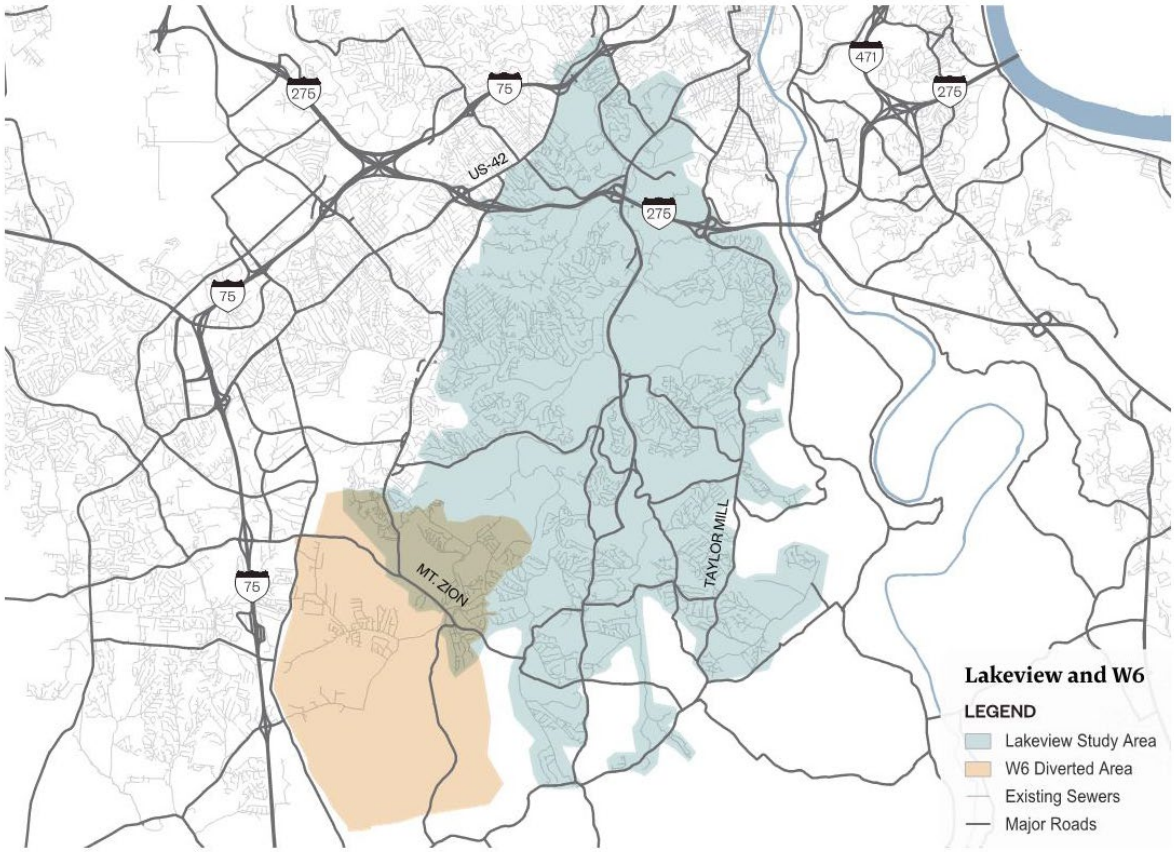
NOTES:
1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2.3 W6 Pump Station

The W6 Pump Station project is another multi-phase project that represents an area with existing capacity constraints and with potential for significant future growth. The W6 Pump Station will divert flow from the southwestern portion of the Lakeview service area to the Western Regional collection system. This solution component is the culmination of years of effort, dating back to the decision to design and build the new Western Regional WRF and associated conveyance tunnel with the capacity to accommodate these diverted flows. The area to be diverted from the Lakeview service area is shown below.

Figure 6-9: W6 Area Diverted from Lakeview Service Area



This project will install a new 5 mgd pump station near manhole 2300091, northwest of Woodford Court, to redirect flow from the Lakeview system to the Western Regional service area. All flow tributary to 2300091 would be pumped through a new 5 mgd pump station and 33,300 feet of new 18-inch force main and discharge at manhole 2420748 near Frogtown Road. The force main alignment generally follows Banklick Creek and crosses I-75 once, and the adjacent railroad multiple times. Trenchless construction methods were assumed for these crossings. The alignment depicted in the project summary sheet would have significant installation footage beneath Banklick and Maher Roads, which would require traffic maintenance, and surface roadway restoration. This project would provide significant relief to the

Lakeview system and eliminates SSOs by diverting flow to the Western Regional Tunnel while supporting future development.

The proposed configuration of the 2029 W6 Pump Station solution is shown in Figure 6-10, and a listing of the SSOs addressed by the W6 projects is provided in Table 6-7.

Table 6-7: List of SSOs Reduced or Eliminated by W6 Pump Station

SSO ID
1750201
2300019
2300027
2300047
2300060
2300107
2300011
2300013
2301219
2311036

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 6-10: W6 2029 Improvements

Project Summary Sheet

2029 SSO Solution

W6 Pump Station and Conveyance Piping

Project Status: Conceptual Planning

Estimated Capital Cost: $26,600,000

Primary Improvement

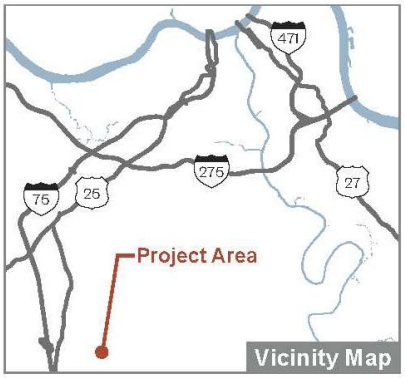
Conveyance ☒ EQ Storage ☐ PS and Force Main ☒

New Pumping Rate: 5.0 MGD 18-inch Gravity: 2,580 LF

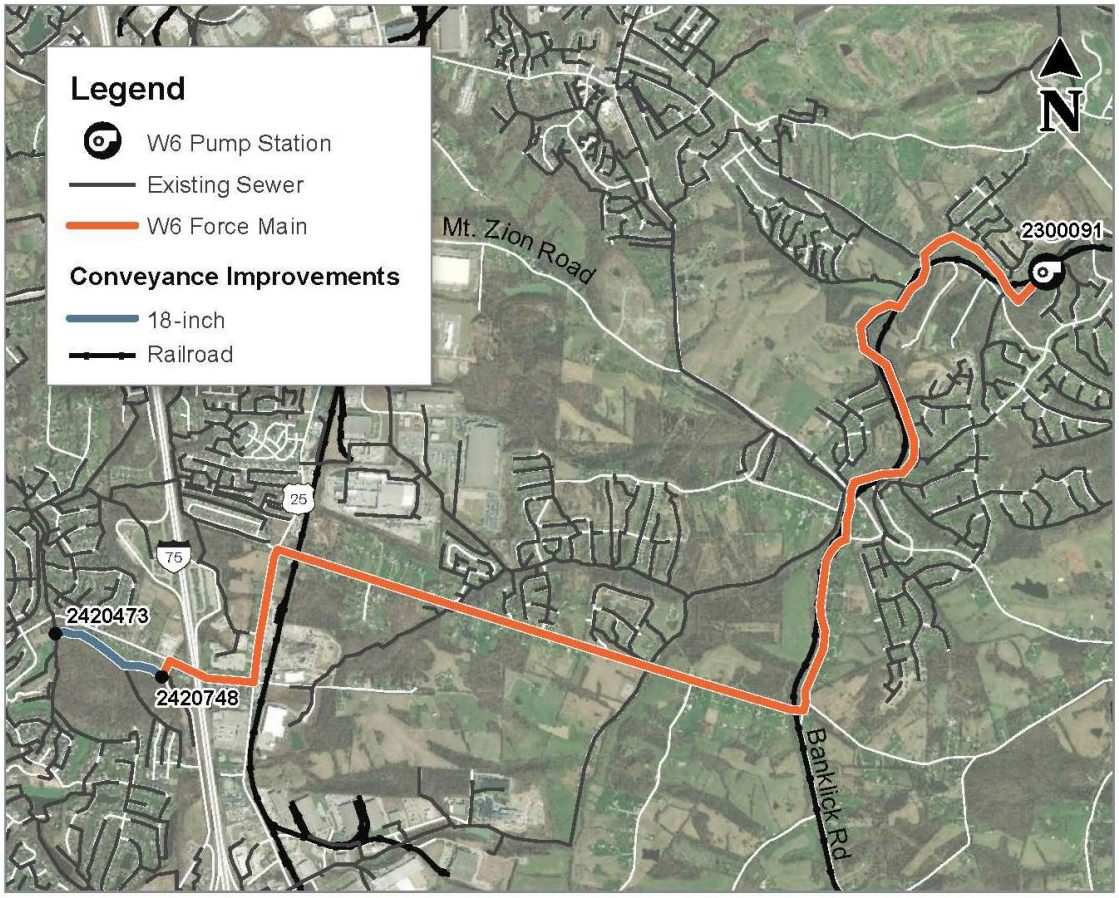
18-inch Force Main: 33,300 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 9.8 MG
Cost Per Gallon Removed (Typical Year): $2.71



NOTES:
1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2.4 Bullitsville Pump Station

The Bullitsville PS improvements consist of upgrading the existing Bullitsville PS to a firm capacity of 3.0 mgd, and constructing 1.3 million gallons of EQ storage upstream of the PS The existing PS upgrade would include larger pumps to increase capacity, as well as new station piping, new valve vault, electrical improvements, additional air release valves, and force main pigging. The 1.3 million gallon above ground EQ tank would be constructed as shown on the project summary sheet near the intersection of Bullitsville and Petersburg Roads. Flow would be diverted just upstream of manhole 2370005 to a 7.7 mgd wet weather pump station, which would pump flow into the tank. Flow would be dewatered by gravity through a drain vault with control valve back to the sanitary system, at a flow rate of up to 3.0 mgd. This project will eliminate SSO volume upstream of Bullitsville through 2040 and provide capacity to support future development. The planned improvements are shown in Figure 6-11, and a listing of the SSOs addressed by this project is provided in Table 6-8.

Table 6-8: List of SSOs Reduced or Eliminated by Bullitsville Pump Station Improvements

SSO ID
2370003
2370534

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 6-11: Bullitsville 2029 Improvements

Project Summary Sheet

2029 SSO Solution

Bullitsville PS Improvements

Project Status: Conceptual Planning

Estimated Capital Cost: $9,970,000

Primary Improvement

Conveyance ☐ EQ Storage ■ PS and Force Main ☐

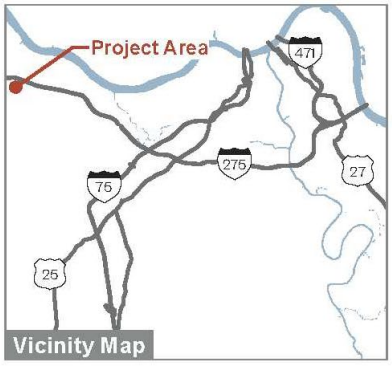
Storage Volume: 1.3 MG

EQ Pumping Rate: 7.7 MGD

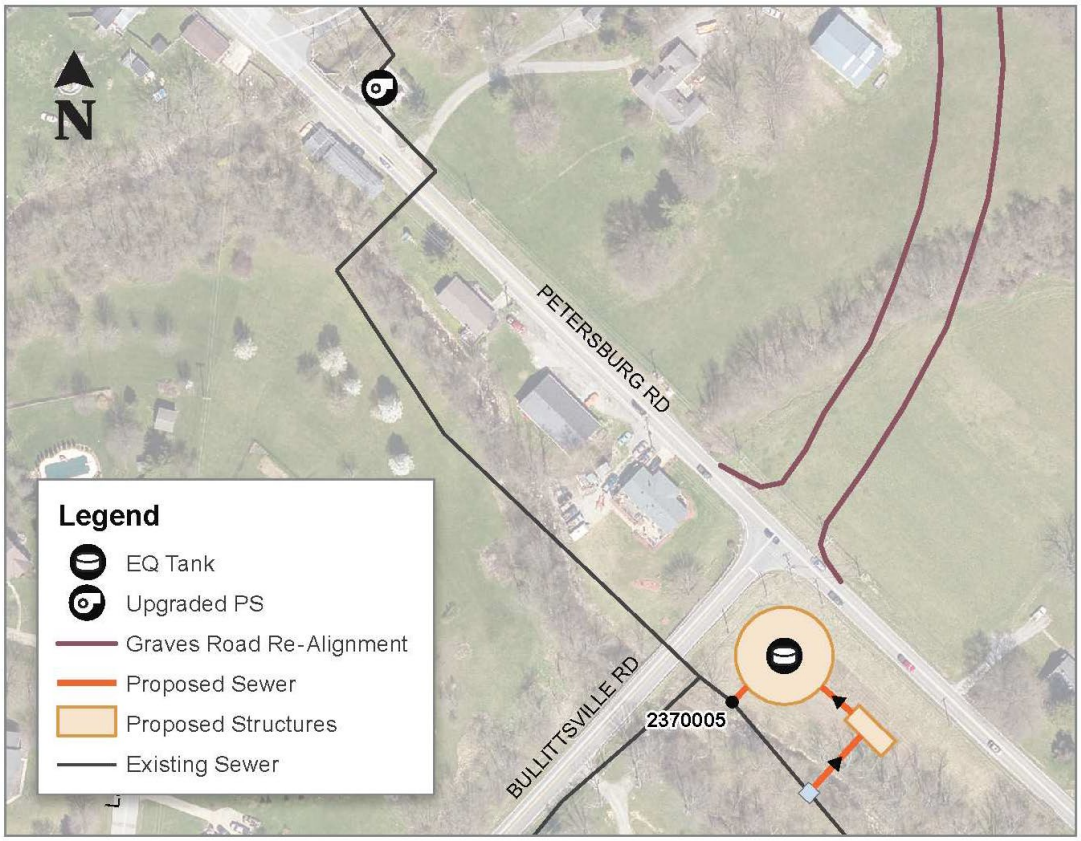
Upgraded Bullitsville PS Pumping Rate: 3.0MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.0 MG
Cost Per Gallon Removed (Typical Year): $9.97



NOTES:
1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



6.2.5 Waterworks Road Conveyance

This project consists of 11,020 feet of 10-inch through 24-inch and 1,450 feet of 42-inch sanitary sewer upsizing as shown in the project summary sheet. The 10-inch through 24-inch upsizing would begin at manhole 0530121 and would extend upstream to manholes 0380005 and 0400034. The 42-inch upsizing extends between manhole 0650097 and 0650022 and discharges to the recently constructed 54-inch sewer along Riveria Drive. This conveyance upsizing will convey additional flow to the combined system and the planned Taylor Creek EQ tank downstream. The downstream combined system solution has been configured to accommodate the additional flow.

The planned improvements are shown in multiple phases in Figures 6-12 and 6-13, and a listing of the SSOs addressed by this project is provided in Table 6-9.

Table 6-9: List of SSOs Reduced or Eliminated by Waterworks Road Conveyance

SSO ID
0370001
0380005
0400002
0400034
0410037
0410039
0430006
0430007
0530083
0530119

Figure 6-12: Waterworks Road 2029 Improvements – Phase I

Project Summary Sheet

2029 SSO Solution

Waterworks Rd Conveyance: Phase I

Project Status: Conceptual Planning

Estimated Capital Cost: $5,410,000

Primary Improvement

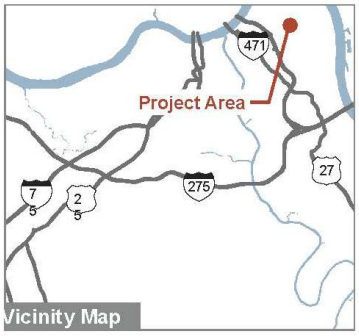
Conveyance ☒ EQ Storage ☐ PS & Force Main ☐

8-inch to 15-inch: 0 LF 27-inch to 42-inch: 1,450 LF

18-inch to 24-inch: 5,090 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.0 MG
Cost Per Gallon Removed (Typical Year): $5.41



NOTES: *1. SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.*

2. Costs are based on preliminary planning level capital cost estimates in 2019 dollars.

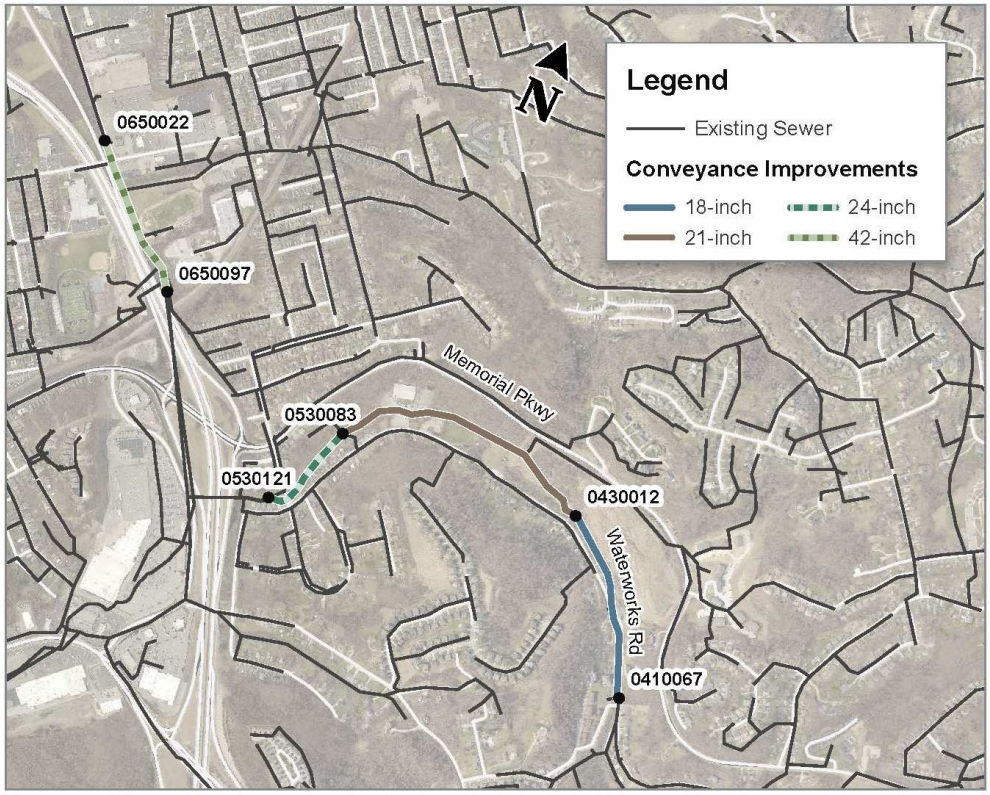


Figure 6-13: Waterworks Road 2029 Improvements – Phase II

Project Summary Sheet

2029 SSO Solution

Waterworks Rd Conveyance: Phase II

Project Status: Conceptual Planning

Estimated Capital Cost: $3,470,000

Primary Improvement

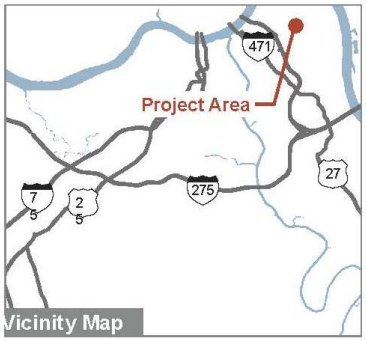
Conveyance ☒ EQ Storage ☐ PS & Force Main ☐

8-inch to 15-inch: 3,950 LF 27-inch to 42-inch: 0 LF

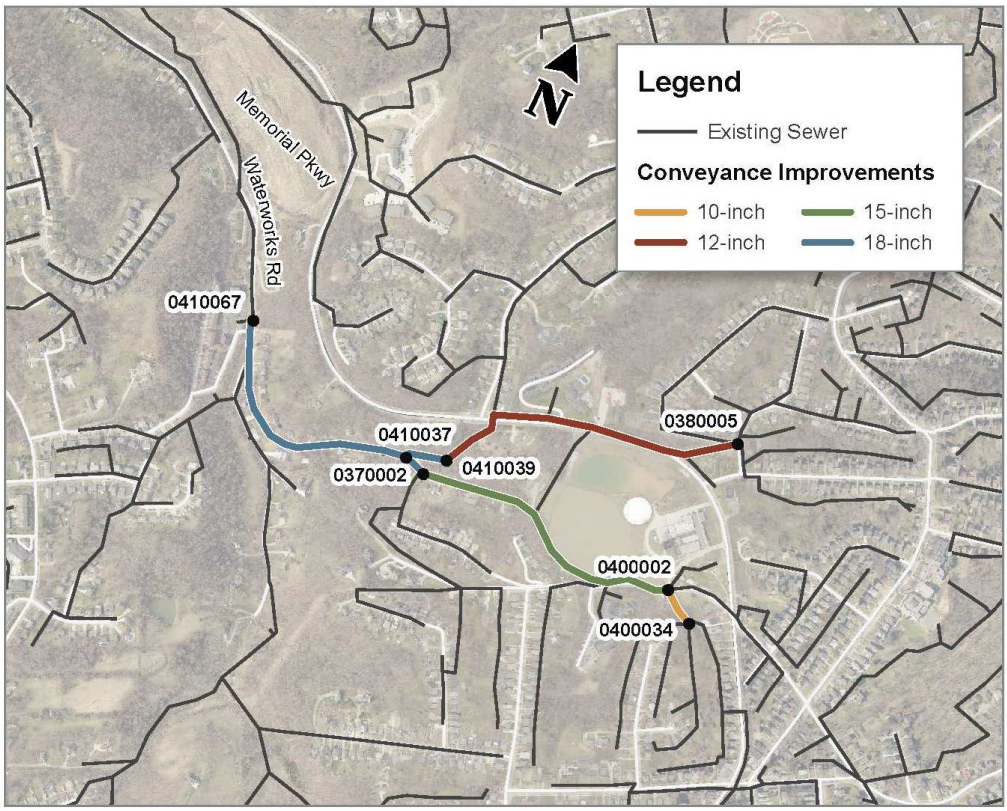
18-inch to 24-inch: 1,980 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.0 MG
Cost Per Gallon Removed (Typical Year): $3.47



NOTES: *1. SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.*
2. Costs are based on preliminary planning level capital cost estimates in 2019 dollars.



6.2.6 Bromley Crescent Springs Conveyance

This conveyance upsizing addresses ongoing maintenance and safety issues by preventing displacement of manhole covers in the roadway due to system surcharge. The project consists of 6,050 feet of 30-inch through 42-inch sanitary sewer upsizing as shown in the project summary sheet. The upsizing would begin at manhole 1730027 and would extend upstream to manhole 1790092. There is an alternative solution for a portion of the dig-and-replace upsizing where a parallel 36-inch sewer is constructed between 1730086 – 1730073. This parallel sewer would allow for the existing sewer to remain in service and avoid open cut installation across Bromley Crescent Springs Road. This conveyance upsizing will convey additional flow to the combined system upstream of Bromley Pump Station, which will have capacity for the additional flow from conveyance improvements.

The planned improvements are shown in Figure 6-14, and a listing of the SSOs addressed by this project is provided in Table 6-10.

Table 6-10: List of SSOs Reduced or Eliminated by Bromley Crescent Springs Conveyance

SSO ID
1730085
1730086

Figure 6-14: Bromley Crescent Springs 2029 Improvements

Project Summary Sheet

2029 SSO Solution

Bromley Crescent Springs Conveyance

Project Status: Conceptual Planning

Estimated Capital Cost: $7,290,000

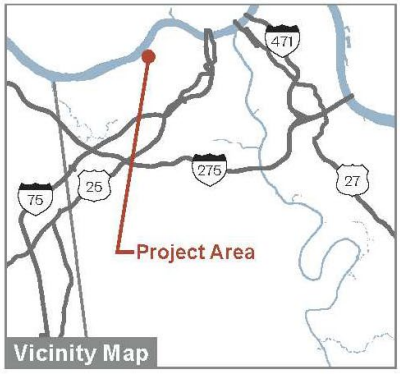
Primary Improvement

Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

8-inch to 16-inch: 0 LF
18-inch to 24-inch: 0 LF
27-inch to 42-inch: 6,050 LF
48-inch and Greater: 0 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.3 MG
Cost Per Gallon Removed (Typical Year): $5.60



NOTES:
1. *SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.*
2. *Costs are based on preliminary planning level capital cost estimates in 2019 dollars.*



6.3 Achieving Consent Decree Metrics

As explained in Section 3.7, a fundamental sequencing criterion was to assemble projects to meet the overflow reduction milestone dates required by the ACD. Tables 6-11 and 6-13 demonstrate that the improvements presented above, sequenced properly for the 2029 timeframe, meet or exceed all ACD milestones. Note that for the CSS, a higher percent capture represents a greater overflow reduction, while for the SSS, a lower percentage of baseline SSO volume remaining represents a greater overflow reduction.

Table 6-11: 2029 CSS Improvements

Time Frame	Project	Remaining CSO Volume (MG)	Total Combined Flow (MG)	Percent Capture	Required ACD Milestone
2029	Bromley PS Short-Term Improvements RWI Mitigation Phase III Willow Run Detention Basin Pilot Project	1,177	4,756	75.3%	75%

The percent capture value in Table 6-11 above is based on the calculation in Table 6-12:

Table 6-12: 2029 Percent Capture Calculation

Category	Typical Year Annual Volume (MG)
Storm water entering combined system	2,737
Sanitary flow during wet weather	1,938
Eliminated Flow	81
Total Combined Flow (TCF)	4,756
Untreated CSO (CSO)	1,177
Percent Capture [(TCF)-(CSO)]/(TCF)	**75.3%**

Table 6-13: 2029 SSS Improvements

Time Frame	Project	Remaining SSO Volume (MG)	Percentage of Baseline SSO Volume Remaining	Required ACD Milestone Volume Remaining
2029	LRS EQ LRS Conveyance Piping W6 PS Lakeview EQ Bullitsville PS Improvements Waterworks Rd. Conveyance (PH I & II) BCS Conveyance	28.6	24.8%	25%

Tables 6-14 and 6-15 below provide detailed by-overflow volume information for CSOs and SSOs remaining in 2029, with the proposed improvements in place, as predicted by the ICM model. Table 6-14 lists annual volume by CSO, and Table 6-15 lists annual volume by SSO.

Table 6-14: Remaining Volume by CSO Location with 2029 Improvements

As Predicted by the ICM Model

Outfall ID	Annual Volume (MG)
0030031	0.81
0200069	0.85
0340050	0.44
0340051	0.20
0360079	2.12
0540156	1.53
0540157	0.88
0550134	0.06
0570089	23.69
0570090	3.38
0600094	0.49
0600096	0.12
0600097	3.89
0600104	0.07
0610071	16.49
0610072	0.52
0620075	8.35
0630061	1.15
0640090	133.32
0650090	10.84
0650098	4.26
0650100	0.15
0660085	0.45
0690067	0.14
0730129	0.77
0770096	0.37
0790084	12.72
0790086	66.17
0840111	0.02
0840112	2.10
0840116	5.05
0870078	0.36
0870079	24.66
0880081	41.14
0880082	0.48
0910065	160.30
0910068	42.69
0910084	0.27
0930103	0.06
0930104	0.05
0930105	27.00
0960063	2.05
0960064	< 0.01
0980073	0.14
0980080	0.02
0980081	50.90
1420141	< 0.01
1420142	54.06
1440204	0.09
1440206	2.09
1440207	0.24
1440209	99.92
1440508	0.49
1470089	0.22
1470093	56.43
1480185	1.51
1480187	244.07
1490132	1.04
1500131	7.77
1710114	0.28
1710116	9.54
1710119	2.88
1710121	1.14
1710124	1.83
1720109	12.42
1730259	1.84
1730263	1.85
1840130	0.97
1850158	18.54
1870193	1.32
1870194	0.13
1880090	2.46
1880091	1.88

Table 6-15: Remaining Volume by SSO Location with 2029 Improvements

As Predicted by the ICM Model

Manhole ID	Overflow Volume (MG)
0010PS6	0.01
0040003	0.09
0050022	0.02
0050131	0.07
0050PS1	0.34
0060001	0.72
0060002	0.18
0060004	0.15
0100001	<0.01
0100004	0.02
0110010	1.33
0150024	0.02
0150086	0.13
0220056	0.02
0220058	<0.01
0220086	<0.01
0230016	<0.01
0270026	0.02
0280001	<0.01
0300035	0.08
0360005	<0.01
0390007	0.01
0410010	0.06
0410019	0.18
0440074	0.02
0490032	<0.01
0490137	<0.01
0500047	0.10
0540009	0.01
0570130	0.06
0710071	0.33
0720027	<0.01
0720028	0.02
0870037	0.53
1010002	0.05
1010026	0.02
1010027	0.01

Manhole ID	Overflow Volume (MG)
1730104	0.76
1760047	0.33
1760048	0.21
1760055	0.02
1790003	0.02
1790004	<0.01
1790109	<0.01
1850140	3.40
1850141	2.21
1860108	1.01
1920086	<0.01
1920097	0.10
1920PS7	<0.01
1930007	0.05
1930008	0.07
1930009	0.04
1930010	0.13
1930012	0.02
1940006	0.18
1940024	0.05
1940026	0.41
1940038	0.03
1940039	0.19
1940044	0.12
1950010	1.02
1950036	1.13
1960002	0.02
1980001	<0.01
1990018	0.54
1990028	0.28
1990032	0.11
2010042	<0.01
2010PS1	0.01
2010PS2	<0.01
2020035	0.49
2020203	0.07
2100057	0.03

Manhole ID	Overflow Volume (MG)
1090069	<0.01
1110025	<0.01
1110027	0.09
1110051	0.18
1110067	0.39
1110103	0.11
1110104	0.02
1110106	<0.01
1110150	<0.01
1110161	0.06
1110164	0.03
1110174	0.02
1110294	0.05
1190001	<0.01
1190012	0.43
1200022	0.23
1220016	0.12
1220054	0.49
1240008	0.43
1520124	0.13
1550053	0.18
1560016	0.02
1560092	0.45
1560121	<0.01
1570100	0.03
1690043	<0.01

Manhole ID	Overflow Volume (MG)
2100081	<0.01
2100126	0.10
2100156	<0.01
2110006	0.04
2120001	0.02
2120023	<0.01
2120041	0.03
2130027	0.10
2160004	0.01
2170097	<0.01
2210009	0.08
2210050	0.19
2300011	0.04
2300013	0.45
2300121	4.20
2300123	1.49
2301219	0.46
2311211	0.08
2350005	0.01
2350008	<0.01
2350055	<0.01
2350681	<0.01
2410387	0.03
2410459	<0.01
L17-282	0.02

6.4 Project Sequencing

Tables 6-16 and 6-17 below presents the proposed sequencing of 2029 improvements. SD1 is presenting these detailed schedules as part of a complete plan, to confirm that projects can be completed as required while accounting for implementation practicalities and engineering sequencing requirements. Interim dates and the timing of individual projects may change during design and implementation. Any such schedule refinements will not impact the ability of the project groupings to meet the ACD milestone metrics.

Table 6-16: 2029 CSO Improvements Schedule

2029 CSO

Description	2023 E	2024 B	2024 E	2025 B	2025 E	2026 B	2026 E	2027 B	2027 E	2028 B	2028 E
Bromley Improvements											
Bromley PS 45 MGD Upgrade				■	■	■	■	■	■		
Willow Run Improvements											
Detention Basin Controls			■	■	■	■	■	■	■	■	
Targeted Sewer Separation											
State Route 9 (SR9)	■	■	■	■	■	■					
Other Improvements											
RWI Phase III	■	■	■	■	■	■	■	■			

Table 6-17: 2029 SSO Improvements Schedule

2029 SSO

Description	2023 E	2024 B	2024 E	2025 B	2025 E	2026 B	2026 E	2027 B	2027 E	2028 B	2028 E
LRS Improvements											
Licking River EQ Tank	■	■	■								
Licking River Conveyance Piping	■	■	■	■	■	■	■	■	■		
Lakeview Improvements											
Lakeview EQ Tank	■	■	■	■	■	■	■	■			
Western Regional Improvements											
W6 Pump Station & Force Main	■	■	■	■	■	■	■	■	■	■	
Taylorsport Improvements											
Bullitsville PS Improvements	■	■	■	■	■	■	■	■	■	■	■
Bromley Crescent Springs Imp.											
Conveyance Piping	■	■	■	■	■	■					
Taylor Creek Improvements											
Waterworks Rd Conveyance Piping (PH I & II)	■	■	■	■	■	■	■	■	■		

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Section 7
2034 Improvements

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7. 2034 Improvements

This section presents UWSP improvements planned for implementation in the period from 2029 to 2034. As these improvements represent the initial phase of projects scheduled after the first ten years following approval of the ACD, they are presented as preliminary plans at a lower level of detail than the 2023 and 2029 improvements (per the approach specified in Paragraph 41(e) of the ACD) and are subject to potentially significant refinement as part of the next watershed planning process. The preliminary level of detail does not diminish SD1's commitment to meeting 2034 ACD milestones, but rather reflects the adaptive management framework of the ACD and the simple fact that any planning process becomes less specific as the timeline moves further into the future.

SD1 has developed, analyzed, and selected a full set of improvements that have been confirmed as appropriate and viable options to meet ACD requirements, based on the best information available today, and using the model projections and assumed growth as outlined in Section 3. As SD1 moves through next watershed planning cycle and implementation of improvements over the next 10 years, these preliminary 2034 improvements will continue to be refined or modified as part of the adaptive management approach, supported by additional information at that time and informed by feedback from completed pilot projects. Any such refinements or modifications will not impact achievement of the 2034 ACD metrics.

The section first presents the selected CSO improvements and SSO improvements, and then demonstrates how these improvements meet the 2034 overflow reduction milestones. The section concludes with a presentation of a preliminary implementation schedule for the proposed projects. In addition to this section, these improvements are included in a comprehensive project list in Appendix H which summarizes project name, cost, volume reduction, proposed completion date, and SSO(s) eliminated or CSO(s) addressed by project for all UWSP projects presented in Sections 5 – 8.

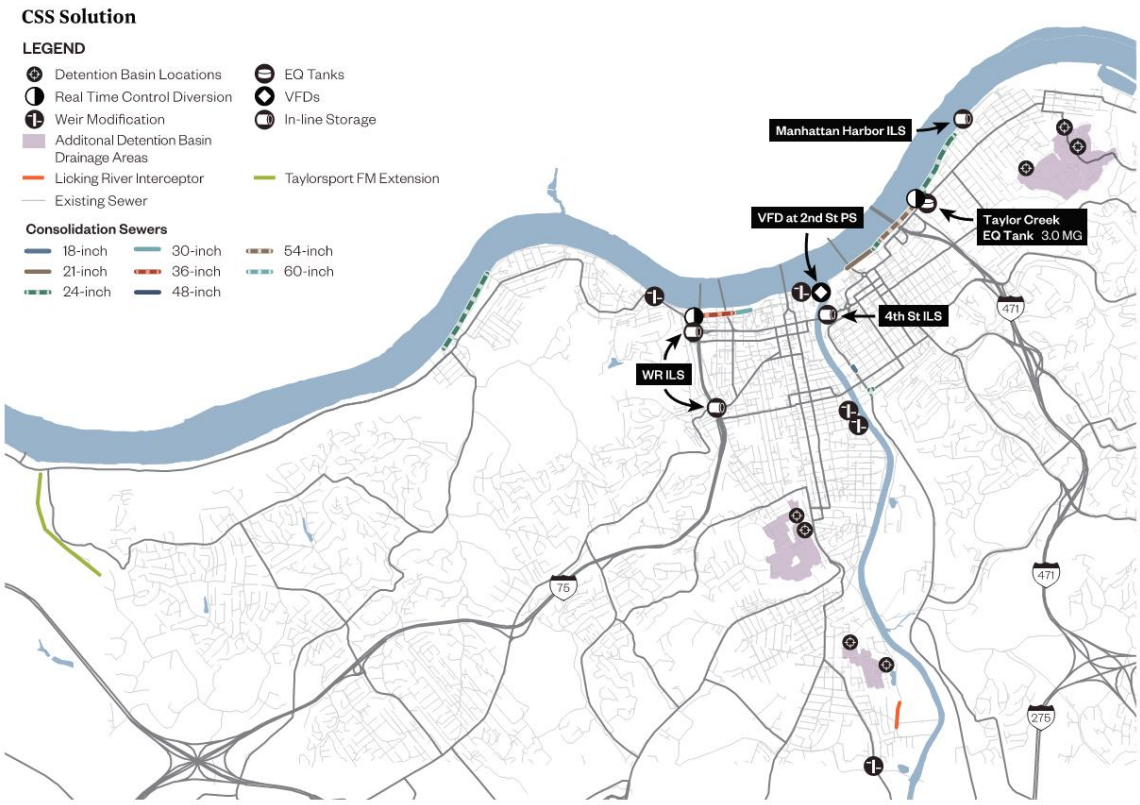
7.1 2034 CSO Improvements

The preliminary 2034 CSO improvements were made up of the following project groupings:

- Ohio River Solution gray components
- Surface stormwater detention basins
- RTC control scheme, to optimize performance of the above components

An overview of all components is shown in Figure 7-1, and additional information on these preliminary solution concepts is provided in the subsequent narratives.

Figure 7-1: 2034 CSO Components



7.1.1 Ohio River Solution Gray Components

The following improvements along the Ohio River represent base gray components of the overall CSO solution. These improvements are shown in Figure 7-1 and are common to both of the potential 2040 Licking River solution options discussed further in Section 8.1.1.

- Consolidation piping along the Ohio River east of the Licking River to an EQ tank at Taylor Creek. Flow from the Ohio River Interceptor is also diverted into the EQ tank via an RTC diversion.
- In-line storage using existing piping at three locations: along the Ohio River Interceptor at Manhattan Harbor, upstream of 4th St CSO, and at two installations upstream of the Willow Run CSO.
- Variable Frequency Drives (VFDs) at 2nd St Pump Station to allow for RTC control of pump discharge.

- An RTC diversion structure on the Willow Run CSO outfall to provide flow balancing capability, by pumping flow from the outfall up into the interceptor when capacity is available.
- Consolidation piping along the Ohio River west of the Licking River that conveys flow to the RTC diversion at the Willow Run CSO.
- Consolidation piping along the Ohio River just upstream of Bromley Pump Station.
- Extension of the existing 24-inch Taylorsport force main to the Lakeview headworks to decouple the existing manifold with Bromley force main, further increasing the capacity of Bromley pump station and providing additional CSO volume reduction.
- Upsize approximately 1,100 feet of the southernmost section of the Licking River Interceptor from existing 15-inch and 18-inch diameter to 24-inch diameter, providing CSO reduction at CSOs 1880090 and 1880091.
- Include strategic diversion weir adjustments at several diversions consisting of raising the overflow elevation to provide CSO volume reduction. Specifically, this project would raise the overflow elevation at the following diversions: 0960003 (1.2 feet); 0980036 (5.3 feet); 1440156 (1.6 feet); 1490027 (0.4 feet); and 1870025 (1.8 feet).

7.1.2 Surface Stormwater Detention Basins

Based on the results of the surface stormwater detention basin evaluation discussed previously, up to nine additional surface detention basins will be included in the overall CSO solution. The number of recommended surface stormwater detention basin depends on which solution is selected along the Licking River. The Licking River solution alternatives are discussed as a part of the 2040 CSO Solution in Section 8.1.1. The Licking River tunnel option would include 7 additional surface detention basins (as shown in Figure 7-1 above), while the Licking River EQ tank option would include 9 additional surface detention basins. All basins are scheduled for construction by 2034 and similar to the 10 detention basins included in the 2029 improvements, all of these additional detention basins will incorporate dynamic outlet structures to allow for optimal performance for CSO control. In addition, all locations have the potential to provide flood mitigation to downstream areas with existing surface flooding issues.

Table 7-1 presents the 2034 surface stormwater detention basins associated with each Licking River solution.

Table 7-1: 2034 Surface Stormwater Detention Basins Associated with Licking River Storage Options

Detention Basin	Included with LR Tunnel Option	Included with LR EQ Tank Option	Construction Factors	Degree of Required Upstream Sewer Separation
Grant Park Development	YES	YES	None – existing basin	None
Riverpointe Drive	YES	YES	None – existing basin	None
Dayton Pike	YES	YES	Located in undeveloped area	None
Twin Oaks	YES		Located in naturally occurring detention area	Potentially significant
36th&Park	YES		Located in developed urban area; Requires property acquisition and demolition	Potentially significant
Packaging Unlimited	YES	YES	Located in industrial complex	None
22nd&Russell	YES	YES	Located in developed urban area; Requires property acquisition and demolition	Potentially significant
James Avenue #1		YES	Located in developed urban area	Potentially significant
James Avenue #3		YES	Located in developed urban area	Potentially significant
James Avenue #5		YES	Located in developed urban area	Potentially significant
19th&Glenway		YES	Located in developed urban area	Potentially significant

SD1 is aware that siting of open surface stormwater detention basins in developed urban areas may be challenging. Siting efforts will involve coordination with local neighborhood groups and SD1 will make every reasonable effort to achieve consensus. In the event that any of the identified detention basin locations become non-viable, other improvements (e.g. tunnel or EQ tank size) can be adjusted to maintain required CSO control levels per the ACD.

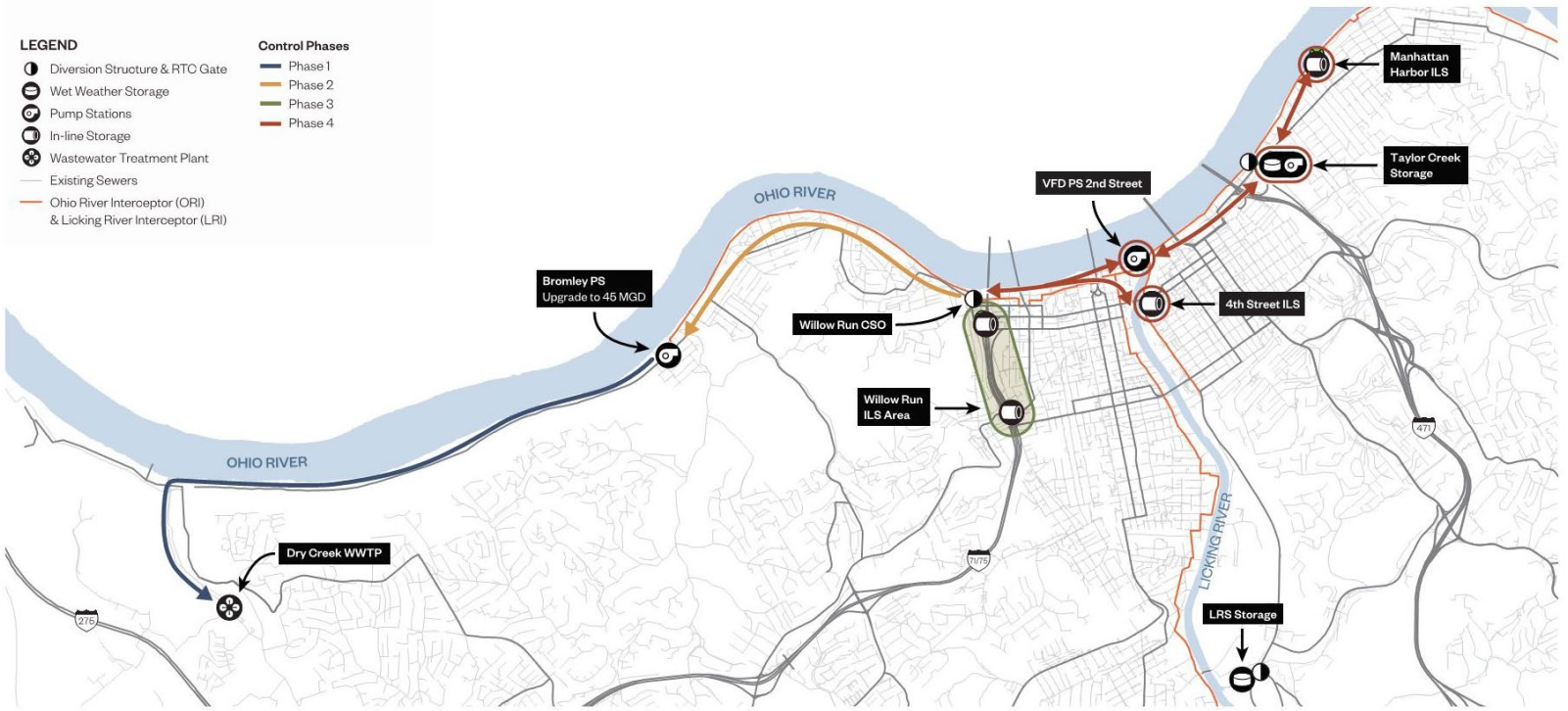
7.1.3 Combined System Coordinated Control Scheme

Coordinated controls are an important component of the proposed combined system solution as they provide the platform to coordinate the operation of dynamic structures such as pump stations, gates, and valves in the collection system. The proposed controls are designed to maximize the benefit from the existing collection system, reduce the need for additional infrastructure, and optimize the performance of constructed controls. To that end, the size and/or operation of the combined system solution components such as surface stormwater detention basins, inline storage facilities, many of the pump stations, the EQ tanks, and the tunnel have all been optimized using coordinated controls. The proposed coordinated control scheme, while preliminary, has been strategically developed using SD1's ICM model to confirm that the 2034 system will function as intended.

Figure 7-2 provides an overview of the proposed coordinated control scheme recommended by 2034 for the combined system solution. As can be seen, the control scheme will move through (up to) four phases during any wet-weather event, and contains the following key concepts:

- Maximize flow to Dry Creek WRF by maintaining Bromley Pump Station at its capacity of 45 mgd.
- Maximize Willow Run inline storage.
- Throttle 2nd Street Pump Station and maximize inline storage at Manhattan Harbor and 4th Street, and store at Taylor Creek EQ tank.

Figure 7-2: Overview of Combined System Coordinated Controls for 2034 Improvements



Coordinated Control RTC Basic Principle: Maximize Flow through ORI to Bromley PS, Minimize CSO, and Optimize Storage, Pumping, and Treatment in Collection System

PHASE 1: Maximize flow to the Dry Creek WWTP by maintaining Bromley PS at 45 MGD whenever possible.

PHASE 2: Maximize flow from the Willow Run area into the Ohio River Interceptor (ORI) to maintain Bromley PS at its maximum capacity. Requires a new diversion structure and pump station for RTC.

PHASE 3: Continuously monitor level at Willow Run Regulator, as depth begins to increase, engage the upstream Willow Run inline storage (ILS).

PHASE 4: If the depth at the Willow Run regulator continues to increase, throttle back the 2nd St. PS to create more capacity in the ORI, maximizing flow from Willow Run and the Licking River Interceptor to Bromley. If the 2nd St. wet well depth begins to increase, engage ILS at Manhattan Harbor and at 4th St. If the depth continues to increase, engage the Taylor Creek Storage, relieving excess flow from the 2nd St. PS and the ORI.

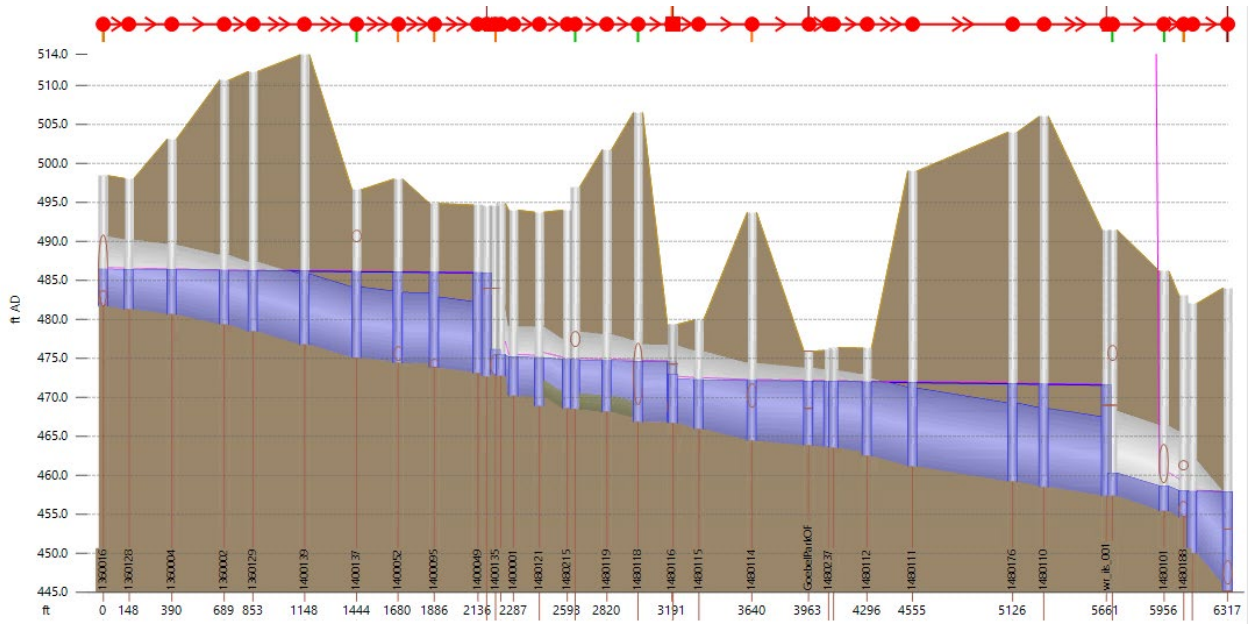
7.1.3.1 Phases 1-2

The first step in the control scheme is to maximize the total Bromley Pump Station capacity of 45 mgd. Currently, the Willow Run CSO (largest CSO in typical year by volume) overflows when pumping capacity exists at the Bromley Pump Station and the ORI is not flowing full, due to regulator capacity limitations. To maximize capacity to Bromley Pump Station, a new diversion structure and pump station will be constructed on the CSO outfall (manhole 1480096) to pump flow from the Willow Run CSO outfall up to the Ohio River Interceptor (manhole 1480010). This diversion structure will also receive flow from neighboring CSOs through consolidation piping. To protect CSO diversion 1490027 just downstream, the pump station will turn off once levels in this manhole exceeded 473.5 and will pump up to 10-mgd for levels below 473.5 in manhole 1490027.

7.1.3.2 Phase 3

This phase will continuously monitor levels at the new Willow Run diversion structure described in Phases 1-2. When flow into the junction is greater than the diversion pumping capacity, upstream inline storage (ILS) facilities along the Willow Run interceptor and outfall will engage to attenuate peak flow to the regulator. As shown in Figure 7-3, two inline storage structures will be installed at manholes 1480104 and 1400135 and will operate in series, starting with the most downstream ILS. The structures will include a flow control valve to throttle flows, and a high-level weir to convey flow downstream once storage is full. Both structures will dewater once downstream capacity at the regulator is restored.

Figure 7-3: Willow Run ILS Areas Upstream of Willow Run Regulator



7.1.3.3 Phase 4

As the depth continues to increase at the Willow Run RTC diversion, the 2nd Street Pump Station will be throttled back to create more capacity in the ORI downstream. To accomplish this, VFDs will be added at

2nd Street Pump Station, which will create additional capacity in the ORI for flow from Willow Run and the Licking River Interceptor. 2nd Street Pump Station will send less flow as the depth in the diversion structure increases, and more flow as the depth decreases. Once 2nd Street throttles flow, depth in its wet well increases. To attenuate flows to 2nd Street Pump Station, the Manhattan Harbor ILS will engage (manhole 0570111). In addition, once 2nd Street Pump Station flow is throttled, 4th Street CSO will see an increase in volume. To counteract this, 4th Street ILS (manhole 0820129) will engage based on levels at the 4th Street CSO diversion (manhole 0820001), to fully utilize available storage in the 4th Street Interceptor. Once 4th Street ILS is full, and levels continue to rise at the 4th Street CSO diversion, the Taylor Creek RTC diversion (manhole 0620110) will engage. This diversion will convey flow to the Taylor Creek EQ tank via an automated gated connection; this flow will be in addition to the flow conveyed to the EQ tank through the consolidation piping along the Ohio River. This diversion control gate will increase the ability to balance flow between the ORI, 2nd Street Pump Station, and the 4th Street Interceptor during wet weather.

7.1.3.4 Coordinated Control Set Point Locations and Action Levels

As noted earlier in this section, the ACD specifies that the 2034 improvements are to be presented as preliminary plans. However, as part of developing the preliminary coordinated control scheme presented above, set point locations with associated action levels were defined using the ICM model to confirm proper operation of the system. These preliminary control scheme metrics are presented in Table 7-2.

Table 7-2: Summary of Coordinated Control Set Point Locations and Action Levels

Phase	Description	Set Point Location	Set Point Action Level
1-2	Willow Run RTC Diversion	1490027	473.5’
		Bromley PS	45 MGD
3	Willow Run ILS	Willow Run RTC Diversion	447.6’
4	2nd Street PS VFD’s	Willow Run RTC Diversion	448.5’
	Manhattan Harbor ILS	14402ST	454.0’
	4th Street ILS	0820001	460.0’
	Taylor Creek RTC Diversion	0820001	461.0’

7.1.4 CSO Locations Addressed by 2034 Improvements

Table 7-3 shows the CSO locations that are reduced/addressed by the 2034 improvements described above. Note that given the integrated nature of the combined system, some of the CSO locations benefit from multiple projects – these are identified by documenting the (up to three) projects that benefit each location.

Table 7-3: CSO Locations Addressed by 2034 Improvements

CSO ID	Project 1	Project 2	Project 3
0540156	Taylor Creek SSS Improvements		
0540157	Taylor Creek SSS Improvements		
0550134	Taylor Creek SSS Improvements		
0570089	Taylor Creek EQ	Grant Park Development Basins	
0570090	Riverpointe Drive Basin	Dayton Pike Basin	
0600094	Taylor Creek Consolidation Piping		
0600097	Taylor Creek Consolidation Piping		
0610071	Taylor Creek Consolidation Piping		
0620075	Taylor Creek Consolidation Piping		
0630061	Taylor Creek Consolidation Piping		
0640090	Taylor Creek EQ	Taylor Creek Inline Storage Control Structure	Taylor Creek Consolidation Piping
0650090	Taylor Creek EQ		
0650098	Taylor Creek EQ		
0790084	Taylor Creek Consolidation Piping		
0790086	4th Street Inline Storage Control Structure		
0870079	Twin Oaks Golf Course Basin		
0880081	East 36th Street and Park Avenue		
0910065	James Avenue Basin 1	James Avenue Basin 3	James Avenue Basin 5
0910068	Packaging Unlimited Basin	22nd & Russell	
0930105	19th & Glenway		
0960064	Misc. Diversion Weir Adjustments		
0980081	Misc. Diversion Weir Adjustments		
1440206	Misc. Diversion Weir Adjustments		
1440209	Willow Run Consolidation Piping	24-inch Taylorsport Forcemain	2nd Street PS VFD
1470089	Willow Run Consolidation Piping		
1470093	Willow Run Consolidation Piping	24-inch Taylorsport Forcemain	2nd Street PS VFD
1480187	Taylor Creek EQ, ILS	Willow Run RTC, ILS; 2nd Street VFD	24-inch Taylorsport Forcemain
1490132	Misc. Diversion Weir Adjustments		
1710116	Bromley Consolidation Piping	24-inch Taylorsport Forcemain	
1720109	Bromley Consolidation Piping		
1870193	Misc. Diversion Weir Adjustments		
1880090	LRI 24-inch Upsizing		
1880091	LRI 24-inch Upsizing		

7.2 2034 SSO Improvements

The proposed 2034 SSO solution includes optimized projects to achieve the overflow reduction milestone in the typical year by July 1, 2034 as required by the ACD. These improvements were selected based on the criteria summarized in Section 3.7, and include EQ facilities, conveyance improvements (i.e. new/upsized pipes, pump stations, force mains), and targeted RDII reduction. Solutions for each study area seek to leverage infrastructure improvements completed since the previous WSP, as well as projects currently planned, in construction, or recently completed. In addition, for the Lakeview sewershed, the Optimatics Optimizer™ software was used to identify the appropriate balance between conveyance improvements and regional EQ facilities by evaluating tens of thousands of unique combinations of improvements to find a plan that minimizes cost and hydraulic performance penalties (as explained in Section 7.2.3).

The section first presents SD1's refined RDII reduction strategy, followed by a summary of the preliminary SSO improvements by study area.

7.2.1 RDII Reduction Strategy

SD1 continues to incorporate targeted removal of rainfall derived infiltration and inflow (RDII) in our SSO improvement program. This strategy is based on knowledge gained from completed pilot RDII removal projects that were recommended as part of the original WSP. A full discussion of the basis for the strategy is presented in Appendix I, with a summary provided below.

The significant removal of rainfall derived infiltration and inflow (RDII) was a key component of the original WSP. The goal was to reduce the RDII by 50% in all areas with a total annual average R-value of 2% or greater, which included almost 40% the entire separate sanitary sewer system. The assumption was that RDII removal would comprise both public and private RDII removal activities. For public RDII removal, the strategy was comprehensive rehabilitation across the entire sewershed, made up of the following activities:

- CIPP lining or replacement of all gravity sewers including end seals
- Lining of all manholes with cementitious or epoxy coating
- CIPP lining of all laterals for at least the first 3' from the main

For private I/I the following activities were assumed:

- Detailed SSES studies including CCTV, smoke testing, dye testing
- Removal of all connected downspouts and area drains

This goal of 50% RDII removal was recognized as a very aggressive goal. For that reason, the original strategy was intended to be tested and validated through various early RDII removal projects conducted as part of the five-year implementation plan. A few of the primary locations for these activities were:

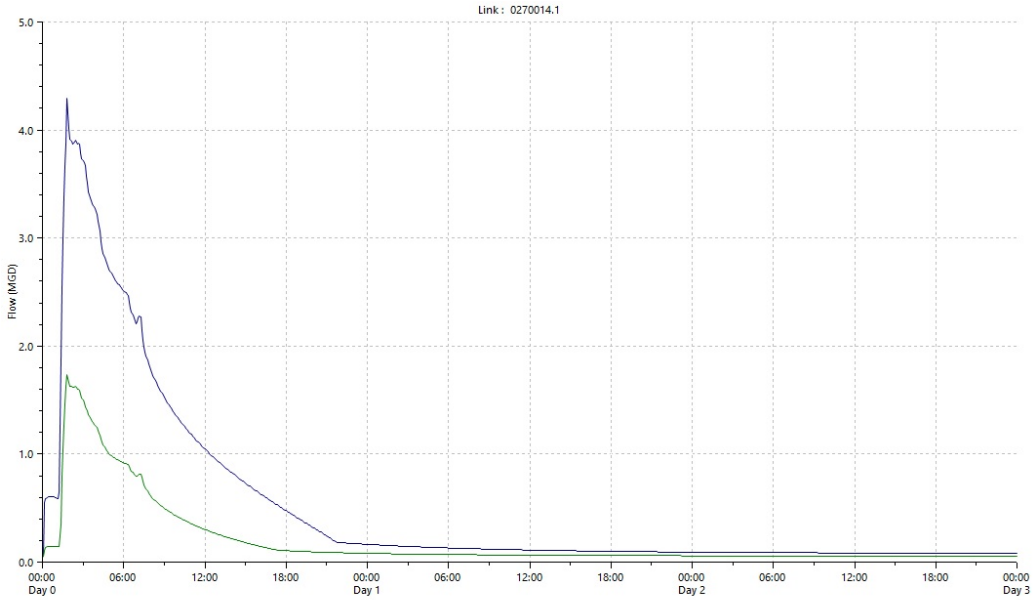
- Lakeside Park (where over 90% of the system was already CIPP lined)
- Vernon Lane (numerous direct connections from downspouts and area drains)

- Area tributary to Crestview Pump Station

These pilot projects have been completed, with the results showing that even consistent application of the same removal program leads to a wide range of success (or lack thereof) across the different areas. RDII removal in Lakeside Park and Crestview Pump Station did not remove enough RDII to significantly affect the peak flows and volumes. Some reasons for that could include the challenges associated with implementing the work on private property, which precluded much of the downspout redirection work from taking place. Another key factor is the extent and nature of the RDII. Recent projects and studies have shown that the higher the initial RDII, the higher percent reduction that can be achieved. The immediate implication of this finding is that it is highly unrealistic to expect 50% removal for all areas with a 2% or greater typical year average R-value. Another key discovery was the amount of time needed to implement projects of this type, which is extensive given the complicated field work, potential disruption on private property, and the time to perform adequate flow monitoring.

Early data from the Vernon Lane project is promising, which did have a very high R-value in the 20% range. While the data collected to date is limited, assessment of that data indicates that the reduction in RDII could be close to 60%. One example indicator of this potential success is shown in Figure 7-4; available post-rehabilitation data has been used for a preliminary re-calibration of SD1's ICM model, which allows for a comparison to pre-rehabilitation conditions during the 2-year, 6-hour storm.

Figure 7-4: Model Predicted Peak Flows from 2-Year Storm in Vernon Lane Pre and Post Rehab



SD1 continues to collect data in the Vernon Lane area, and once enough data has been collected a full conclusion on the level of success and associated success factors will be developed. The potential success in RDII removal in Vernon Lane could be attributed greatly to the high level of initial RDII, the amount

of preliminary SSES work to identify RDII sources, and the significant effort to remove both private and public sources of RDII.

Another important step in refining SD1's RDII removal strategy is to consider the total costs for the pilot projects compared to the cost assumptions in the original WSP. The WSP estimated that comprehensive RDII removal would cost approximately $1.2M per mile of sewer in the removal area. The total estimated capital cost for the Vernon Lane project was approximately $4.5M, which results in a cost of over $2.2M per mile of sewer. This cost did include some storm sewer work and stormwater BMP costs, which would lower the RDII portion of the costs. That said, while Vernon Lane was successful, the costs were higher than expected, especially for the private source reduction.

With the valuable local information collected from these RDII pilot studies, SD1 has concluded that the RDII removal assumptions incorporated in the original WP are not realistic on a system-wide basis. This is a key conclusion and indicates a need to shift towards a greater reliance on conveyance upgrades and equalization as part of the UWSP SSO solution. However, RDII removal should clearly be maintained as a targeted solution component for potential application in the following areas:

1. Areas where the initial RDII percentages are dramatically high (at least 20% or greater) and are upstream of SSOs.
2. Areas tributary to SSOs that are upstream of under-sized major trunk sewers, where RDII reduction can significantly reduce the need for downstream pipe upsizing.

Finally, SD1 will continue to investigate enforcement strategies to target known issues with direct connections to the sanitary sewers from private property. Eliminating direct connections via enforcement cannot be forecast sufficiently to be included in a compliance plan at this time. With ongoing monitoring and the adaptive opportunities available in ACD, it is possible that future infrastructure sizing could be adjusted based on reduction of RDII.

7.2.2 Licking River Siphon

To address the current and projected SSOs within the Licking River Siphon sewershed in the area surrounding the I-471/I-275 interchange, conveyance to the new parallel siphon and surface storage tank projects identified as part of the 2023 and 2029 solution was identified as the recommended alternative. This solution also assumes redirecting flows away from 12-inch sewer underneath the I-471/I-275 interchange to a new lift station. This lift station will pump flow into an upsized 15-inch sewer downstream of NKU. Additional improvements will be constructed by 2040 to the north, near Alexandria Pike and crossing under I-471. Those are summarized in Section 8.2.2.

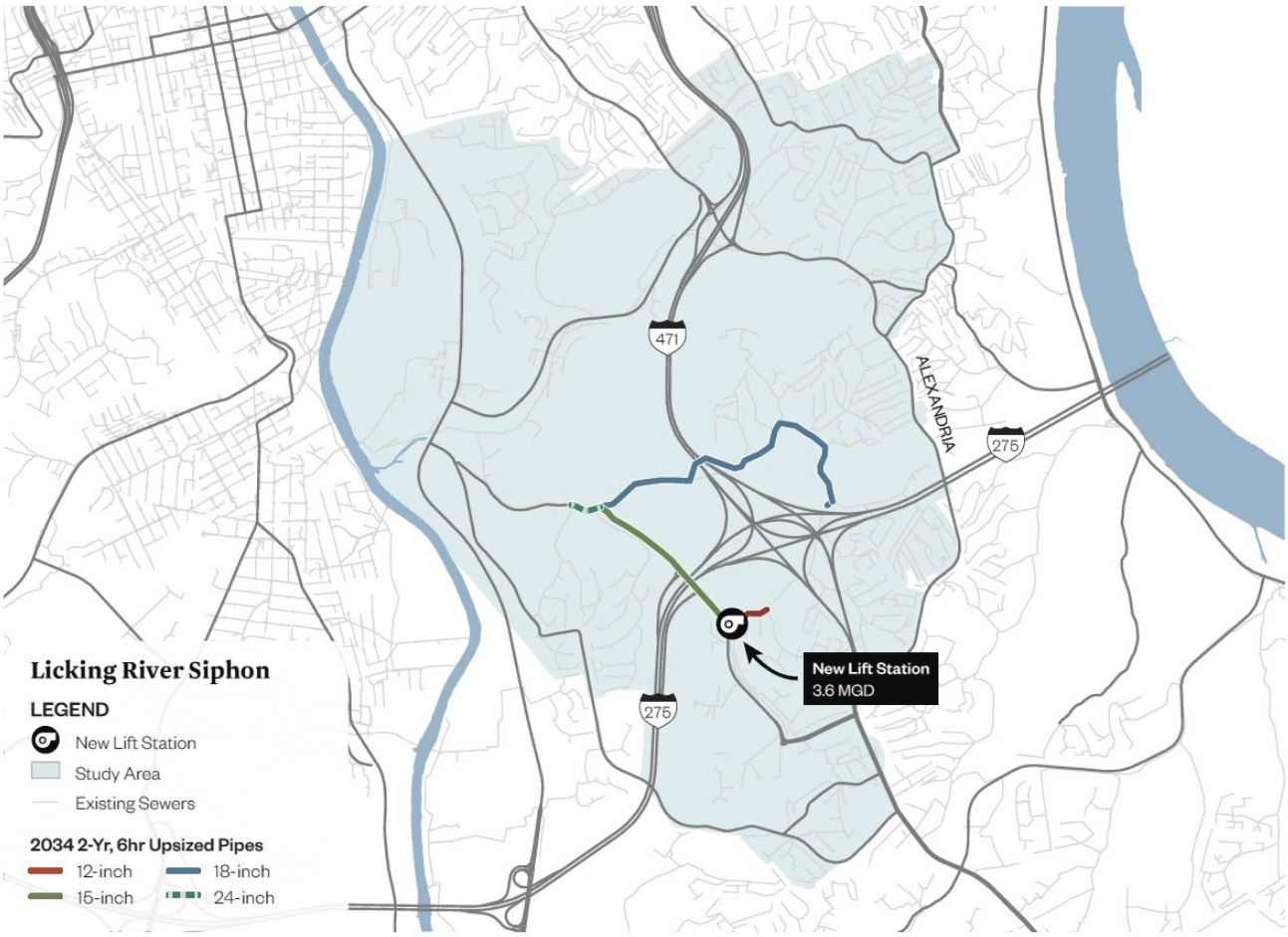
A map showing the locations of the preliminary improvements is shown in Figure 7-5. A listing of SSOs addressed is provided below.

Table 7-4: List of SSOs Eliminated by the Licking River Siphon Improvements

Manhole ID
0100001
0100004
0110010
0150086

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 7-5: 2034 Licking River Siphon 2034 Sanitary Sewershed Improvements



7.2.3 Lakeview

Construction of the Western Regional conveyance improvements by 2029 will significantly reduce flow into the Lakeview sewershed; however, the basin will still have a significant number of remaining SSOs to address by 2034. The recommended 2034 solution identified for this sewershed includes a combination of regional storage tanks, conveyance, and in-line storage with no I/I removal assumed.

The Lakeview 2034 solution includes the impact of redirected flow to Western Regional from the Richwood PS/FM project (completed in 2018), and a new W6 pump station (located near MH 2300091) to be constructed by 2029, as summarized in Section 6.2.3. These projects have and will relieve significant flows to the Lakeview system. Construction of new sewers in this sewershed will likely be challenging as many locations are along unstable streams, surrounded by steeply sloped hillsides that have been, in some cases, unstable. Thus, to address remaining SSOs, the preferred solution attempts to reduce necessary conveyance by constructing strategically located EQ facilities. The regional EQ facilities are surface storage tanks that will store flows exceeding local conveyance capacities, as well as the current capacity of the Lakeview pump station, and will be drained following the storm event to be treated at the Dry Creek WWTP. In addition, several pump stations (Keavy Rd, Leathers Rd and Meadow Lane) would require small additional storage (< 50,000 gallons) to address SSOs in wet weather. This solution does not assume any upgrades to Lakeview pump station capacity.

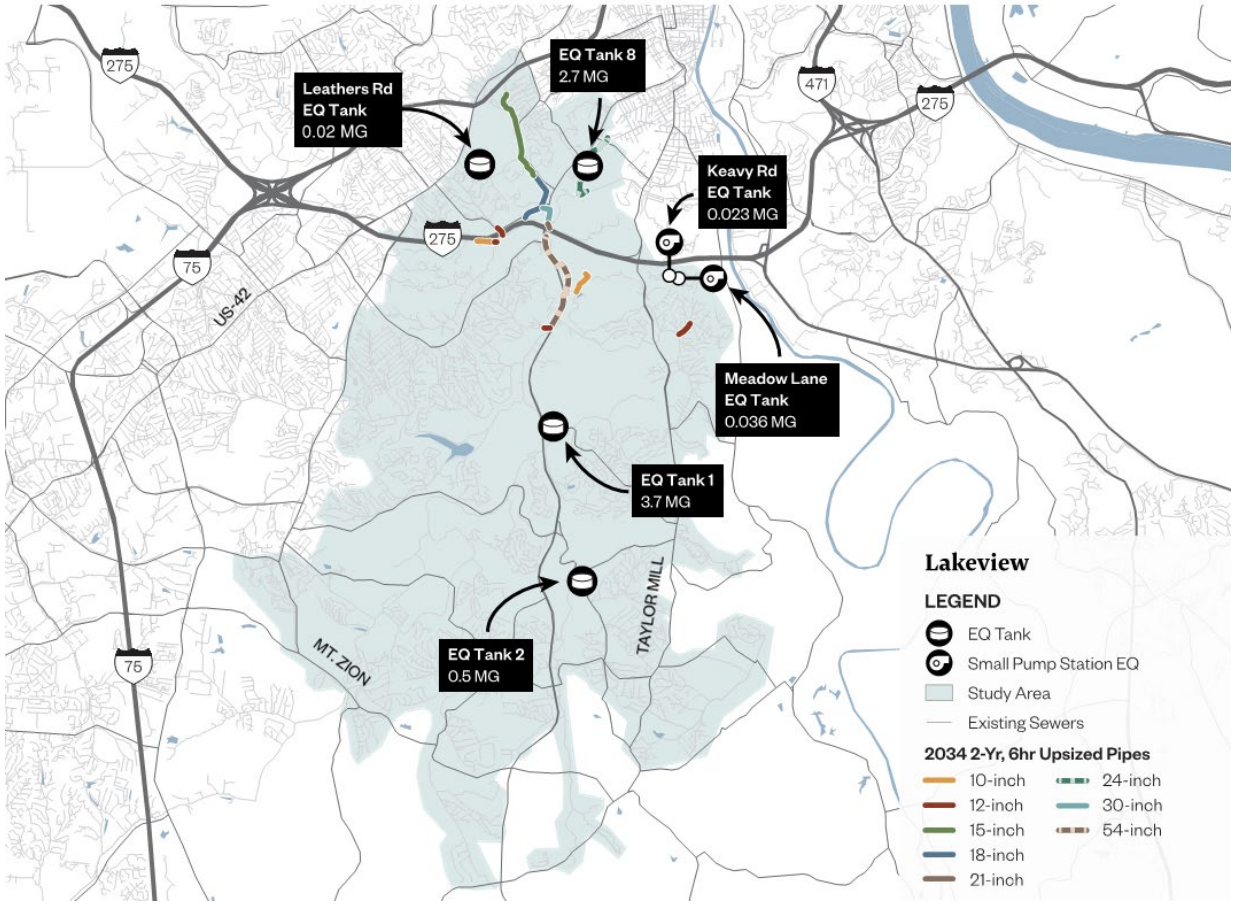
A map showing the improvements to be completed by 2034 is shown in Figure 7-6. This includes three proposed EQ facilities, PS storage, and a portion of the ultimate conveyance improvements with the remaining improvements constructed by 2040 (see Section 8.2.2). A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 7-5: List of SSOs Eliminated by Lakeview Improvements

Manhole ID
1520124
1570100
1940006
1940024
1940026
1940038
1940039
1940044
1950010
1950027
1950036
1960002

Manhole ID
1980001
1990018
1990028
1990032
1990203
2010042
2010PS1
2010PS2
2160004
2170097
2300011

Figure 7-6: Lakeview Pump Station 2034 Sanitary Sewershed Improvements



7.2.4 Taylor Creek

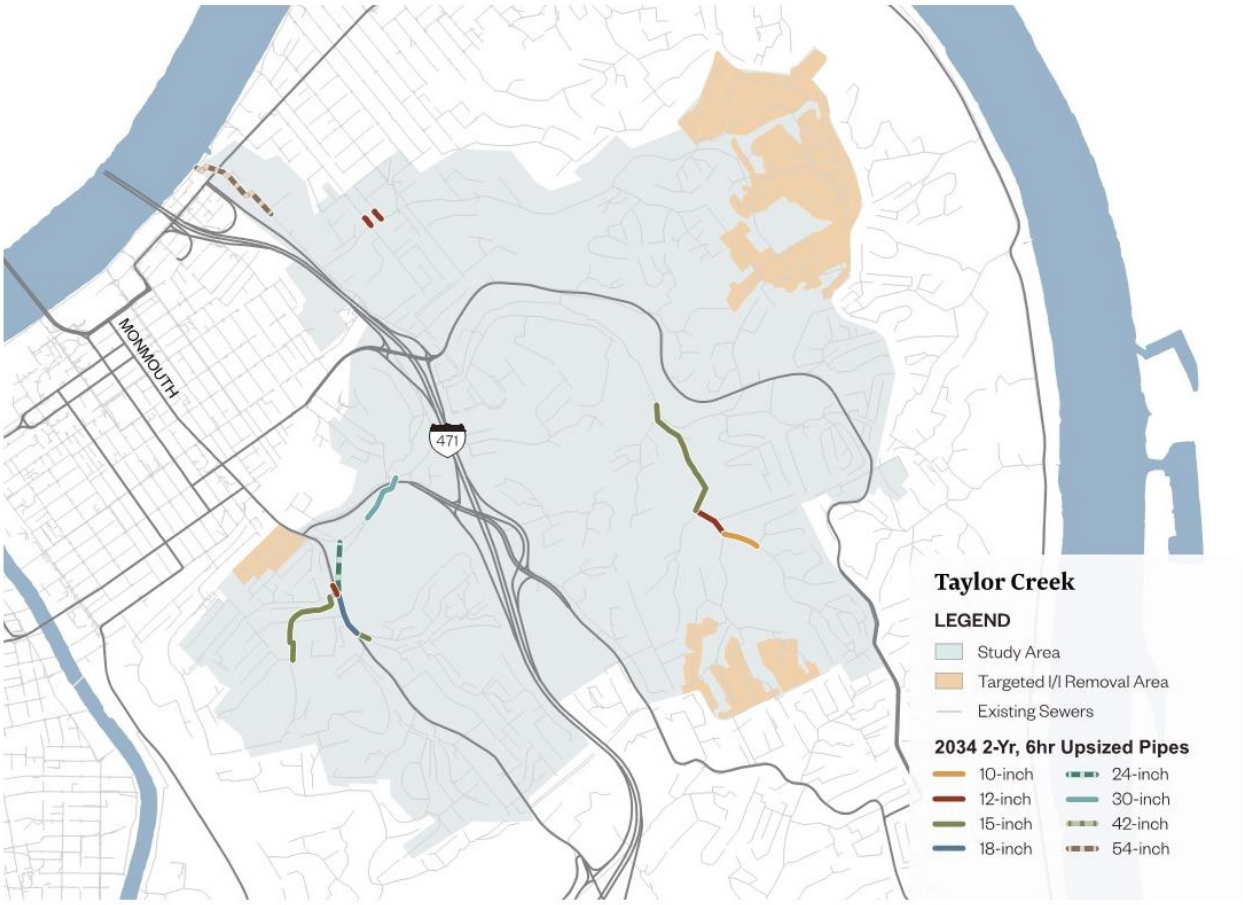
The Taylor Creek sewershed includes both combined and separate areas. The recommended solution for the sanitary portion of this sewershed includes conveyance and targeted I/I removal to address SSOs in upstream portions. The targeted I/I removal has been strategically applied to minimize conveyance as much as possible. A portion of the conveyance solution recommended for this sewershed will be completed via the Waterworks Road Conveyance project described in the 2029 improvements section. The combined area solution includes conveyance to the Ohio River Interceptor via an upsized Riviera trunk sewer to accommodate these flows. SD1 has recently upsized approximately 850 feet of the Riviera trunk sewer to 54-inch pipe which reduces the required conveyance near the outlet of the sewershed. Combined flows in excess of the capacity of the Ohio River Interceptor will be stored at the Taylor Creek EQ facility as part of the CSO control solution further described in 7.1.

A map showing the locations of the preliminary improvements is shown in Figure 7-7. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 7-6: List of SSOs Eliminated by Taylor Creek Improvements

Manhole ID
0390007
0410010
0410019
0440074
0490032
0490137
0500047
0710071
1010002
1010026
1010027
0720027
0720028

Figure 7-7: Taylor Creek 2034 Sanitary Sewershed Improvements



7.2.5 Bromley Crescent Springs

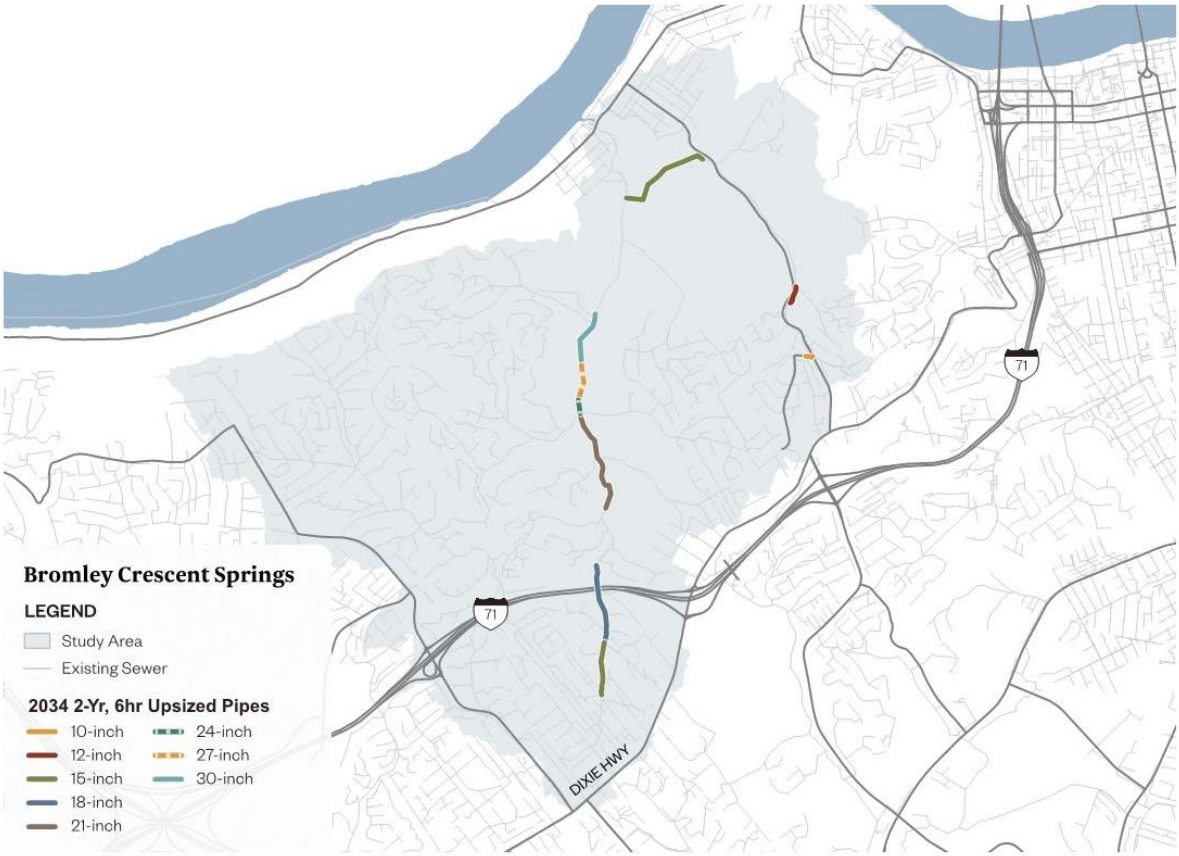
The recommended 2034 solution to address SSOs in Bromley Crescent-Springs is conveyance upsizing. This sewershed discharges into the combined system near Bromley Pump Station, which conveys flow to the Dry Creek WWTP. Based on the storage and RTC scheme in the combined system discussed in section 7.1, Bromley PS will have capacity for the additional flow from conveyance improvements in this sewershed. A portion of the full conveyance solution recommended for this sewershed will be completed via the Bromley Crescent Springs Conveyance project described in the 2029 improvements section.

A map showing the locations of the preliminary improvements is shown in Figure 7-8. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 7-7: List of SSOs Eliminated by Bromley Crescent-Springs Improvements

Manhole ID
1550053
1560016
1560092
1560121
1690043
1730104

Figure 7-8: Bromley Crescent Springs 2034 Sanitary Sewershed Improvements



7.2.6 Western Regional

Construction of Western Regional improvements completed by 2029 will have redirected a significant volume of flow from the Dry Creek WRF to the Western Regional WRF and provided a foundation to redirect additional flow from the Lakeview system. Additional redirection of flow will maximize treatment capacity of the Western Regional WRF and available capacity in the Western Regional tunnel. The majority of the improvements required in this sewershed will address future flows, and include upsized/new conveyance, EQ storage, pump stations, and force mains. The W6 PS (completed as part of the 2029 improvements) will redirect future flows away from the South Kenton Interceptor and to Western Regional. These 2029 improvements include a new pump station and force main, as well as a gravity connection to the Frogtown sewer. Additional improvements by 2034 include the remaining W6 improvements (EQ tank at the PS and conveyance upstream), and additional local conveyance that would be needed to accommodate projected growth and development based on current assumptions.

A map showing the locations of the preliminary improvements is shown in Figure 7-9. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 7-8: List of SSOs Eliminated by Western Regional Improvements

Manhole ID
1750201
2300123
2300121
2410387
2410459
2280004
2280010
2280011
2320520

For the W6 PS project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 7-9: Western Regional 2034 Sanitary Sewershed Improvements



7.2.7 Eastern Regional

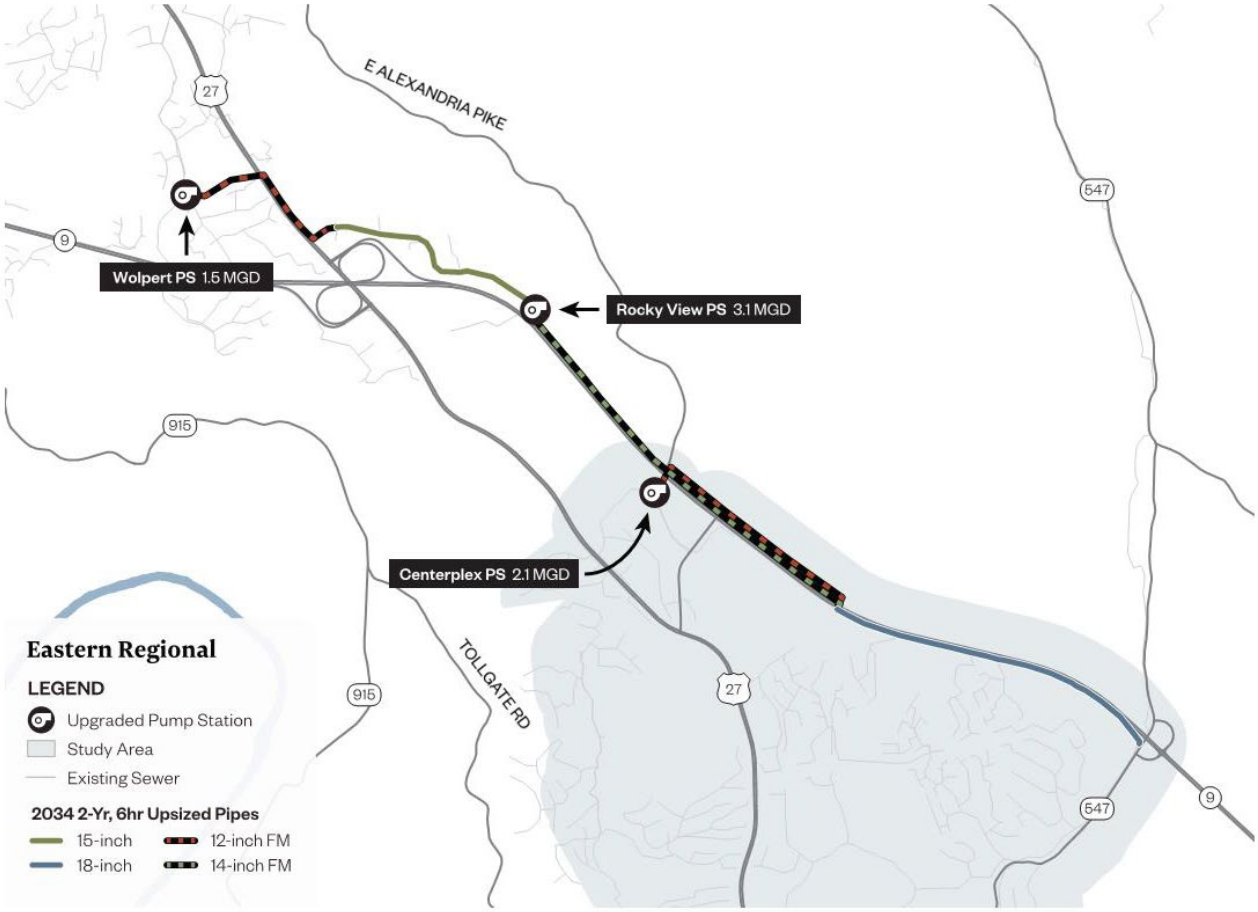
To address the current and projected SSOs within the Eastern Regional sewershed, the recommended solution includes a combination of upsized conveyance piping, and pumps station upgrades. Improvements along the US27/AA Highway will be needed to accommodate the Wolpert PS redirection, as well as to support future development in this area.

A map showing the locations of the preliminary improvements is shown in Figure 7-10. A listing of SSOs addressed is provided below.

Table 7-9: List of SSOs Eliminated by Eastern Regional Improvements

Manhole ID
0020006
2230123
1920086
1920097
1920PS7

Figure 7-10: Eastern Regional 2034 Sanitary Sewershed Improvements



7.2.8 Banklick SSOs

To address the current SSOs within Banklick sewershed, limited conveyance to a storage tank just upstream of the Banklick pump station was identified as the recommended solution. Given the limited capacity of the Banklick pump station, a 2.6-million-gallon surface-storage tank is proposed to store flows above the pump station capacity. This facility has been sized to also receive flow from the Church Street combined system area and will reduce CSO volume at the Church Street CSO (Outfall ID 1850158).

A map showing the locations of the preliminary improvements is shown in Figure 7-11. A listing of SSOs addressed is provided below.

Table 7-10: List of SSOs Eliminated by Banklick Improvements

Manhole ID
1850140
1850141
1860108
1870018

Figure 7-11: Banklick 2034 Sanitary Sewershed Improvements



7.3 Dry Creek WRF Improvements

The Dry Creek WRF treats the majority of the flow from SD1's collection system, receiving separate sanitary flow from the Dry Creek/Lakeview Interceptor and the Taylorsport Force main and combined flow from the Bromley Pump Station. This section summarizes improvements at the Dry Creek WRF scheduled for completion by 2034.

- Disinfection Improvements (UV System) - As documented in the original NFA (2014 WSP Section 2.4), the current disinfection system is sized for a disinfection capacity of 93 MGD, based on a 10 States Standards requirement for 15 minutes of contact time at peak flow within the outfall. UV improvements will increase disinfection capacity to 160 MGD, which matches the outfall hydraulic capacity.
- Primary Clarifier Improvements - Primary clarifier improvements will increase the hydraulic capacity of the primary clarifiers to 160 MGD, including the ability to a) send separate sanitary sewer flows directly to the aeration tanks (remaining separated from the combined flow), and b) accommodate enhanced primary treatment of peak flows through chemical addition.
- Aeration Tank Improvements - Aeration tank improvements include modifications to allow step feed / contact stabilization and modified air delivery, including creation of anoxic zone for enhanced settling. These improvements will significantly increase the biological treatment capacity, from 55 MGD to up to 100 MGD.

Additional details on these improvements, including costs and rationale, are presented in Appendix J.

7.4 Achieving Consent Decree Metrics

As explained in Section 2.7, a fundamental sequencing criterion was to assemble projects to meet the overflow reduction milestone dates required by the ACD. Tables 7-11 and 7-13 demonstrate that the improvements presented above, sequenced properly for the 2034 timeframe, meet or exceed all ACD milestones. Note that for the CSS, a higher percent capture represents a greater overflow reduction, while for the SSS, a lower percentage of baseline SSO volume remaining represents a greater overflow reduction.

Table 7-11: 2034 CSO Improvements

Time Frame	Combined System Solution	Remaining CSO Volume (MG)	Total Combined Flow (MG)	CSO Percent Capture	Required ACD Milestone
2034	All CSS Components except Licking River Solution	932	4,807[1]	80.6%	80%

The percent capture value in Table 7-11 above is based on the calculation in Table 7-12:

Table 7-12: 2034 Percent Capture Calculation

Category	Typical Year Annual Volume (MG)
Storm water entering combined system	2,747
Sanitary flow during wet weather	1,970
Eliminated Flow	90
Total Combined Flow (TCF)	4,807
Untreated CSO (CSO)	932
Percent Capture [(TCF)-(CSO)]/(TCF)	**80.6%**

Note:
1) 2034 percent capture metric calculated using the 2040 model.
2) Eliminated Flow includes additional separation of the IRS building in Covington, Ky.

Table 7-13: 2034 SSO Improvements

Time Frame	Project	Remaining SSO Volume (MG)	Percentage of Baseline SSO Volume Remaining	Required ACD Milestone
2034	LRS Conveyance Extension Lakeview Regional EQ Tanks Lakeview Conveyance Taylor Creek Conveyance Taylor Creek I/I Reduction BCS Conveyance W6 EQ/Conveyance Western Regional Conveyance US27/AA Improvements Banklick EQ/Conveyance	9.3	8.1%	10%

Tables 7-14 and 7-15 below provide by-overflow volume information for CSOs and SSOs remaining in 2034, with the proposed improvements in place, as predicted by the ICM model. Table 7-14 lists annual volume by CSO, and Table 7-15 lists annual volume by SSO.

Table 7-14: Remaining Volume by CSO Location with 2034 Improvements

As Predicted by the ICM Model

Outfall ID	Annual Volume (MG)
0030031	0.80
0200069	0.85
0340050	0.45
0340051	0.20
0360079	2.15
0540156	0.18
0540157	0.08
0550134	<0.01
0570089	62.85
0570090	2.76
0600094	<0.01
0600096	0.12
0600097	1.05
0600104	0.04
0610071	1.56
0610072	0.37
0620075	2.29
0630061	0.49
0640090	8.12
0650054	<0.01
0650090	227.80
0650100	0.22
0660085	0.43
0690067	0.03
0730129	0.27
0790084	2.87
0790086	32.09
0840111	9.21
0840112	0.37
0840116	0.33
0870078	0.36
0870079	12.52
0880081	9.89
0880082	0.72
0910065	212.82
0910068	27.49
0910084	0.32
0930103	0.07
0930104	0.06
0930105	28.72
0960063	4.03
0960064	<0.01
0980073	0.15
0980080	0.01
0980081	51.04
1420141	0.01
1420142	50.39
1420144	<0.01
1440204	0.06
1440206	1.05
1440207	0.02
1440209	4.21
1440508	0.78
1470093	1.42
1480185	1.51
1480187	114.36
1490132	0.49
1500131	6.74
1710114	0.27
1710116	2.42
1710119	2.81
1710121	1.20
1710124	1.81
1720109	16.09
1730259	1.83
1730263	1.58
1840130	0.78
1850158	11.39
1870193	0.06
1870194	0.39
1880090	2.11
1880091	2.23

Table 7-15: Remaining Volume by SSO Location with 2034 Improvements

As Predicted by the ICM Model

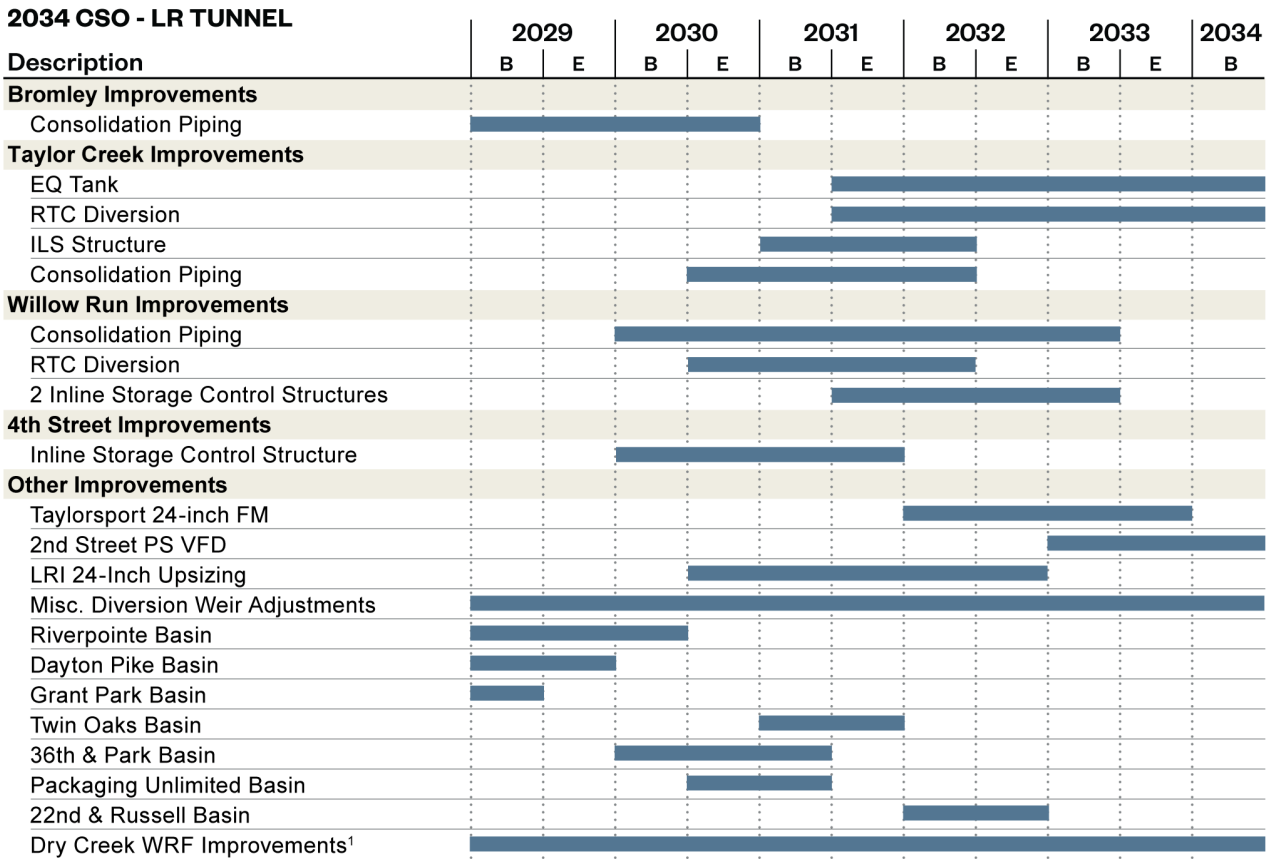
Manhole ID	Overflow Volume (MG)
0010PS6	0.01
0020006	0.06
0040003	0.09
0050022	0.02
0050131	0.07
0050PS1	0.28
0060001	0.70
0060002	0.18
0060004	0.15
0150024	0.02
0220056	0.02
0220058	<0.01
0220086	<0.01
0230016	<0.01
0270026	0.02
0280001	<0.01
0300035	0.08
0360005	<0.01
0570130	0.13
1090069	<0.01
1110025	<0.01
1110027	0.09
1110051	0.18
1110067	0.37
1110103	0.10
1110104	0.02
1110106	<0.01
1110150	<0.01
1110161	0.03
1110164	0.03
1110174	0.02
1110294	0.05
1190001	<0.01
1190012	0.43
1200022	0.23
1220016	0.12
1220054	0.49
1240008	0.43
1760047	0.33
1760048	0.21
1760055	0.02
1790003	0.02
1790004	<0.01
1930007	0.05
1930008	0.07
1930009	0.04
1930010	0.13
1930012	0.02
2020035	0.66
2020203	0.14
2100057	0.03
2100081	<0.01
2100126	0.10
2100156	<0.01
2110006	0.04
2110008	<0.01
2120001	0.02
2120023	<0.01
2120041	0.03
2130027	0.13
2210009	0.08
2210050	0.19
2300013	0.13
2301219	1.47
2311211	0.52
2350005	0.02
2350008	<0.01
2350055	0.02
2350681	0.01
2360024	0.32
L17-282	0.02

7.5 Project Sequencing

Tables 7-16 through 7-18 below present the proposed preliminary sequencing of 2034 improvements. SD1 is presenting these detailed schedules as part of a complete plan, to confirm that projects can be completed as required while accounting for implementation practicalities and engineering sequencing requirements. Interim dates and the timing of individual projects may change during design and implementation. Any such schedule refinements will not impact the ability of the project groupings to meet the ACD milestone metrics. Further, these projects may change based on subsequent Updated Watershed Plans.

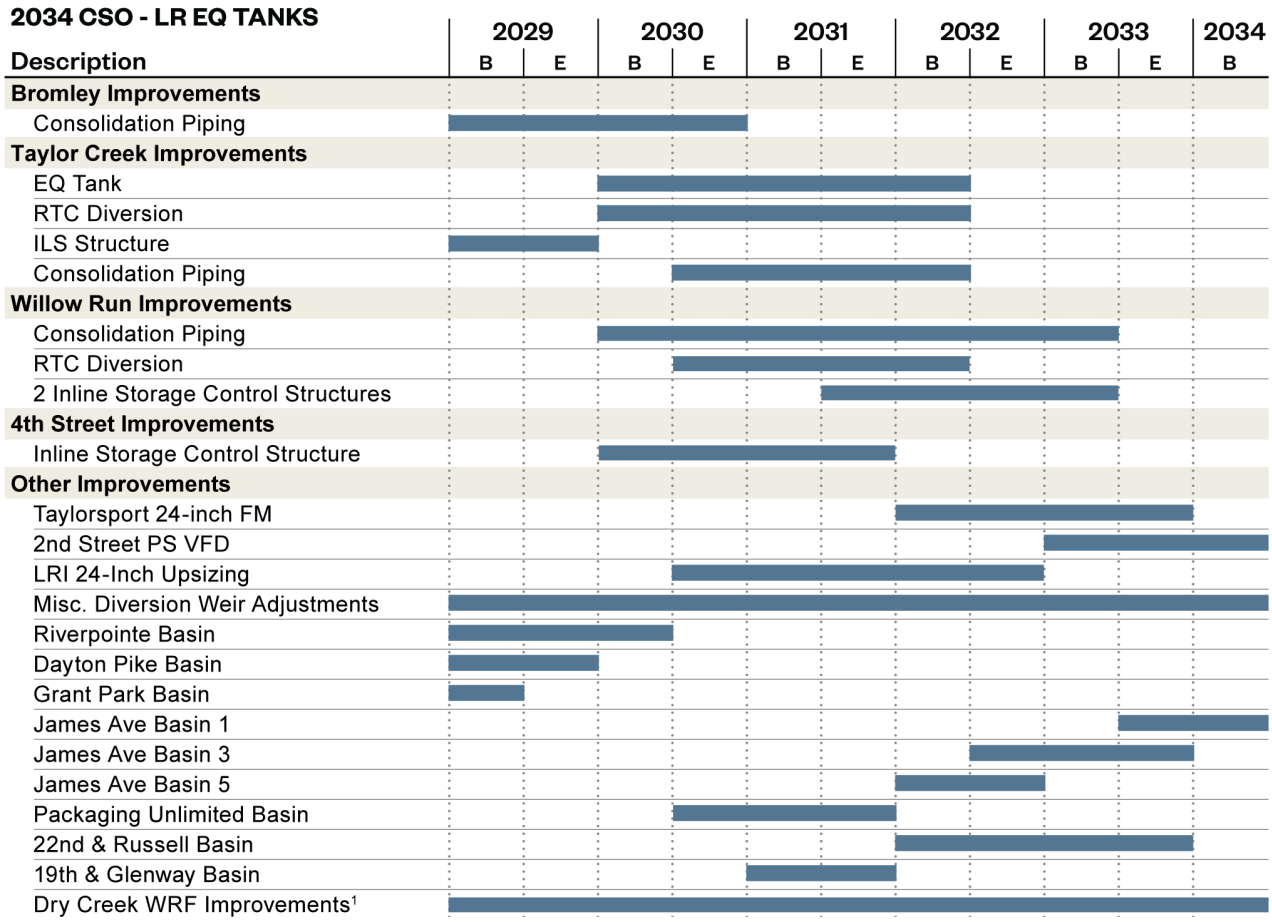
For the 2034 improvements, the final choice on surface stormwater detention basins is dependent on SD1's future decision on a Licking River Tunnel versus Licking River EQ Tanks (described in Section 8.1.1). Therefore, at this preliminary level, a schedule is provided for each option.

Table 7-16: 2034 CSO Improvements Schedule – Licking River Tunnel Option



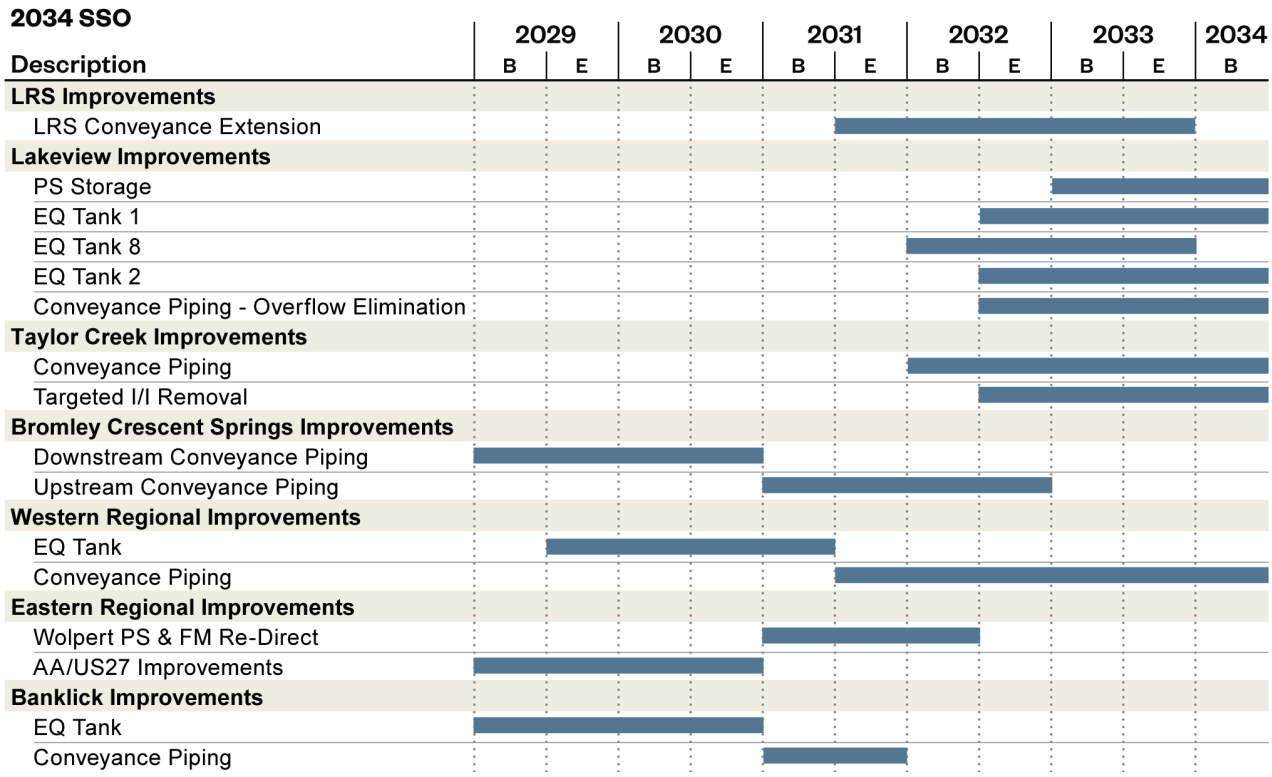
[1]Included in the CSO schedule for convenience but the Dry Creek WRF Improvements benefit both CSO and SSO control.

Table 7-17: 2034 CSO Improvements Schedule – Licking River EQ Tank Option



[1]Included in the CSO schedule for convenience but the Dry Creek WRF Improvements benefit both CSO and SSO control.

Table 7-18: 2034 SSO Improvements Schedule



Section 8
2040 Improvements

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8. 2040 Improvements

This section presents a preliminary concept for the UWSP improvements planned for implementation in the period from 2034 to 2040. These improvements represent projects scheduled after the first ten years following approval of the ACD, and so consistent with the 2034 improvements are presented as preliminary plans at a lower level of detail than the 2023 and 2029 improvements (per the approach specified in Paragraph 41(e) of the ACD) and are subject to refinement as part of the next WSP process. SD1 will complete the next round of watershed planning by 2030, so a full 4 years before any of these 2040 projects need to be implemented. Note that the potential for future 2040 solution refinement does not impact SD1's current UWSP objective, which is to develop, analyze, and select preliminary 2040 improvements that have been confirmed as appropriate and viable options to meet ACD requirements, based on the best information available today, and using the model projections and assumed growth outlined in Section 3.

The section first presents the preliminary CSO improvements and SSO improvements, and then demonstrates how these improvements meet the 2040 overflow reduction milestones. The section concludes with a presentation of the preliminary implementation schedule for the proposed projects. In addition to this section, these improvements are included in a comprehensive project list in Appendix H which summarizes project name, cost, volume reduction, proposed completion date, and SSO(s) eliminated or CSO(s) addressed by project for all UWSP projects presented in Sections 5 – 8.

8.1 2040 CSO Improvements

The CSO plan described below includes the following project groupings to achieve the necessary CSO capture:

- Gray infrastructure components along the Licking River
- An expanded coordinated control scheme, to expand on the 2034 implementation and optimize performance of the gray infrastructure

Additional information on each of these preliminary solution concepts is provided in the following narratives.

8.1.1 Licking River Solution Gray Components – Two Viable Options

The final component of the 2040 CSO solution comprises extensive equalization storage along the Licking River. This final component is the capstone of the program, building on and complementing earlier improvements. In essence, all other viable CSO control technologies (targeted separation, surface stormwater detention basins, inline storage, flow balancing, Taylor Creek EQ tank) are maximized up through the 2034 milestone; the storage component then completes the full 2040 solution by achieving the final control requirements for the Licking River CSOs.

SD1 examined two storage options, both of which meet the CSO capture requirements. One is a deep rock tunnel and the other a series of distributed above ground EQ tanks. Both options were analyzed, sized,

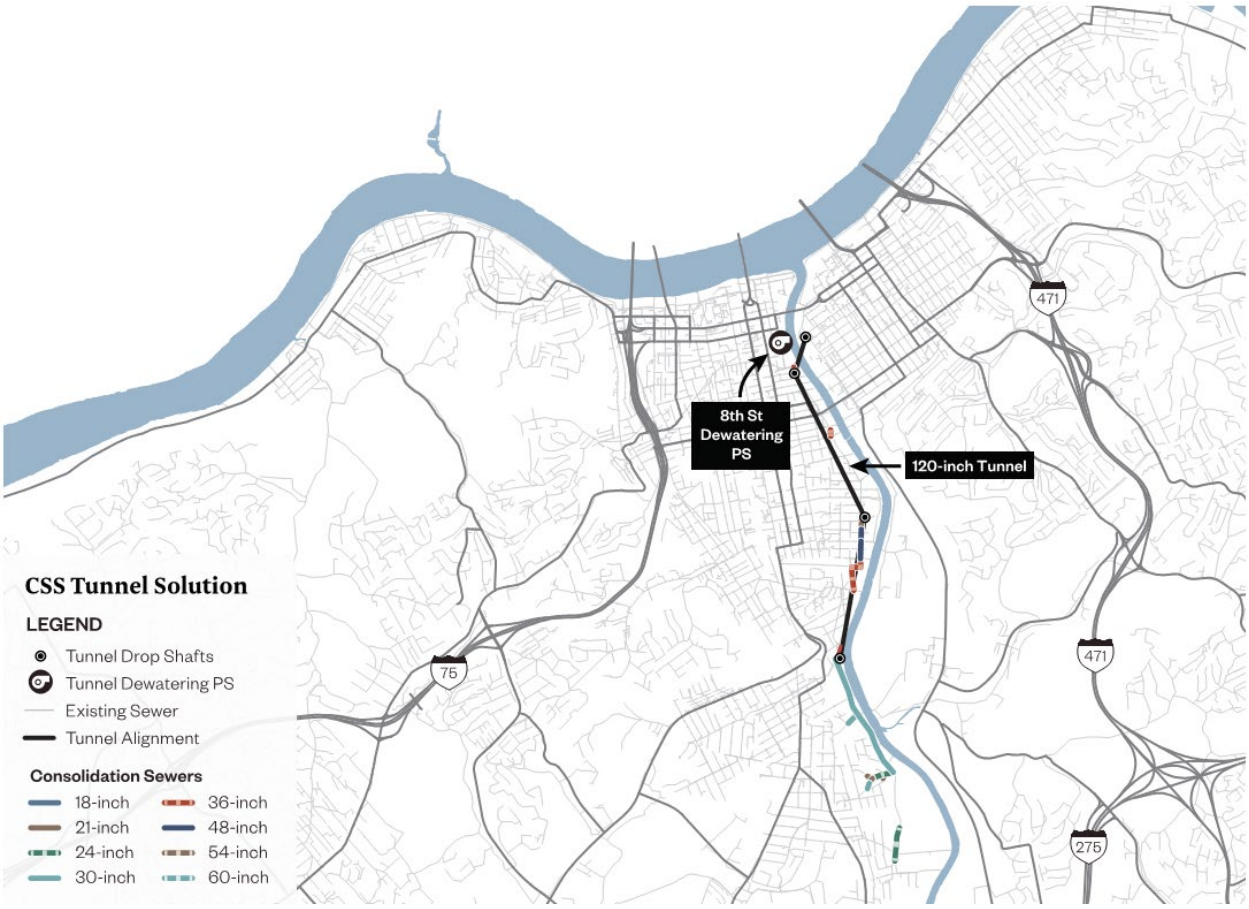
and costed, with the original intent of selecting one as the preferred preliminary option for this UWSP. However, based on the full analysis and based on the best information currently available, neither option emerged as clearly superior, and both options are estimated to have essentially the same cost given typical Class IV estimate ranges. Therefore, SD1 is including both options in the current UWSP, with full confidence that both options will meet ACD requirements and that either option can be constructed on the necessary timeline. The choice between the two options will be made during the next phase of watershed planning, as additional information becomes available.

8.1.1.1 Licking River Tunnel Solution

This option includes a large diameter tunnel along the Licking River as shown in Figure 8-1, with a detail view shown in Figure 8-2. This alternative would include the following list of conveyance and storage improvements:

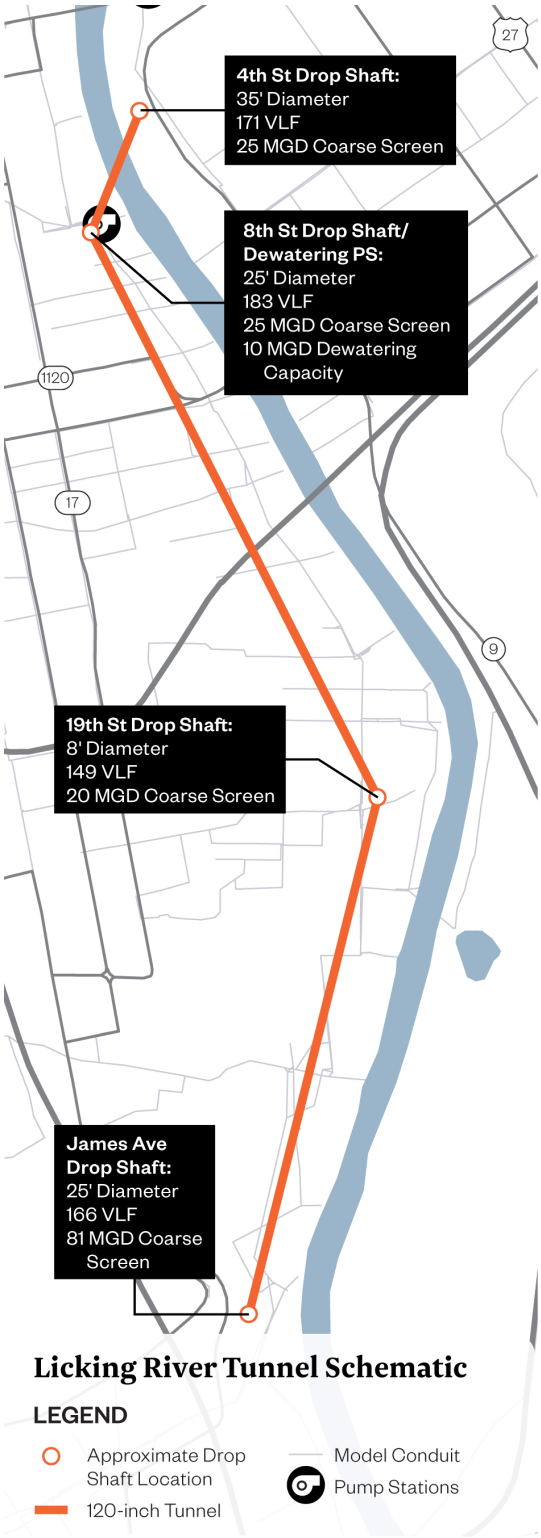
- Consolidation piping along the Licking River to four drop shaft locations at James Avenue, 19th Street, 8th Street and 4th Street.
- The four drop shafts locations would direct flow into a 11,100 feet long, large diameter tunnel that would be dewatered by a lift station located just downstream of the 8th Street Pump Station discharge.

Figure 8-1: 2040 CSO Components with Licking River Tunnel Solution



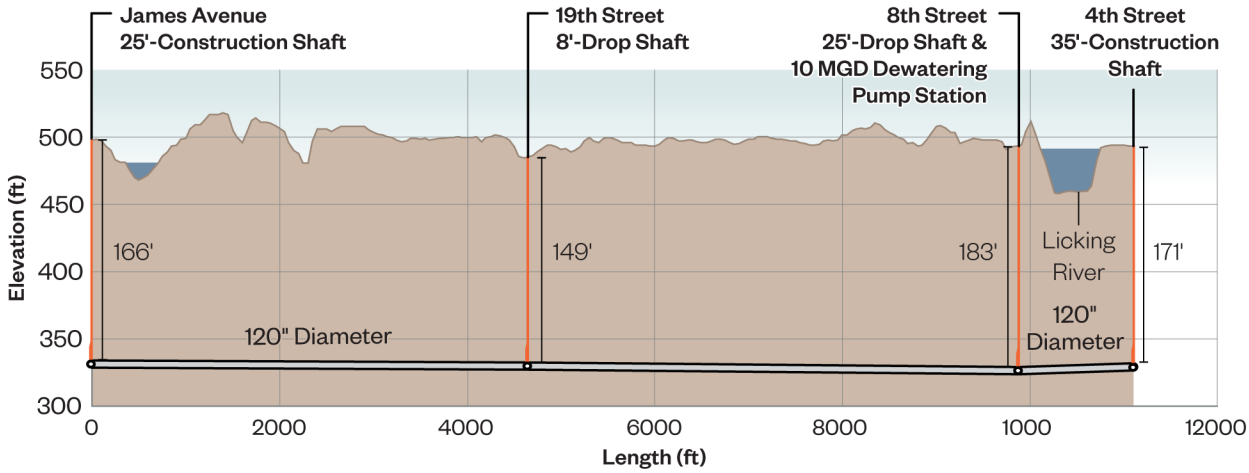
The tunnel would begin at a construction shaft near the 4th Street CSO and would extend southwest to a drop shaft near 8th Street CSO. From here, the tunnel would extend south to a drop shaft near 19th Street CSO and terminate at a construction shaft near James Ave CSO, collecting additional flow from consolidation piping along the Licking River. Based on the model results, a 10-ft finished diameter tunnel would be required to meet ACD requirements. A dewatering pump station would be located near the 8th Street drop shaft and would dewater the tunnel into the Licking River Interceptor just downstream of the 8th Street Pump Station discharge.

Figure 8-2: Licking River Tunnel Schematic



The proposed tunnel profile is shown in Figure 8-3 and assumes a grade of 0.1%. The depth of the tunnel used in this alternative was based on the deepest known top-of-rock elevation in the area which is approximately Elevation 364. It is anticipated the tunnel will be located in the Lexington Formation for its entire length. The Lexington Formation is generally a strong limestone but can contain some weak layers of shale. It is expected that the tunnel excavation would be supported with rock bolts and welded wire fabric.

Figure 8-3: Licking River Tunnel Profile

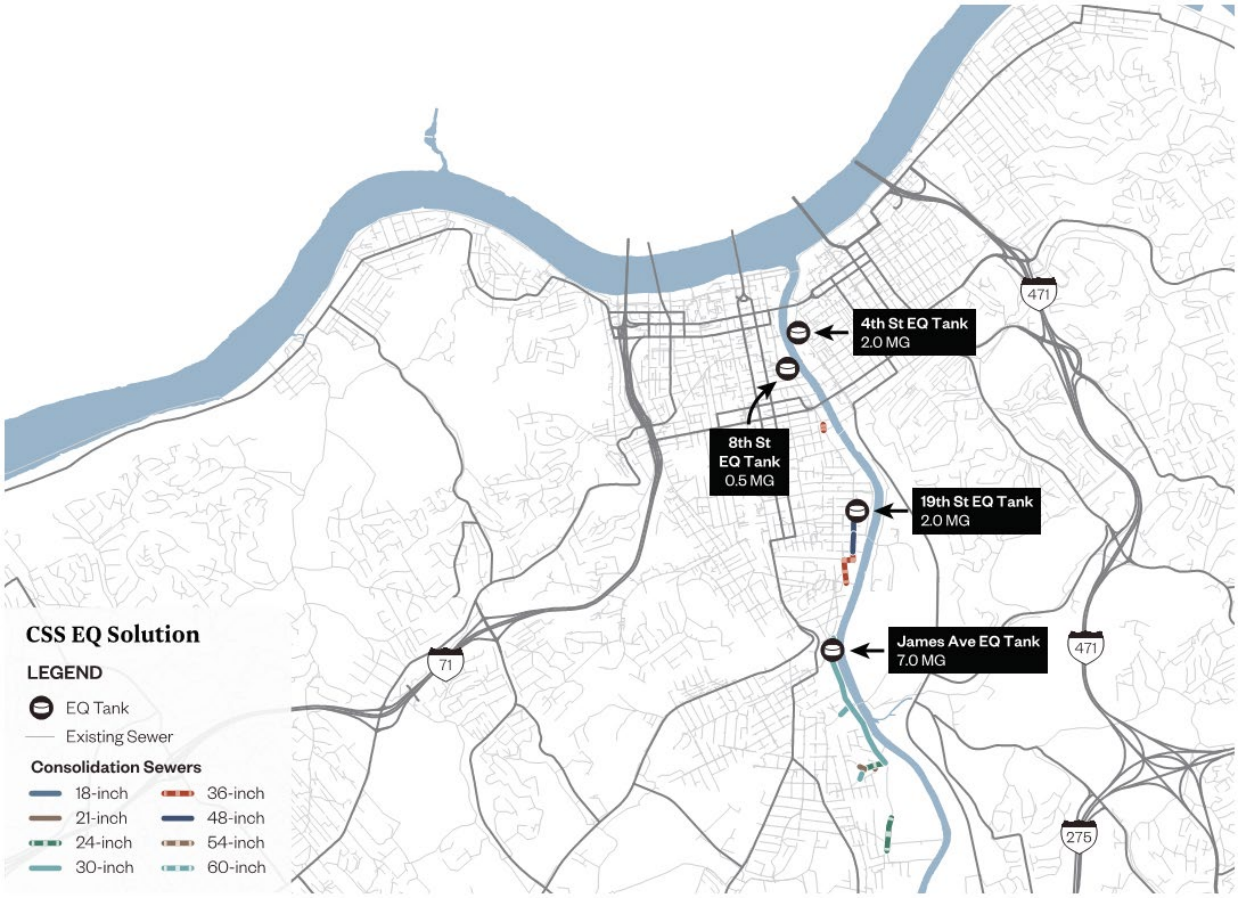


8.1.1.2 Licking River EQ Tank Solution

This option includes four distributed surface EQ tanks along the Licking River as shown in Figure 8-4. This alternative would include the following list of conveyance and storage improvements:

- Consolidation piping along the Licking River to collect and direct flow to the four EQ tanks.
- Four EQ tank facilities:
    - James Avenue, with a preliminary size of 7.0 MG
    - 19th Street, with a preliminary size of 2.0 MG
    - 8th Street, with a preliminary size of 0.5 MG
    - 4th Street, with a preliminary size of 2.0 MG

Figure 8-4: 2040 CSO Components with Licking River EQ Tank Solution



8.1.2 Expanded Coordinated Control Scheme

To implement the final component of the 2040 CSO solution, the coordinated controls previously described in Section 7.1.3 would be updated to include controlled dewatering from either the Licking River Tunnel or the Licking River EQ tanks to minimize CSO volume as the 5th and final control phase. For the Licking River Tunnel option, a dewatering PS would dewater flow to the Licking River Interceptor just downstream of 8th Street PS. This dewatering would occur based on available capacity at the Willow Run RTC diversion to minimize CSO volume and maximize flow to Bromley PS. For the Licking River EQ Tank option, the 8th Street and 19th Street EQ Tanks would dewater in a similar fashion to the tunnel, by checking available capacity at the Willow Run RTC diversion. The 4th Street EQ Tank would dewater based on available capacity at the 4th Street diversion, and the James Avenue EQ tank would dewater based on available capacity at the James Avenue diversion, and in the Licking River Interceptor.

The ACD specifies that the 2040 improvements are to be presented as preliminary plans. However, as part of developing the preliminary coordinated control scheme presented above, and consistent with the previously presented 2034 solution, set point locations with associated action levels were defined using

the ICM model to confirm proper operation of the system. These preliminary control scheme metrics are presented in Table 8-1 for this 5th and final control phase.

Table 8-1: Summary of Coordinated Control Set Point Locations and Action Levels–2040 Components

Solution Option	Description	Set Point Location	Set Point Action Level
5 (LR Tunnel)	LR Tunnel Dewatering PS	Willow Run RTC Diversion	448.0’
5 (LR EQ Tanks)	8th St, 19th St EQ	Willow Run RTC Diversion	448.0’
	4th St EQ	0820001	461.0’
	James Ave EQ	0910064	466.8’
		0910063	466.3’

8.1.3 CSO Locations Addressed by 2040 Improvements

Table 8-2 and Table 8-3 below showing the CSO locations that are reduced/addressed by the 2040 improvements described above for each of the Licking River Alternatives. Note that as with the 2034 solution, the integrated nature of the combined system results in some of the CSO locations receiving benefit from multiple projects – these are identified by documenting the (up to two) projects that benefit each location. In addition to the CSO locations shown, these improvements also eliminate SSO 0870037.

Table 8-2: Licking River EQ Tank Alternative: Projects that Address CSOs

CSO ID	Project 1	Project 2
0030031	HHSG SSS Improvements	
0200069	HHSG SSS Improvements	
0340050	HHSG SSS Improvements	
0340051	HHSG SSS Improvements	
0360079	HHSG SSS Improvements	
0650090	4th Street EQ & Consolidation Piping	
0790086	4th Street EQ & Consolidation Piping	
0840111	4th Street EQ & Consolidation Piping	
0840112	4th Street EQ & Consolidation Piping	
0840116	4th Street EQ & Consolidation Piping	
0870037 (SSO)	James Avenue EQ & Consolidation Piping	
0870078	James Avenue EQ & Consolidation Piping	
0870079	James Avenue EQ & Consolidation Piping	
0880081	Patton Street EQ & Consolidation Piping	James Avenue EQ & Consolidation Piping
0880082	Patton Street EQ & Consolidation Piping	James Avenue EQ & Consolidation Piping
0910065	Patton Street EQ & Consolidation Piping	James Avenue EQ & Consolidation Piping
0910068	Patton Street EQ & Consolidation Piping	
0930105	James Avenue EQ & Consolidation Piping	
0960063	Patton Street EQ & Consolidation Piping	
0980081	8th Street EQ & Consolidation Piping	
1420142	Patton Street EQ & Consolidation Piping	8th Street EQ & Consolidation Piping
1480187	Patton Street EQ & Consolidation Piping	

Table 8-3: Licking River Tunnel Alternative: Projects that Address CSOs

CSO ID	Project 1	Project 2
0030031	HHSG SSS Improvements	
0200069	HHSG SSS Improvements	
0340050	HHSG SSS Improvements	
0340051	HHSG SSS Improvements	
0360079	HHSG SSS Improvements	
0650090	4th Street Drop Shaft, Screening, Consolidation Piping	
0790086	4th Street Drop Shaft, Screening, Consolidation Piping	
0840111	4th Street Drop Shaft, Screening, Consolidation Piping	
0840112	4th Street Drop Shaft, Screening, Consolidation Piping	
0840116	4th Street Drop Shaft, Screening, Consolidation Piping	
0870037 (SSO)	James Avenue Drop Shaft, Screening, Consolidation Piping	
0870078	James Avenue Drop Shaft, Screening, Consolidation Piping	
0870079	James Avenue Drop Shaft, Screening, Consolidation Piping	
0880081	Patton Street Drop Shaft, Screening, Consolidation Piping	James Avenue Drop Shaft, Screening, Consolidation Piping
0880082	Patton Street Drop Shaft, Screening, Consolidation Piping	James Avenue Drop Shaft, Screening, Consolidation Piping
0910065	Patton Street Drop Shaft, Screening, Consolidation Piping	James Avenue Drop Shaft, Screening, Consolidation Piping
0910068	Patton Street Drop Shaft, Screening, Consolidation Piping	
0930105	Patton Street Drop Shaft, Screening, Consolidation Piping	James Avenue Drop Shaft, Screening, Consolidation Piping
0960063	Patton Street Drop Shaft, Screening, Consolidation Piping	
0980081	8th Street Drop Shaft, Screening, Consolidation Piping	
1420142	Patton Street Drop Shaft, Screening, Consolidation Piping	8th Street Drop Shaft, Screening, Consolidation Piping
1480187	Patton Street Drop Shaft, Screening, Consolidation Piping	

8.2 2040 SSO Improvements

The 2040 SSO improvements include a combination of gray infrastructure and targeted I/I reduction to achieve elimination of SSOs in the typical year by 2040. As with the CSO improvements, the 2040 SSO improvements shown in this section are in addition to the 2023, 2029 and 2034 improvements already discussed. This section presents the 2040 SSO improvements, summarized by study area, representing the projects necessary to eliminate current and projected SSOs in the typical year by January 1, 2040 as required by the ACD. These improvements were selected based on the criteria summarized in Section 3.7. The proposed solution for each study area seeks to leverage infrastructure improvements completed since the previous WSP, as well as projects currently planned, in construction, or recently completed.

As with previous sections, the discussion of preliminary 2040 SSO improvements is organized by study area.

8.2.1 Licking River Siphon

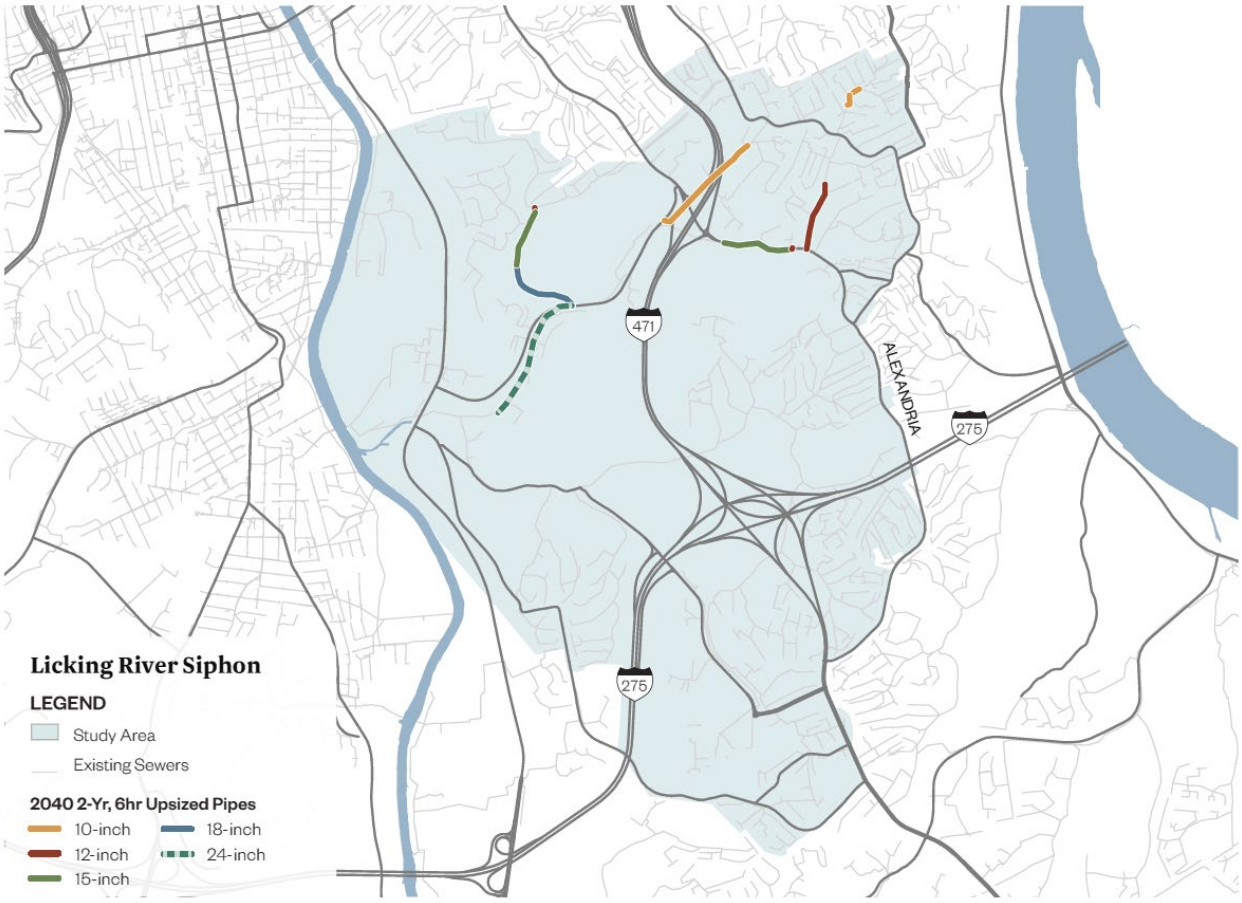
To address the SSOs that remain within the Licking River Siphon sewershed after improvements through 2034, conveyance to the new parallel siphon and surface EQ tank projects identified as part of the 2023 and 2029 solution was identified as the recommended alternative. This solution does not include any additional I/I removal to reduce flows in the study area, as all strategic options for I/I removal will have been exhausted by 2034.

A map showing the locations of the preliminary 2040 improvements is shown in Figure 8-5. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 8-4: List of SSOs Eliminated by Licking River Siphon Improvements

Manhole ID
0150024
0220056
0220058
0220086
0230016
0270026
1930007
1930008
1930009
1930010
1930012

Figure 8-5: Licking River Siphon 2040 Sanitary Sewershed Improvements



8.2.2 Lakeview

To address the SSOs that remain within the Lakeview sewershed after improvements through 2034, conveyance improvements to downstream EQ facilities was identified as the recommended alternative. These improvements would fully utilize the EQ facilities constructed by 2029 and 2034 and will eliminate the remaining SSOs in the Lakeview sewershed in the typical year.

A map showing the locations of the preliminary 2040 improvements is shown in Figure 8-6. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

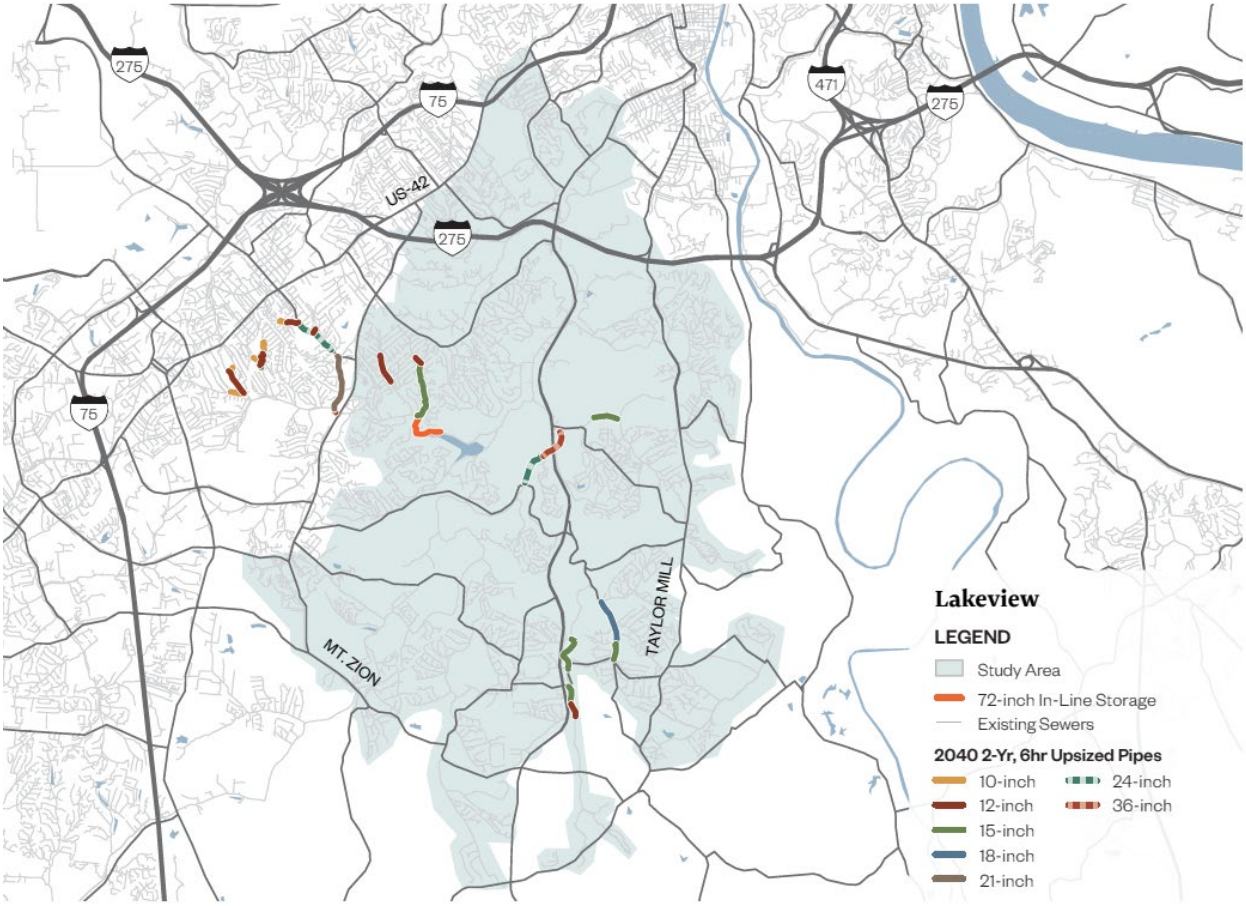
Table 8-5: List of SSOs Eliminated by Lakeview Improvements

Manhole ID
1090069
1110025
1110027
1110051
1110067
1110103
1110104
1110106
1110150
1110161
1110164
1110174
1110294
1760047
1760048
1760055
2020035

Manhole ID
2020203
2100057
2100081
2100126
2100156
2110006
2110008
2120001
2120023
2120041
2311211
2350005
2350008
2350055
2350681
L17-282
2301219
2300013

To address SSOs in the Erlanger/Elsmere area, located in the western portion of the 2040 solution components shown in Figure 8-6, and just downstream, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 8-6: Lakeview Pump Station 2040 Sanitary Sewershed Improvements



8.2.3 Highland Heights/Silver Grove

To address the current and projected SSOs within the Highland Heights/Silver Grove sewershed, the recommended solution includes a combination of regional storage tanks, conveyance, new pump stations and force mains, and targeted I/I removal. This solution does not require construction of Ash Street PS and Force Main to Riley Road – rather this solution pairs with the Ash Street solution presented as part of the 2023 improvements to achieve goals. Therefore, the direction of flow from the entire study area will continue to be through the Ohio River Interceptor to the Dry Creek WWTP.

This solution includes the following key features:

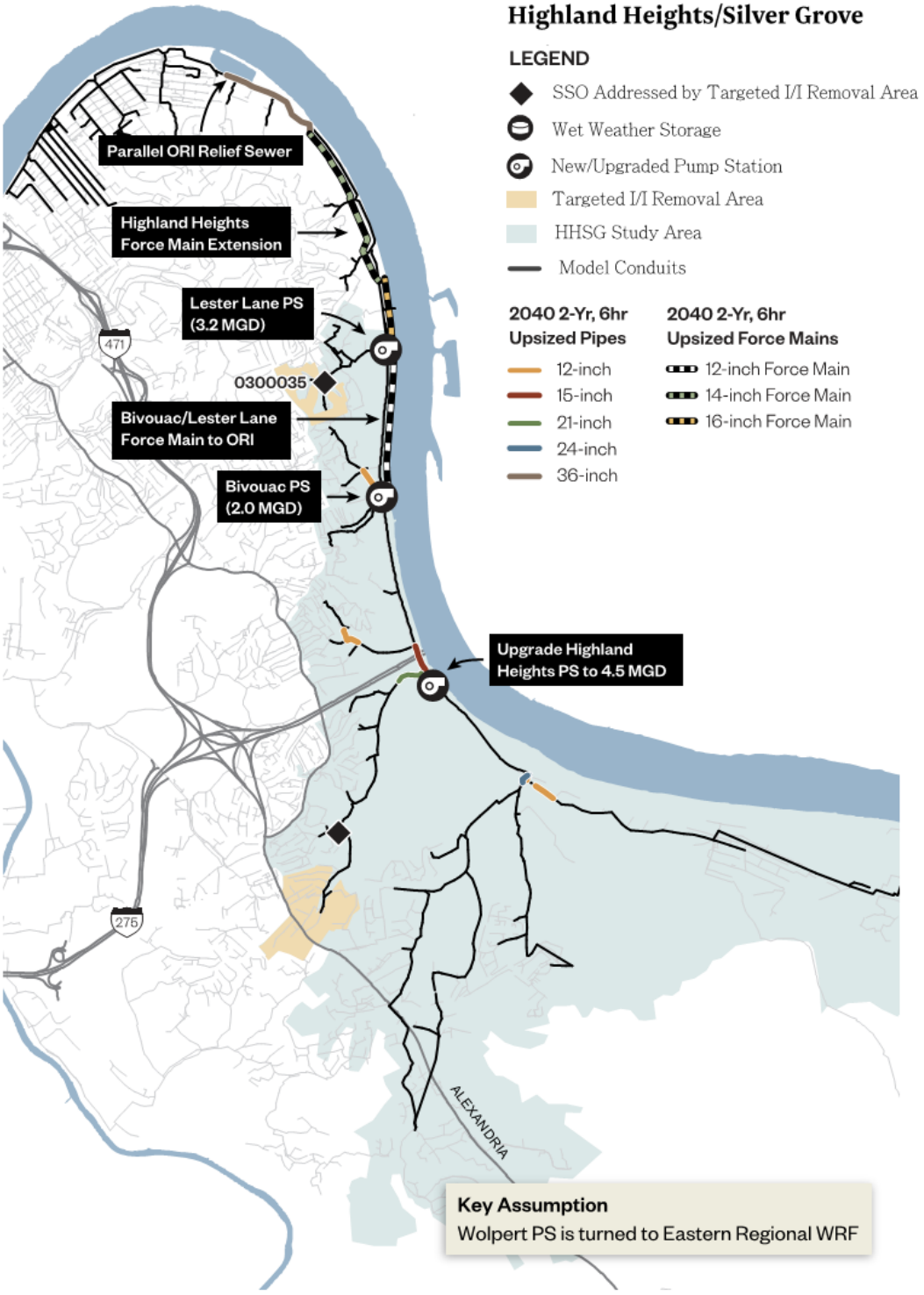
- Highland Heights PS capacity upgrade, and force main extension
- Two new pump stations to convey flow from the Lester Lane and Bivouac areas to the Ohio River Interceptor
- Redirection of Wolpert PS to Riley Road PS
- New gravity sewer conveyance to the Manhattan Harbor improvements
- Targeted I/I removal to address far upstream SSOs
- Optimized conveyance upsizing to handle flows without additional I/I removal

A map showing the locations of the preliminary 2040 improvements is shown in Figure 8-7. A listing of SSOs addressed is provided below – note that in some cases the benefit to a given SSO is cumulative across milestone dates, so manhole IDs for this solution may be repeated from analogous tables in previous sections.

Table 8-6: List of SSOs Eliminated by Highland Heights/Silver Grove Improvements

Manhole ID
0010PS6
0040003
0050022
0050131
0050PS1
0060001
0060002
0060004
0280001
0300035
0360005
0570130

Figure 8-7: Highland Heights/Silver Grove Station 2040 Sanitary Sewershed Improvements



8.2.4 Dry Creek

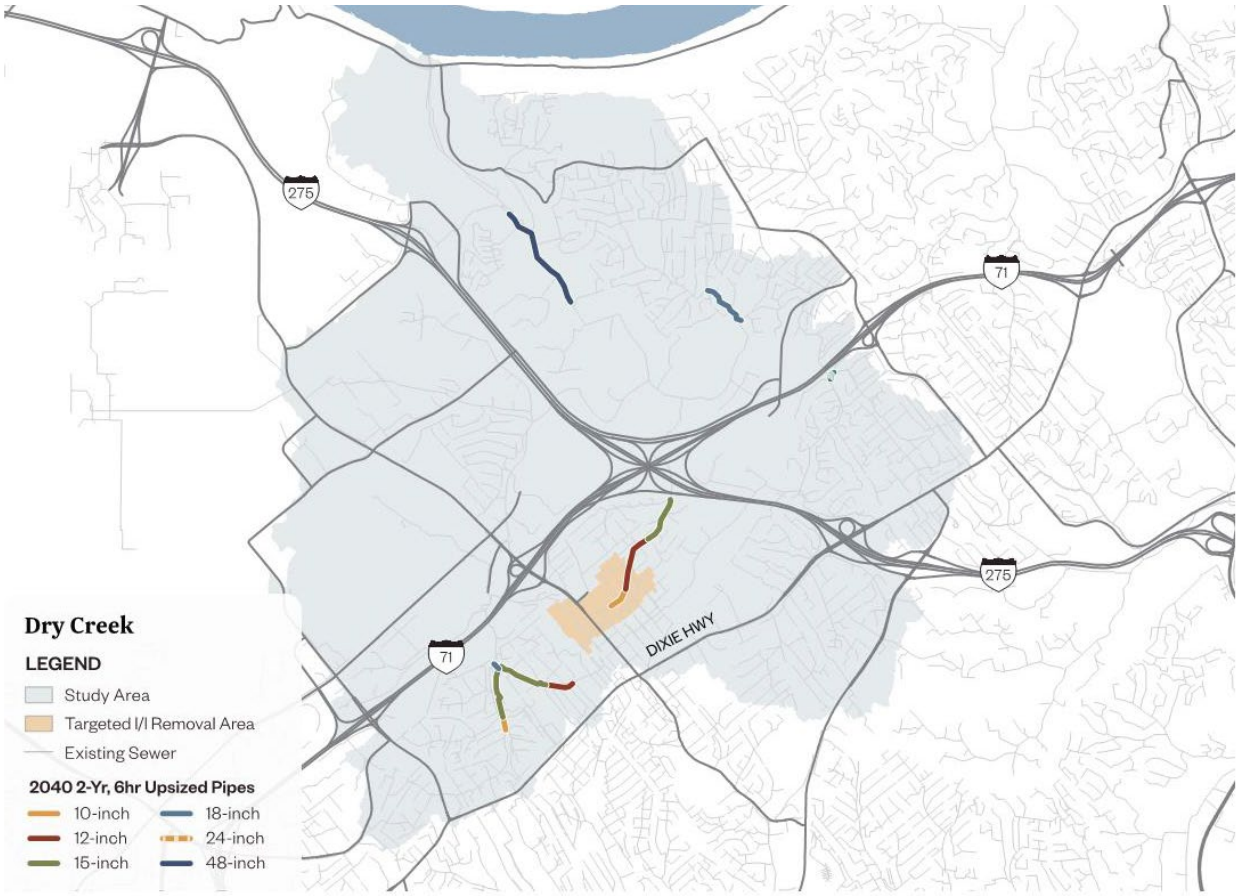
Current and projected SSO locations in the Dry Creek sewershed are proposed to be addressed via conveyance improvements and targeted I/I removal to address SSOs in upstream portions of the system; the targeted I/I removal allows for minimizing conveyance as much as possible. Conveyance improvements include construction of 3,580 feet of 48-inch sewer that will replace the existing Dry Creek interceptor and will convey flows to the Dry Creek WWTP.

A map showing the locations of the preliminary improvements is shown in Figure 8-8. A listing of SSOs addressed is provided below.

Table 8-7: List of SSOs Eliminated by Dry Creek Improvements

Manhole ID
1190001
1190012
1200022
1220016
1220054
1240008
1790003
1790004
1790109
2130027

Figure 8-8: Dry Creek 2040 Sanitary Sewershed Improvements



8.2.5 Taylorsport

Projected SSO locations in the Taylorsport sewershed are proposed to be addressed via construction of an EQ tank at Taylorsport PS. This EQ tank would accommodate flows from additional growth in the sewershed, including increased flows due to the Bullitsville PS 2029 improvements.

A map showing the locations of the preliminary improvements is shown in Figure 8-9. A listing of SSOs addressed is provided below.

Table 8-8: List of SSOs Eliminated by Taylorsport Improvements

Manhole ID
2360024

For this project, SD1 has identified multiple planning-level options to achieve the required goals. The presented solution is considered the most viable option given current information; however, that decision may change during final planning and design. A change in project details will not impact achievement of ACD metrics.

Figure 8-9: Taylorsport 2040 Sewershed Improvements



8.2.6 Eastern Regional

To address the remaining SSOs within the Eastern Regional sewershed, the recommended solution includes upgrades to Enzweiller and Kees pump stations in addition to downstream conveyance to accommodate the increased station capacities.

A map showing the locations of the preliminary improvements is shown in Figure 8-10. A listing of SSOs addressed is provided below.

Table 8-9: List of SSOs Eliminated by Eastern Regional Improvements

Manhole ID
2210009
2210050

Figure 8-10: Eastern Regional 2040 Sanitary Sewershed Improvements



8.3 Achieving Consent Decree Metrics

Tables 8-10 and 8-12 demonstrate that the improvements presented above will meet or exceed all 2040 ACD milestones. Table 8-10 summarizes information for CSOs, demonstrating achievement of a minimum of 85 percent capture system wide for CSOs by January 1, 2040. Table 8-12 summarizes information for SSOs, demonstrating that the proposed SSO improvements will successfully eliminate SSOs in the typical year by January 1, 2040.

Table 8-10: 2040 CSO Improvements

Time Frame	Combined System Solution	Remaining CSO Volume (MG)	Total Combined Flow (MG)	CSO Percent Capture	Required ACD Milestone
2040	CSO Licking River Tunnel	627	4,807	86.9%	85%
	CSO Licking River EQ Tanks	652	4,807	86.4%	85%

The percent capture value in Table 8-10 above is based on the calculation in Table 8-11:

Table 8-11: 2040 Percent Capture Calculation

Category	CSO Licking River Tunnel Solution Typical Year Annual Volume (MG)	CSO Licking River EQ Tanks Solution Typica. Year Annual Volume (MG)
Storm water entering combined system	2,747	2,747
Sanitary flow during wet weather	1,970	1,970
Eliminated Flow	90	90
Total Combined Flow (TCF)	4,807	4,807
Untreated CSO (CSO)	627	652
Percent Capture [(TCF)-(CSO)]/(TCF)	**86.9%**	**86.4%**

Table 8-12: 2040 SSO Improvements

Time Frame	Project	Remaining SSO Volume (MG)	Percentage of Baseline SSO Volume Remaining	Required ACD Milestone Volume Remaining
2040	LRS Conveyance	0	0%	0%
	Lakeview Conveyance			
	HH/SG Improvements			
	Dry Creek Conveyance			
	Dry Creek I/I Reduction			
	Taylorsport EQ			
	ER PS Upgrades/Conveyance			

Tables 8-13 and 8-14 below provide detailed by-overflow volume information for CSOs remaining in 2040, with the proposed improvements in place, as predicted by the ICM model. Table 8-13 summarizes the Licking River Tunnel solution, and Table 8-14 summarizes the Licking River EQ tank solution. Note that no table is required for SSO volume remaining in 2040, as by 2040 all SSOs are successfully eliminated in the typical year.

Table 8-13: Remaining Volume by CSO Location - Licking River Tunnel Solution

As Predicted by the ICM Model

Outfall ID	Annual Volume (MG)
0010220	0.00
0030031	0.00
0200069	0.00
0330100	0.00
0340050	0.00
0340051	0.00
0360079	0.29
0540156	0.18
0540157	0.08
0540158	0.00
0550134	< 0.01
0570089	83.13
0570090	4.43
0600094	< 0.01
0600096	0.12
0600097	1.13
0600104	0.04
0610071	1.59
0610072	0.38
0620075	2.29
0620077	0.00
0630054	0.00
0630061	0.49
0640090	7.72
0650054	< 0.01
0650090	178.05
0650098	0.00
0650100	0.22
0660085	0.43
0690067	0.03
0730129	0.27
0770096	0.00
0790084	2.63
0790086	3.07
0840111	2.90
0840112	0.28
0840116	0.33
0870078	0.36
0870079	2.39
0880081	2.87
0880082	0.23
0910065	113.56
0910066	0.00
0910068	5.26
0910084	0.32
0930102	0.00
0930103	0.00
0930104	0.06
0930105	5.46
0930106	0.00
0960063	0.77
0960064	< 0.01
0980073	0.15
0980080	0.33
0980081	4.86
1420141	0.01
1420142	1.14
1420144	0.10
1420145	0.00
1420146	0.00
1420147	0.00
1440204	0.06
1440206	1.04
1440207	0.02
1440209	5.19
1440508	0.78
1470089	0.00
1470093	1.66
1480185	1.51
1480187	131.83
1490132	0.56
1490172	0.00
1500131	6.75
1710114	0.28
1710116	5.27
1710119	5.81
1710121	2.00
1710124	2.59
1720109	15.93
1730259	1.85
1730262	0.00
1730263	1.85
1840130	0.78
1850158	11.41
1870193	0.06
1870194	0.39
1880090	0.97
1880091	0.88

Table 8-14: Remaining Volume by CSO Location - Licking River EQ Tanks

As Predicted by the ICM Model

Outfall ID	Annual Volume (MG)
0010220	0.00
0030031	0.00
0200069	0.00
0330100	0.00
0340050	0.00
0340051	0.00
0360079	0.29
0540156	0.18
0540157	0.08
0540158	0.00
0550134	< 0.01
0570089	63.26
0570090	3.22
0600094	0.00
0600096	0.12
0600097	1.00
0600104	0.04
0610071	1.51
0610072	0.37
0620075	2.28
0620077	0.00
0630054	0.00
0630061	0.49
0640090	7.78
0650054	< 0.01
0650090	178.24
0650098	0.00
0650100	0.22
0660085	0.43
0690067	0.03
0730129	0.27
0770096	0.04
0790084	2.70
0790086	11.97
0840111	4.63
0840112	0.23
0840116	0.33
0870078	0.29
0870079	2.61
0880081	2.66
0880082	0.24
0910065	93.02
0910066	0.00
0910068	2.03
0910084	0.24
0930102	0.00
0930103	0.00
0930104	0.05
0930105	53.74
0930106	0.00
0960063	0.88
0960064	< 0.01
0980073	0.15
0980080	0.23
0980081	5.27
1420141	0.12
1420142	21.43
1420144	0.10
1420145	0.00
1420146	0.00
1420147	0.00
1440204	0.06
1440206	1.05
1440207	0.02
1440209	5.00
1440508	0.78
1470089	0.00
1470093	1.55
1480185	1.51
1480187	128.18
1490132	0.54
1490172	0.00
1500131	6.74
1710114	0.30
1710116	5.24
1710119	3.08
1710121	1.32
1710124	2.02
1720109	13.30
1730259	1.84
1730262	0.00
1730263	1.85
1840130	0.82
1850158	11.41
1870193	0.06
1870194	0.39
1880090	0.98
1880091	0.90

8.4 Project Sequencing

Tables 8-15 through 8-17 below present the proposed preliminary sequencing of 2040 improvements. SD1 is presenting these detailed schedules as part of a complete plan, to confirm that projects can be completed as required while accounting for implementation practicalities and engineering sequencing requirements. Interim dates and the timing of individual projects may change during design and implementation. Any such schedule refinements will not impact the ability of the project groupings to meet the ACD milestone metrics. In addition, as described above, these projects may change based on future Updated Watershed Plans.

Table 8-15: 2040 CSO Improvements Schedule - Licking River Tunnel Option

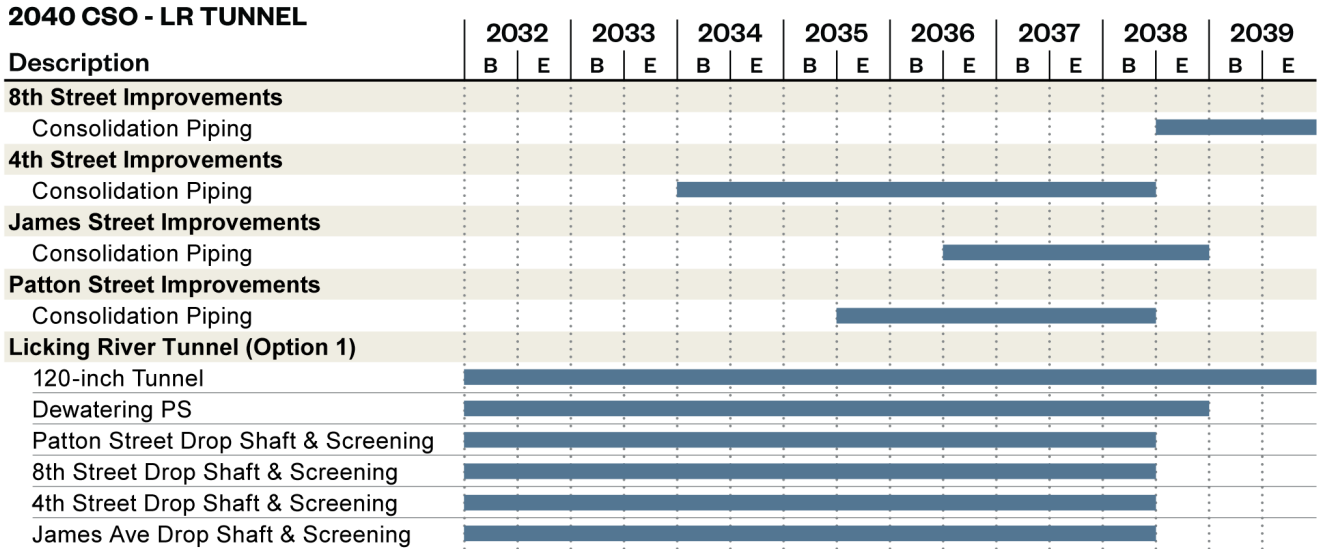


Table 8-16: 2040 CSO Improvements Schedule - Licking River EQ Tank Option

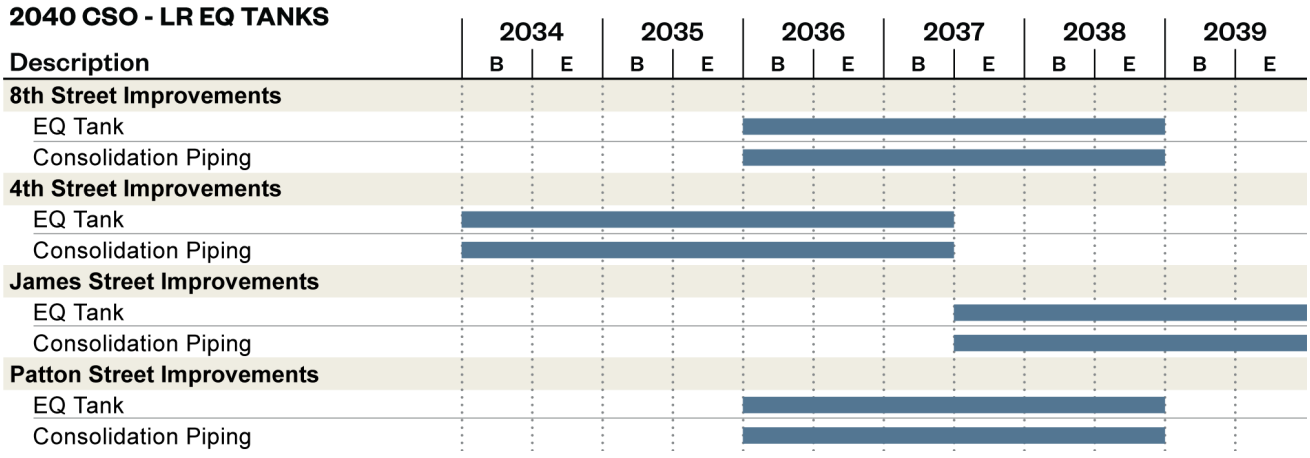
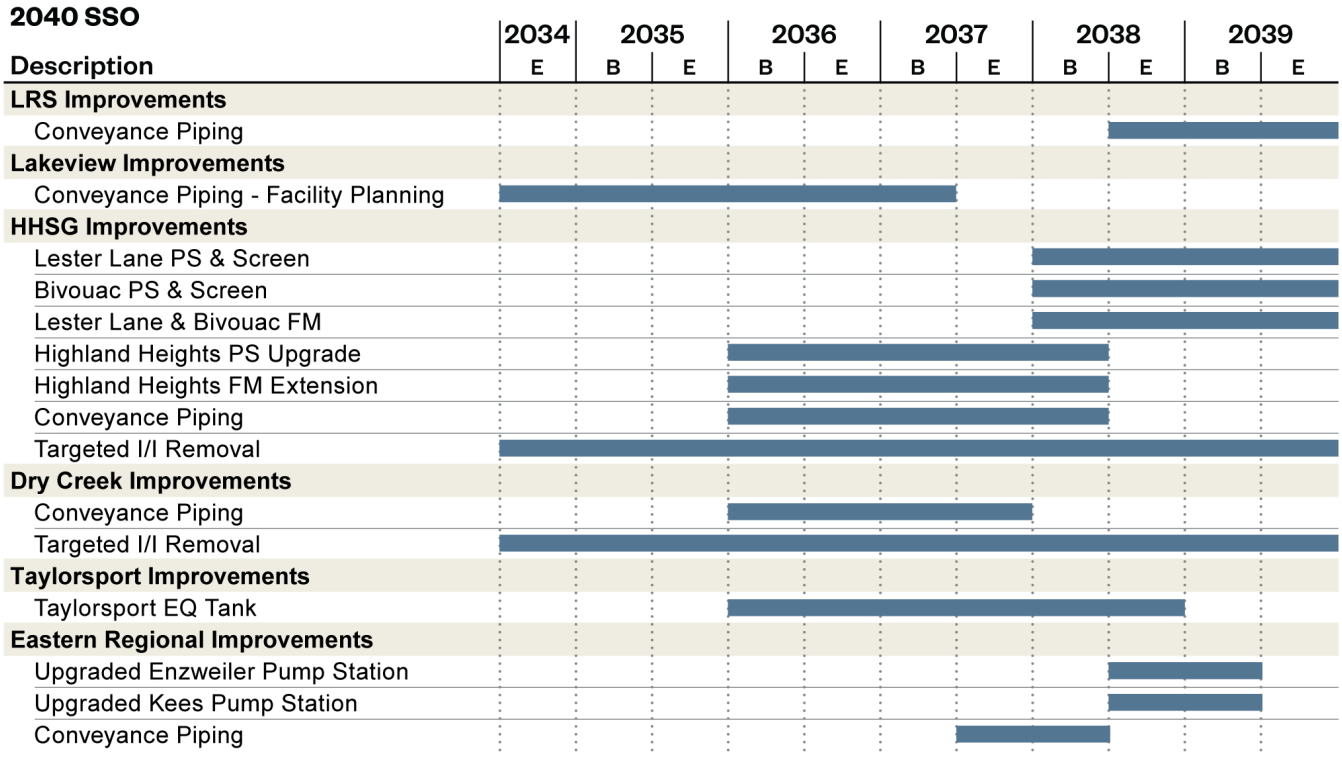


Table 8-17: 2040 SSO Improvements Schedule



Section 9
Other UWSP Factors and Considerations

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9. Other UWSP Factors and Considerations

This section presents brief summary narratives on UWSP factors and consideration not covered in previous sections. These topics are important to either explain SD1's full compliance with ACD requirements, or to present additional information on key aspects of SD1's wet-weather program. Where necessary, the summary narratives reference a supporting UWSP appendix containing additional information on the topic.

9.1 Estimated UWSP Costs and Financial Capability Assessment Update

As part of preparing the UWSP, SD1 has developed Class IV planning-level cost estimates for each of the 2023, 2029, 2034, and 2040 improvements detailed previously in Sections 5, 6 7, and 8 respectively. Table 9-1 summarizes the capital cost estimates for the CSO component, the SSO component, and the resulting total UWSP, all in 2019 dollars. Costs are presented for both of the potential Licking River options, a single deep rock storage tunnel or distributed surface EQ tanks (as detailed previously in Section 8).

Table 9-1: UWSP Capital Cost Summary (Total Program Costs Through 2040)

Categories of Projects	UWSP Capital Cost: LR Tunnel (2019 $M)	UWSP Capital Cost: LR EQ Tanks (2019 $M)
SSO Control Projects	$395	$395
CSO Control Projects	$284	$260
TOTAL UWSP Costs	**$679**	**$655**

These total UWSP costs (using the Licking River EQ Tanks option) were combined with SD1's other cost obligations and used as the basis for updating the Financial Capability Assessment (FCA) developed previously. A full description of the updated FCA assessment including all USEPA worksheets is provided in Appendix K.

9.2 Evaluation of WRF Peak Flow Treatment Capacity

An important component of any SSOP or LTCP is to confirm that a utility's WRFs have the capacity to accept the peak flows expected after plan implementation. SD1 has tracked and assessed this flow-based requirement throughout the watershed planning process, dating back to the approved 2014 WSP.

Two of SD1's WRFs, Eastern Regional and Western Regional, are newer facilities, designed and built since 2000 and so already configured (in existing form or through already-planned expansion) to accommodate the future flows used in the watershed planning process. The third WRF, Dry Creek, was built in the 1970s and accepts and treats the majority of flow in SD1's system, including all of the combined sewer flow. The original watershed planning process included a capacity assessment and a No Feasible Alternatives (NFA) analysis for Dry Creek, as documented in Section 2.4 of the approved 2014 WSP and in SD1's approved 2008 Nine Minimum Controls Report.

While the original Dry Creek WRF capacity evaluation remains valid today, the UWSP does result in a change in inflow patterns to the plant. These changes are due to both updated flow projections (see Section 3) and refinement of the improvements in the UWSP overflow reduction plans (primarily in the combined system). Therefore, SD1 updated the NFA analysis to account for this change in flow patterns, and to ensure proper sequencing of Dry Creek WRF improvements to accommodate peak flows during and after UWSP implementation. This updated NFA is included in Appendix J.

Appendix J includes a description of the Dry Creek WRF improvements included in the UWSP, their estimated costs, and their currently projected completion dates. The costs of the WRF improvements are included in the "Total UWSP Costs" presented in Section 9.1 (and in the associated FCA), and the schedule for WRF improvements is included in the 2034 Improvements Schedule in Section 7.

9.3 Addressing Sensitive Areas

An important component of the LTCP development process is to ensure that sensitive areas are addressed as a high priority for controlling overflows. The approved 2014 WSP performed a comprehensive analysis to identify sensitive areas (see WSP Section 6) and in fact extended the sensitive area concept to include SSO impacts as well as CSO impacts. These sensitive areas were a criterion used to identify Priority Areas in the original WSP, which in turn became a criterion used to prioritize certain overflows for control.

The sensitive area identification process and associated Priority Areas from the approved 2014 WSP remain valid today and are incorporated by reference in the UWSP. Sensitive areas have been addressed through use of the Priority Area designation in the prioritization and sequencing of UWSP projects, as described in Section 3.

9.4 Meeting Water Quality Objectives

SD1 recognizes our responsibility to develop and implement a long-term CSO control plan that will ultimately result in compliance with the requirements of the CWA. The challenge for SD1, like most CSO utilities, is to identify what that responsibility means in the context of a pragmatic, approvable plan, given the impact of background non-CSO pollutant sources and the difficulty in real-world measurement of uniquely CSO impacts on water quality.

The LTCP component of the UWSP represents SD1's approach to meeting our responsibility for developing and implementing a plan that meets the goals of the CWA and achieves the combined sewer overflow reduction milestones of 85% capture, as required by the ACD.

9.5 Public Participation Process

SD1 completed a comprehensive public participation process during development of the approved 2014 WSP (see WSP Section 5), which is incorporated by reference in the UWSP. The public outreach program worked to educate stakeholders on the issues facing Northern Kentucky, ensure that the Watershed Plans reflect the goals and concerns of the community, obtain input and feedback on key milestones, and establish ongoing communication.

SD1 has maintained a proactive public outreach program since development of the approved 2014 WSP. That outreach takes many forms, from project fact sheets to inform the public on watershed plan projects, to educational materials for local schools, to guidance for stakeholders on what they can do to help (e.g. downspout disconnect guidance). Examples of public outreach materials are provided in Appendix L.

In addition to direct outreach to the general ratepayer community, SD1 managers and field staff frequently interact with various local watershed groups in northern Kentucky. These independent watershed groups, made up of local stakeholders, often have in-depth knowledge of their watershed and so serve as informal citizen advisory groups on local issues and objectives.

While the completed 2014 WSP efforts and ongoing public interaction described above provide a strong foundation for public participation, SD1 also developed and began implementing an UWSP-specific public participation process in early 2020. SD1 was able to hold the first planned public forum and present details of the UWSP at a March 5, 2020, meeting called "What's Happening at SD1" attended by dozens of regional stakeholders including representatives from local cities, planning commissions, public works offices, Planning and Development Services (PDS), etc. (see Sign-In Sheets in Appendix L and video at https://business.facebook.com/SanitationDistrictNo.1/videos/2554670344862875). Unfortunately, shortly after this first presentation, the remaining public participation process (including additional presentations scheduled for the spring) had to be suspended when the COVID-19 pandemic forced an immediate halt to public gatherings and meetings.

On April 1, 2021, SD1 continued the public participation process in virtual format and presented a more detailed overview of the UWSP (branded as part of Clean H2O40) at the second annual What's Happening at SD1 (see Attendance Sheets in Appendix L and video at https://www.facebook.com/103664890480437/videos/151783993491161).

Both of these presentations (March 5, 2020, and April 1, 2021) were shared on SD1's website and social media accounts. The Clean H2O40 presentation from April 1, 2021, has also been edited into a standalone video to be shared on a splash page (a prominent graphical link on SD1's home page) that will include the full Updated Watershed Plan and provide an opportunity for public comments and feedback. SD1 will be advertising this page, which should be completed by the end of April, in regional newspapers in accordance with KRS 424.145.

SD1 has also been aggressive in sharing information about our Clean H2O40 Amended Consent Decree and Updated Watershed Plan Program in various traditional and nontraditional media, including bill inserts, project signage, vehicle stickers, educational videos (e.g.: https://www.facebook.com/103664890480437/videos/363041374592412). A more detailed Clean H2O40 video is currently in production. SD1 has also used regional media to share details about Clean H2O40, as evidenced by the Clean H2O40 Media Clip Report included in Appendix L.

9.6 Post-Construction Monitoring Program

SD1 is committed to meeting the post-construction monitoring requirements of the CSO Policy. The overall program will include monitoring as necessary throughout plan implementation to:

- Provide data for the ongoing refinement of hydraulic collection system models, where necessary to inform detailed design of improvements.

- Collect data to understand the impacts and performance of different control projects that impact decisions and sizing for future improvements – for example, data to characterize the efficacy of the Willow Run Detention Basin Pilot Project.

After the UWSP is fully implemented, a more detailed and formal post-construction monitoring program will be implemented to verify that the controls meet the final performance targets established in the ACD and to verify compliance of the District's CSOs with Kentucky's water quality-based CWA requirements.

9.7 Continuing SD1's Green Infrastructure Program

SD1's original CD was unique in that it incorporated a watershed-based approach into a traditional wet-weather improvement program. This approach was specifically crafted by the EPA, the Cabinet, and SD1 to allow for a program that evaluates water pollution control needs using a holistic, watershed-based approach. The ACD continues this approach, including the opportunity for SD1 to use adaptive management to improve each watershed plan submittal based on lessons learned and new information obtained since the last submittal.

Several important green infrastructure candidates from the approved 2014 WSP have been implemented, either as pilot projects or to fit an identified control need. These include the KTC Basin Retrofit, I-75 corridor Terraced Reforestation, Banklick Creek Regional Wetlands, and 12th Street Green Improvement Project. Project fact sheets for each of these completed projects are included in Appendix M. SD1 remains committed to green infrastructure where found to be cost-effective in this and future planning cycles, and will continue implementing additional projects on an opportunistic basis.

The current UWSP continues the green infrastructure component in the form of the surface stormwater detention basins included in the CSO improvements. As outlined in Sections 6 and 7, at least 17, and potentially 19, of these facilities are anticipated, beginning with the 10 locations in the Willow Run Detention Basin Pilot Project. These stormwater detention basins have not been explicitly identified as green infrastructure in the UWSP, as SD1 is claiming only the volume reduction credit as part of meeting ACD requirements. However, in implementation, these stormwater detention basins have clear opportunity to function as green infrastructure components, similar to the in-place KTC Basin Retrofit project. Decisions on potential green infrastructure enhancements to individual detention basins will be made during the siting and design process.

Appendix A: Cross Reference Between ACD Paragraph 41 and UWSP Content

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LTCP Elements

Paragraph 41(h) of the Amended CD specifies elements for inclusion in the LTCP. The following table provides a cross-reference to the location of those elements in the UWSP and 2014 WSP.

Paragraph 41(h) Item	Summary of Content Specified in Paragraph 41(h)	UWSP Location	2014 WSP Location
1)	Results of water quality assessment to coordinate CSO control with control of other sources, and demonstration that District CSOs (following LTCP implementation) comply with water quality standards considering natural background conditions and pollution sources other than CSOs.		Section 3.3.2.b Appendix 3-A "Full System Bounding Analysis"
2)	Results of characterization, monitoring, and modeling activities as the basis for selecting CSO controls.	Sections 3, 4, 5, 6, 7, and 8 Appendix G "Relationship Between Recommended Projects and Project-Specific Selection Criteria" Section 5.1.1 and 6.1.2 (relevant to controlling discharges resulting from compliance with the requirements of the United States Army Corps of Engineers' Ohio River Flood Protection System Pumping Operations Manual).	Section 2.1 Section 2.2 (with updates to current conditions included in Section 3 of UWSP) Section 7.3.1 (relevant to controlling discharges resulting from compliance with the requirements of the United States Army Corps of Engineers' Ohio River Flood Protection System Pumping Operations Manual).

3)	Results of an evaluation of WWTP peak flow treatment capacity.	Section 9.2 Appendix J “Update of Previously Approved NFA Analysis”	Section 2.4 Appendix 7-A “Dry Creek WWTP – No Feasible Alternative Analysis”
4)	Documentation of the public participation process.	Section 9.5 Appendix L “Public Participation Outreach Materials”	Section 5 Appendix 5-A “Response to Public Comments”
5)	Identification of how the LTCP addresses sensitive areas.	Section 9.3	Section 6.2.2
6)	Documentation of the cost analysis of the alternatives considered, including a financial capability assessment.	Section 9.1 Appendix H "Comprehensive Listing of UWSP Projects"" Appendix K “FCA Summary Sheets”	
7)	Operational plan revisions related to long-term CSO controls.	Sections 7.1.3 and 8.1.2	
8)	Maximization of WWTP treatment for wet weather flows.	Section 9.2 Appendix J “Update of Previously Approved NFA Analysis”	Section 2.4 Appendix 7-A “Dry Creek WWTP – No Feasible Alternative Analysis”
9)	Identification of, and an implementation schedule for, the selected CSO controls.	Identification of: Sections 4, 5, 6, 7, and 8 Implementation schedule for: Tables 5-10, 6-16, 7-16, 7-17, 8-15, and 8-16	
10)	Documentation of the post-construction compliance monitoring program.	Section 9.6	

SSOP Elements

Paragraph 41(i) of the Amended CD specifies elements for inclusion in the SSOP. The following table provides a cross-reference to the location of those elements in the UWSP and 2014 WSP.

Paragraph 41(i) Item	Summary of Content Specified in Paragraph 41(i)	UWSP Location	2014 WSP Location
1)	Results of an evaluation of WWTP peak flow treatment capacity.	Section 9.2 Appendix J "Update of Previously Approved NFA Analysis"	Section 2.4 Appendix 7-A "Dry Creek WWTP – No Feasible Alternative Analysis"
2)	Map showing location of all known capacity-related SSOs and Unpermitted Discharges.	Figure ES-1 Figures in Appendix D "SSO Characterization"	Figure 2.11, Figure 2.20, Figure 2.24, Figure 2.28, Figure 2.32 (with updates to current conditions included in Figure ES-1 and Appendix D of UWSP)
3)	Smaller maps of individual tributary areas as warranted.	Appendix N "Project Summary Graphics"	
4)	Description of each capacity-related SSO and Unpermitted Discharge location.	Appendix D "SSO Characterization"	Section 2.2 (with updates to current conditions included in Section 3 and Appendix D of UWSP)
5)	Prioritization of the capacity-related SSOs and Unpermitted Discharge locations, and description of projects with associated schedules for eliminating these discharges.	Sections 3.7, 4, 5, 6, 7, and 8 Appendix G "Relationship Between Recommended Projects and Project-Specific Selection Criteria"	Section 6.2.2, 6.2.7

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Appendix B: Model Updates Since 2014

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Figure I-1: 2014 Model Calibration Refinement Project Areas

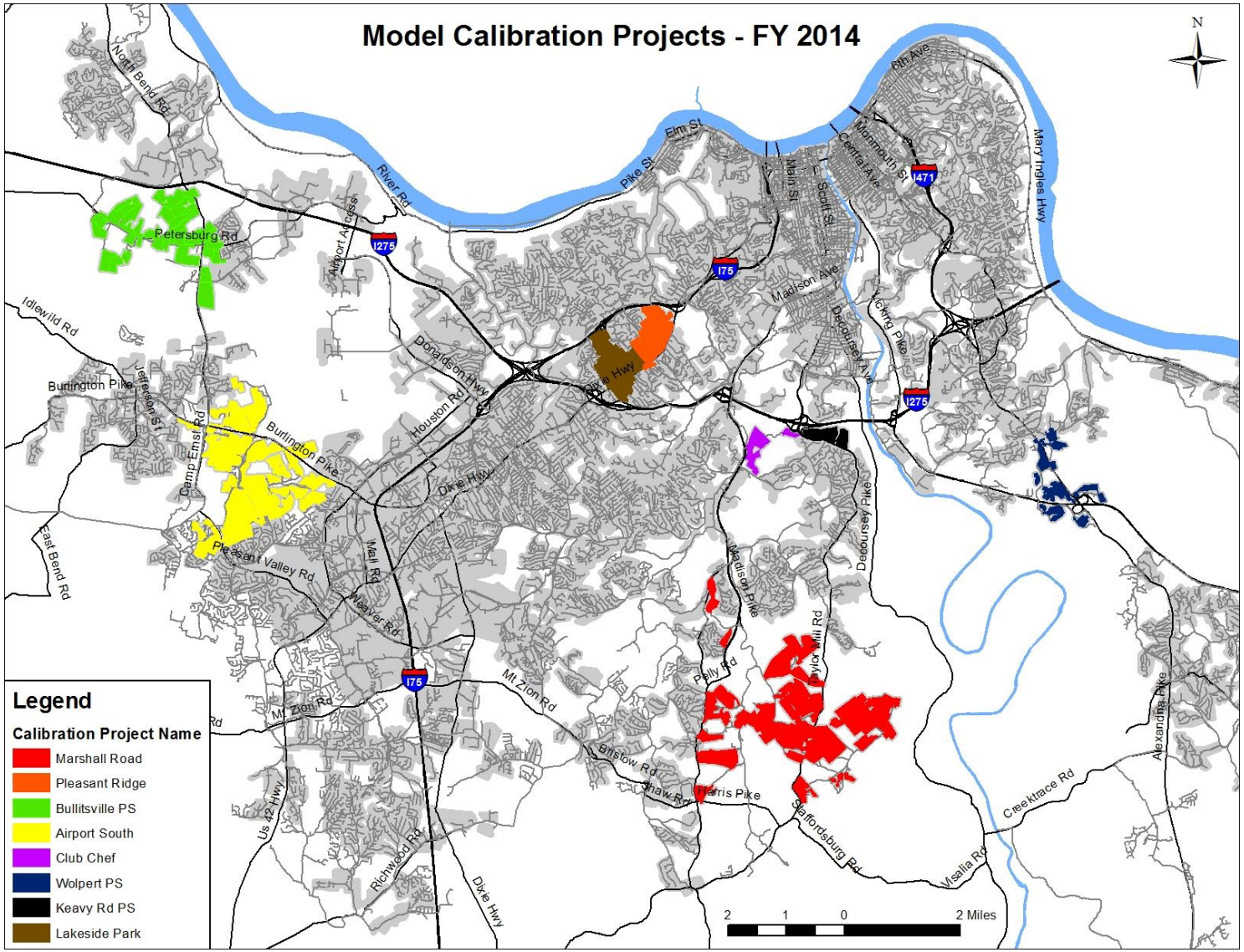


Figure I-2: 2015 Model Calibration Refinement Project Areas

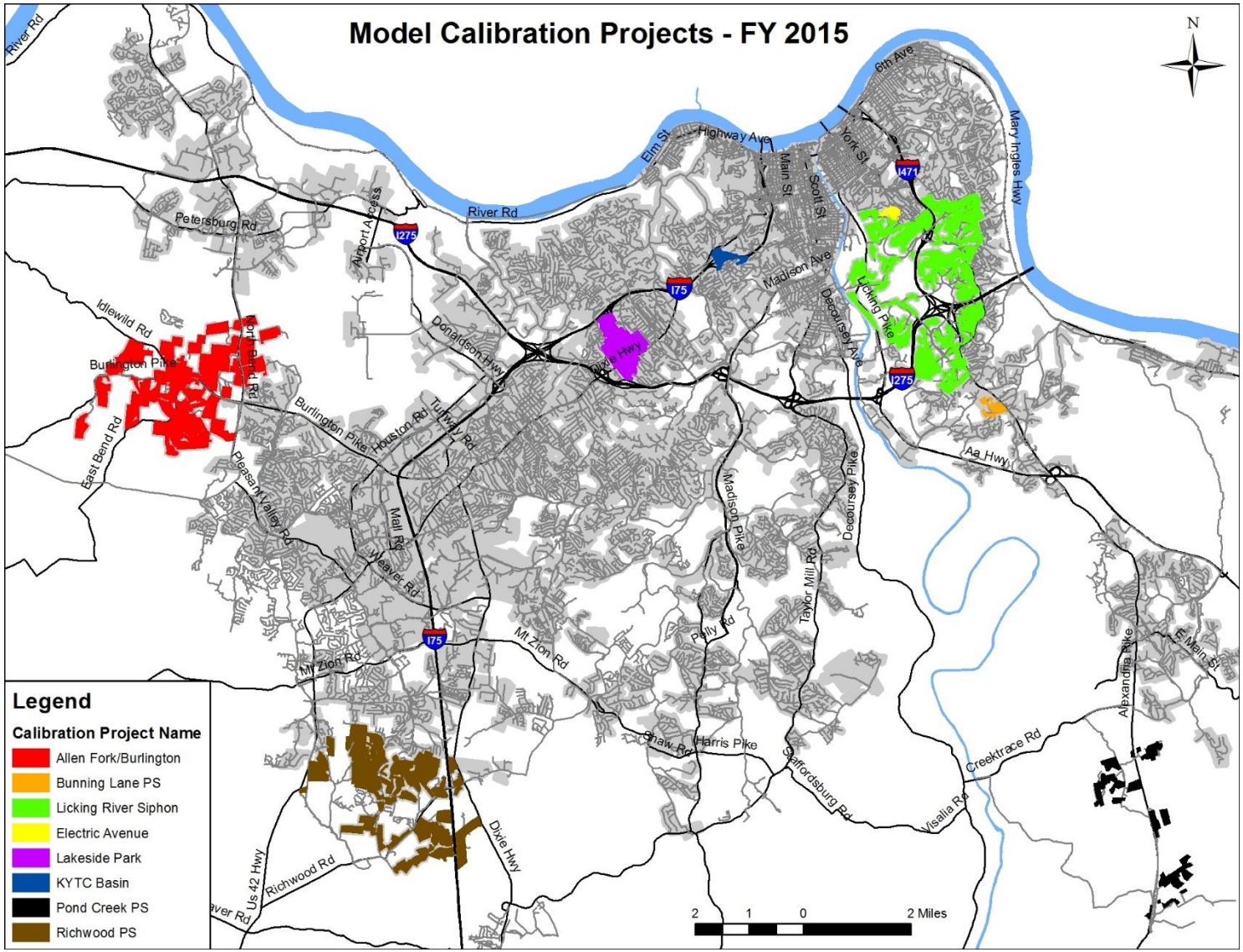


Figure I-3: 2016 Model Calibration Refinement Project Areas

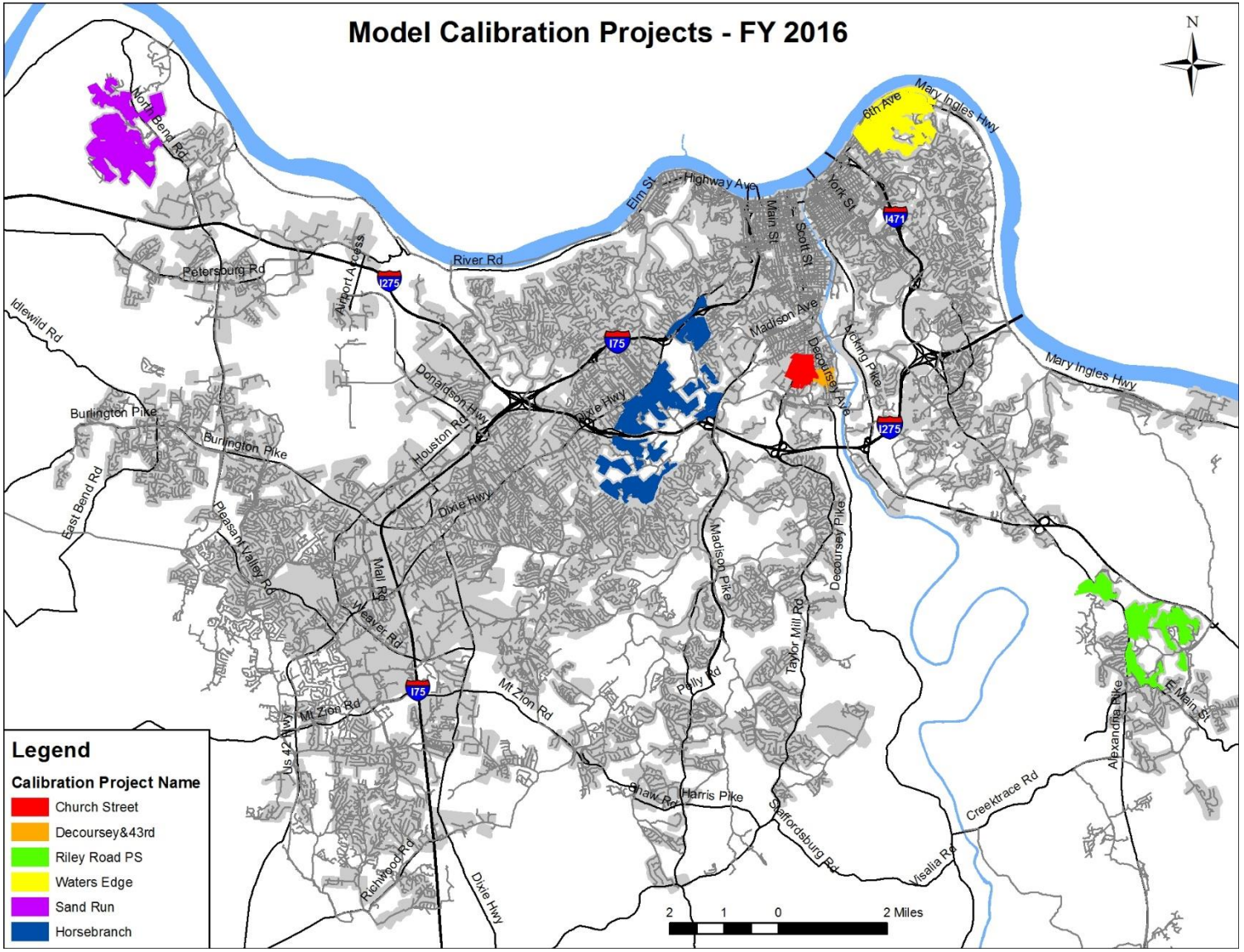


Figure I-4: 2017 Model Calibration Refinement Project Areas

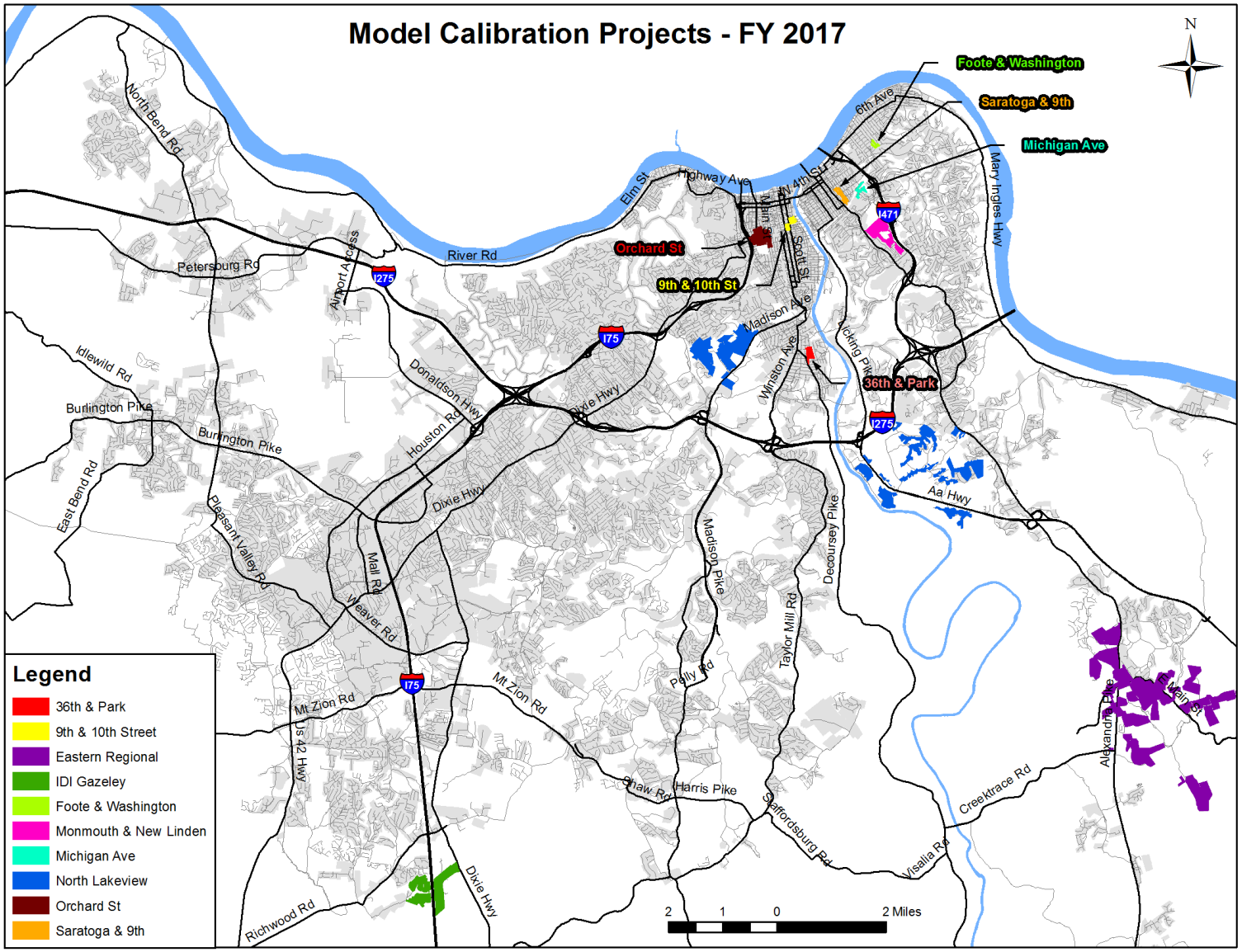


Figure I-5: 2018 Model Calibration Refinement Project Areas

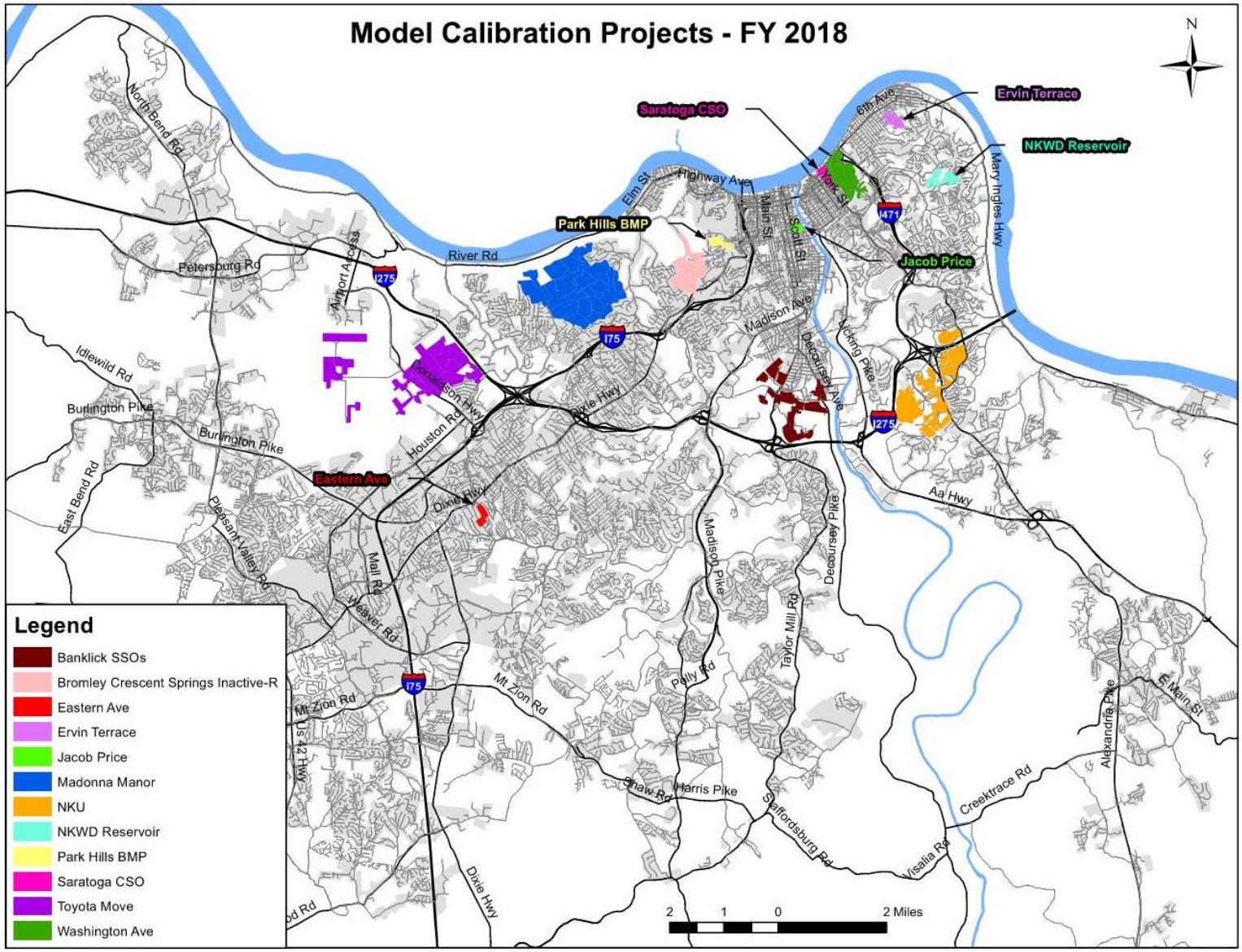


Figure I-6: 2019 Model Calibration Refinement Project Areas

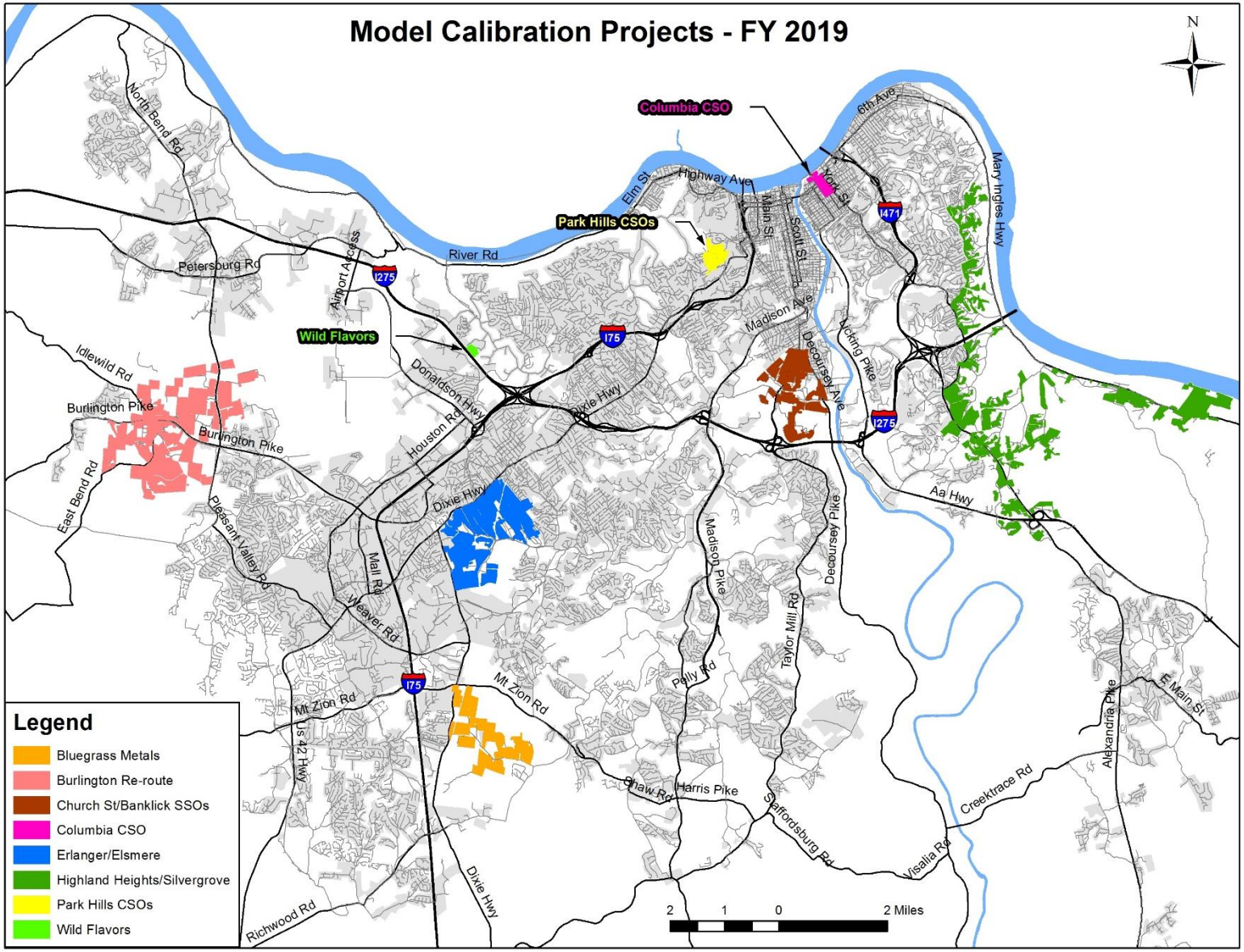
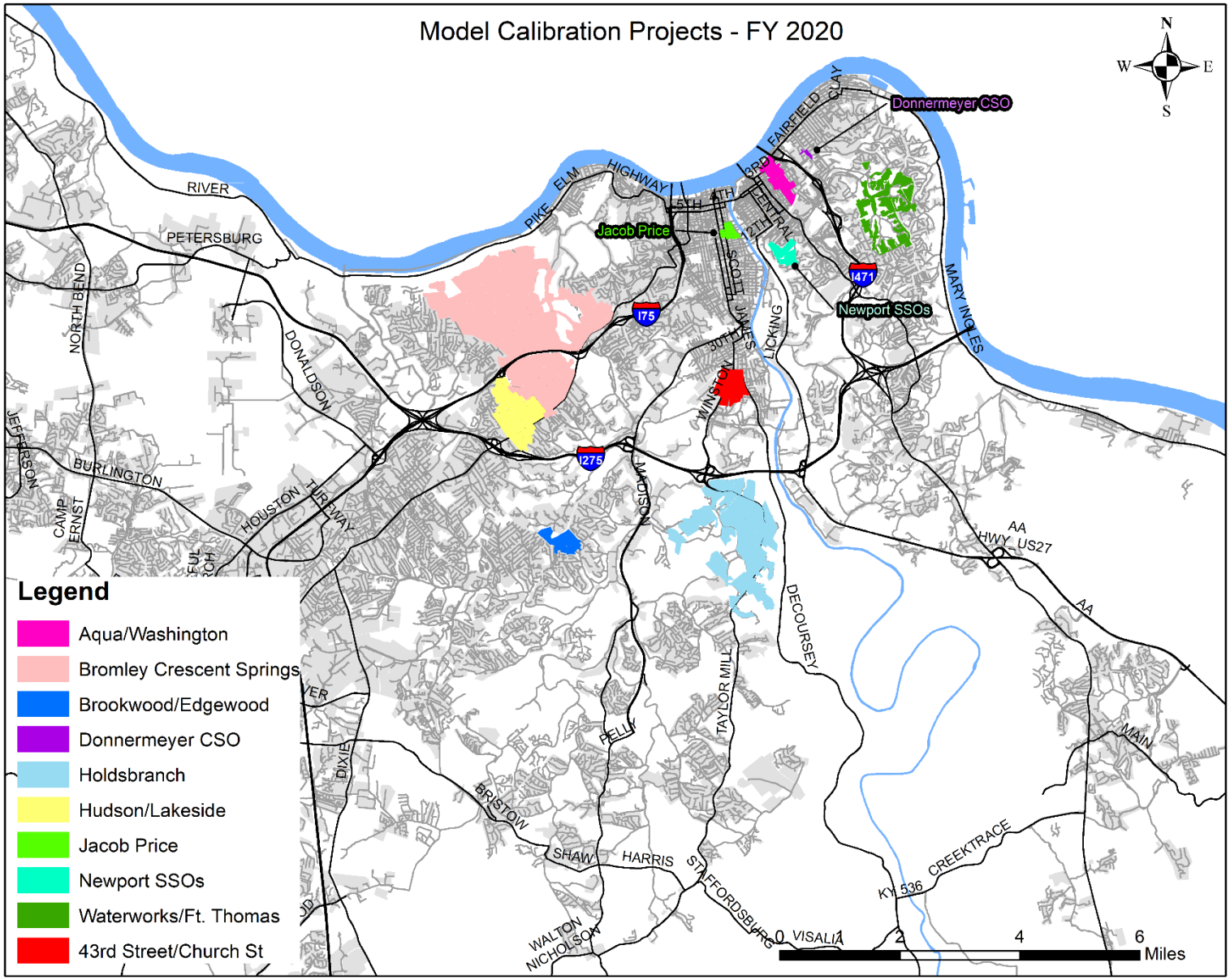


Figure I-7: 2020 Model Calibration Refinement Project Areas



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Appendix C: CSO Characterizations

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Table 15, Pages 23-27, KPDES Fact Sheet KY 0021466, May 17, 2019

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
010	External	39.062039°	84.437283°	Unnamed Tributary to Ohio River	Untreated CSO from Carmel Manor Rd CSO ID 0030031	7	0.061	0	0	0	0
011	External	39.073216°	84.439588°	Unnamed Tributary to Ohio River	Untreated CSO from Mary Ingles Hwy CSO ID 0200069	32	0.764	0	0	0	0
012	External	39.097319°	84.440467°	Unnamed Tributary to Ohio River	Untreated CSO from Tower Hill Rd CSO ID 0330100	0	0	0	0	0	0
013	External	39.075013°	84.440420°	Unnamed Tributary to Ohio River	Untreated CSO from Manor Ln CSO ID 0340051	19	0.192	0	0	0	0
014	External	39.087055°	84.439078°	Unnamed Tributary to Ohio River	Untreated CSO from Burnet Ridge CSO ID 0340050	19	0.453	0	0	0	0
016	External	39.115305°	84.477346°	Ohio River	Untreated CSO from McKinney St CSO ID 0570089	19	24.929	25	83.132	21	63.261
017	External	39.118053°	84.467686°	Ohio River	Untreated CSO from Main St CSO ID 0570090	5	3.444	6	4.432	5	3.221
018	External	39.109485°	84.484290°	Ohio River	Untreated CSO or Stormwater from Foote Ave CSO ID 0600094	17	0.497	1	0.008	0	0
019	External	39.110195°	84.483822°	Ohio River	Untreated CSO from Ward Ave CSO ID 0600097	30	4.051	12	1.129	14	0.996
020	External	39.108959°	84.484915°	Ohio River	Untreated CSO from Washington Ave CSO ID 0610072	16	0.569	12	0.382	13	0.369
021	External	39.107491°	84.485842°	Ohio River	Untreated CSO from Taylor Ave CSO ID 0610071	47	21.066	14	1.590	13	1.510
022	External	39.106153°	84.486833°	Ohio River	Untreated CSO from Lafayette Ave CSO ID 0620077	24	0.288	0	0	0	0

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
023	External	39.103714°	84.488676°	Ohio River	Untreated CSO from Patchen St CSO ID 0620075	55	8.658	22	2.291	22	2.284
024	External	39.097547°	84.495027°	Ohio River	Untreated CSO from Washington Ave Chamber CSO ID 0640090	61	230.697	24	7.717	24	7.779
025	External	39.094216°	84.479007°	Unnamed Tributary to Ohio River (Taylor Creek)	Untreated CSO from Geiger Ave CSO ID 0650100	3	0.118	5	0.219	5	0.219
026	External	39.101485°	84.488758°	Unnamed Tributary to Ohio River (Taylor Creek)	Untreated CSO or Stormwater from Taylor Bottoms CSO ID 0650090	28	7.418	26	178.045	25	178.238
027	External	39.077734°	84.497751°	Licking River	Untreated CSO or Stormwater from 12th St – River Metals CSO ID 0730129	71	1.698	6	0.274	6	0.274
028	External	39.096603°	84.496062°	Ohio River	Untreated CSO from Saratoga St CSO ID 0770096	32	3.879	0	0	1	0.044
029	External	39.088868°	84.503625°	Licking River	Untreated CSO from 4th St Chamber CSO ID 0790086	63	95.834	7	3.067	13	11.967
030	External	39.089123°	84.523640°	Ohio River	Untreated CSO from Willow Run CSO ID 1480187	78	404.409	36	131.826	36	128.180
031	External	39.094163°	84.500068°	Ohio River	Untreated CSO from Columbia St Chamber CSO ID 0790084	68	15.156	23	2.632	23	2.698
033	External	39.049433°	84.493991°	Licking River	Untreated CSO from Park Drive CSO ID 0870078	3	0.254	3	0.362	3	0.294
034	External	39.048351°	84.492595°	Licking River	Untreated CSO from Southern – Twin Oaks CSO ID 0870079	67	16.445	12	2.394	13	2.609
035	External	39.053826°	84.496956°	Licking River	Untreated CSO from 33rd St CSO ID 0880082	6	0.447	3	0.226	3	0.238

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
036	External	39.052274°	84.495955°	Licking River	Untreated CSO from 34th St CSO ID 0880081	64	35.068	11	2.869	12	2.657
037	External	39.063108°	84.496120°	Licking River	Untreated CSO from Oakland & Florist CSO ID 0910068	43	31.916	9	5.259	4	2.032
038	External	39.058517°	84.498133°	Licking River	Untreated CSO from James Ave CSO ID 0910065	68	173.613	16	113.558	18	93.019
039	External	39.072361°	84.494208°	Licking River	Untreated CSO from 16th St CSO ID 0930106	0	0	0	0	0	0
040	External	39.071442°	84.493914°	Licking River	Untreated CSO from 17th St CSO ID 0930104	3	0.049	3	0.055	2	0.048
041	External	39.069849°	84.494683°	Licking River	Untreated CSO or Stormwater from 19th St & Glenway Ave ID 0930105	67	30.208	12	5.456	14	53.738
042	External	39.067566°	84.494739°	Licking River	Untreated CSO from 20th St CSO ID 0930103	3	0.052	0	0	0	0
043	External	39.065970°	84.495160°	Licking River	Untreated CSO from Durrett Ave CSO ID 0930102	0	0	0	0	0	0
044	External	39.075385°	84.497181°	Licking River	Untreated CSO from 15th St CSO ID 0960064	2	0.013	2	0.004	2	0.004
045	External	39.073539°	84.495377°	Licking River	Untreated CSO or Stormwater from Patton St CSO ID 0960063	29	6.985	5	0.768	4	0.884
046	External	39.079125°	84.499858°	Licking River	Untreated CSO from 12th St CSO ID 0980073	11	0.135	11	0.152	11	0.152
047	External	39.077970°	84.499091°	Licking River	Untreated CSO from 13th St CSO ID 0980080	2	0.027	8	0.335	7	0.235
048	External	39.077302°	84.498634°	Licking River	Untreated CSO or Stormwater from Maryland St CSO ID 0980081	75	45.388	13	4.863	14	5.273

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
050	External	39.085541°	84.504684°	Licking River	Untreated CSO or Stormwater from Garrard St & 6th St CSO ID 1420141	31	0.676	3	0.013	3	0.118
051	External	39.083225°	84.503372 °	Licking River	Untreated CSO or Stormwater from Garrard St & 8th St CSO ID 1420142	70	96.377	3	1.136	14	21.431
052	External	39.082346°	84.502601°	Licking River	Untreated CSO or Stormwater from 9th St CSO ID 1420144	3	0.029	3	0.099	3	0.098
053	External	39.081793°	84.502153°	Licking River	Untreated CSO or Stormwater from 10th St CSO ID 1420145	3	0.045	0	0	0	0
054	External	39.081192°	84.501709°	Licking River	Untreated CSO or Stormwater from Robbins St CSO ID 1420146	0	0	0	0	0	0
055	External	39.080308°	84.500686°	Licking River	Untreated CSO or Stormwater from 11th St CSO ID 1420147	2	0.012	0	0	0	0
056	External	39.089765°	84.515114°	Ohio River	Untreated CSO or Stormwater from River Center at Russell St CSO ID 1440209	106	97.597	15	5.191	15	5.001
059	External	39.090968°	84.510417°	Ohio River	Untreated CSO or Stormwater from Scott St CSO ID 1440204	3	0.095	3	0.058	3	0.058
060	External	39.091071°	84.509154°	Ohio River	Untreated CSO or Stormwater from Greenup St CSO ID 1440508	16	0.510	23	0.777	23	0.780
061	External	39.091460°	84.507115°	Ohio River	Untreated CSO or Stormwater from Garrard St CSO ID 1440206	33	3.064	27	1.044	27	1.049

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
062	External	39.089350°	84.520025°	Ohio River	Untreated CSO or Stormwater from Philadelphia St CSO ID 1470089	5	0.282	0	0	0	0
063	External	39.089436°	84.517597°	Ohio River	Untreated CSO or Stormwater from Main St (Covington) CSO ID 1470093	56	56.698	11	1.657	7	1.554
064	External	39.091928°	84.531473°	Ohio River	Untreated CSO from Swain Ct CSO ID 1490172	0	0	0	0	0	0
065	External	39.090754°	84.529541°	Ohio River	Untreated CSO from Parkway Ave at Highway Ave CSO ID 1490132	8	1.453	4	0.564	4	0.536
066	External	39.095513°	84.538670°	Ohio River	Untreated CSO from Post Pl & West St CSO ID 1500131	46	7.761	33	6.750	33	6.739
068	External	39.093156°	84.555211°	Ohio River	Untreated CSO from Adela St CSO ID 1710116	53	12.413	36	5.272	36	5.244
069	External	39.095930°	84.551274°	Ohio River	Untreated CSO or Stormwater from Kenner St CSO ID 1710114	9	0.396	9	0.284	9	0.299
070	External	39.096119°	84.550061°	Ohio River	Untreated CSO from Butler St CSO ID 1710119	30	3.073	24	5.808	24	3.084
071	External	39.096706°	84.547591°	Ohio River	Untreated CSO from Carneal St CSO ID 1710121	22	2.507	18	2.000	16	1.322
072	External	39.096798°	84.543748°	Ohio River	Untreated CSO from Ash St (Ludlow) CSO ID 1710124	23	3.416	18	2.589	17	2.024
073	External	39.086956°	84.559775°	Ohio River	Untreated CSO from Lagoon St CSO ID 1720109	37	14.153	34	15.928	33	13.297
074	External	39.083150°	84.564250°	Ohio River	Untreated CSO or Stormwater from Rohman St CSO ID 1730263	36	1.889	36	1.852	36	1.852

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
075	External	39.085299°	84.560073°	Pleasant Run Creek	Untreated CSO from Pleasant St CSO ID 1730259	25	2.138	21	1.854	21	1.844
076	External	39.036099°	84.505193°	Banklick Creek	Untreated CSO or Stormwater from Church St CSO ID 1850158	28	15.165	23	11.412	23	11.408
078	External	39.033783°	84.495966°	Banklick Creek	Untreated CSO from Decoursey Ave ID 1870193	26	1.215	3	0.063	3	0.063
079	External	39.033712°	84.494090°	Banklick Creek	Untreated CSO from 47th St CSO ID 1870194	4	0.108	6	0.394	6	0.394
080	External	39.040007°	84.485768°	Licking River	Untreated CSO or Stormwater from 44th St CSO ID 1880091	17	1.435	5	0.885	5	0.895
081	External	39.038211°	84.487045°	Licking River	Untreated CSO or Stormwater from 45th St & Virginia Ave CSO ID 1880090	31	1.969	8	0.967	10	0.985
083	External	39.100174°	84.492045°	Ohio River	Untreated CSO or Stormwater from Riverside Dr CSO ID 0630061	25	2.075	2	0.490	2	0.490
084	External	39.036200°	84.397126°	Unnamed Tributary to Fourmile Creek	Untreated CSO from or Stormwater Ash St (Silver Grove) CSO ID 0010220	20	1.379	0	0	0	0
085	External	39.109710°	84.447455°	Unnamed Tributary to Ohio River	Untreated CSO from Anchor Inn CSO ID 0360079	19	2.106	4	0.295	4	0.295
086	External	39.111471°	84.482554°	Ohio River	Untreated CSO or Stormwater from O'Fallon Ave CSO ID 0600096	5	0.119	5	0.120	5	0.120
087	External	39.110769°	84.483387°	Ohio River	Untreated CSO or Stormwater from Van Voast Ave ID 0600104	1	0.003	2	0.041	2	0.036

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
088	External	39.099851°	84.473226°	Unnamed Tributary to Ohio River (Covert Run)	Untreated CSO from South Ward Ave CSO ID 0550134	4	0.057	1	0.003	1	0.003
089	External	39.099267°	84.477944°	Unnamed Tributary to Ohio River (Covert Run)	Untreated CSO or Stormwater from Taylor & Retreat CSO ID 0540158	1	0.021	0	0	0	0
090	External	39.099100°	84.479241°	Unnamed Tributary to Ohio River (Covert Run)	Untreated CSO from Covert Run Lafayette CSO ID 0540156	28	1.059	7	0.182	7	0.182
091	External	39.098777°	84.479798°	Unnamed Tributary to Ohio River (Covert Run)	Untreated CSO from Covert Run Berry Ave CSO ID 0540157	31	0.878	5	0.085	5	0.085
092	External	39.093311°	84.476971°	Unnamed Tributary to Ohio River (UT to Taylor Creek)	Untreated CSO from Glazier Ave CSO ID 0650054	0	0	2	0.009	2	0.009
093	External	39.096297°	84.482249°	Unnamed Tributary to Ohio River (Taylor Creek)	Untreated CSO from Wildcat CSO ID 0650098	15	7.215	0	0	0	0
094	External	39.095021°	84.480379°	Unnamed Tributary to Ohio River (Taylor Creek)	Untreated CSO or Stormwater from Linden Ave & 9th St CSO ID 0660085	17	0.461	15	0.432	15	0.432
095	External	39.097500°	84.486577°	Unnamed Tributary to Ohio River (UT to Taylor Creek)	Untreated CSO from Linden Ave & Nelson Pl CSO ID 0630054	0	0	0	0	0	0

Outfall No.	Outfall Type	Latitude (N)	Longitude (W)	Receiving Water	Description of Outfall	Baseline		UWSP – Tunnel Solution Model		UWSP – EQ Solution Model	
						Activations	Volume (MG)	Activations	Volume (MG)	Activations	Volume (MG)
096	External	39.082142°	84.501272°	Licking River	Untreated CSO or Stormwater from 9th St at KY-9 CSO ID 0840111	2	0.115	7	2.900	8	4.630
097	External	39.080968°	84.500218°	Licking River	Untreated & Treated CSO from 10th St at KY-9 CSO ID 0840112	52	2.808	5	0.283	4	0.231
098	External	39.089531°	84.504905°	Licking River	Untreated CSO from Kennedy St CSO ID 1440207	56	0.244	11	0.020	11	0.020
099	External	39.058200°	84.498443°	Licking River	Untreated CSO from Eastern Ave at Greenup St CSO ID 0910084	4	0.222	8	0.317	5	0.243
100	External	39.060179°	84.497462°	Licking River	Untreated CSO or Stormwater from Adams St CSO ID 0910066	0	0	0	0	0	0
101	External	39.045596°	84.518843°	Unnamed Tributary to Banklick Creek	Untreated CSO from 33rd St & Howard Litzler Rd CSO ID 1840130	23	0.876	24	0.776	25	0.824
102	External	39.089547°	84.527008°	Ohio River	Untreated CSO from Highway Ave at Wright St CSO ID 1480185	24	1.495	24	1.513	24	1.513
103	External	39.078481°	84.498158°	Licking River	Untreated CSO or Stormwater from Fitzsimmons St CSO ID 0840116	74	5.594	3	0.329	3	0.329
104	External	39.081137°	84.557496°	Unnamed Tributary to Pleasant Run Creek	Untreated CSO or Stormwater from Moore St CSO ID 1730262	0	0	0	0	0	0
105	External	39.094898°	84.480178°	Unnamed Tributary to Ohio River (Taylor Creek)	Untreated CSO or Stormwater from Monmouth St & Carothers St CSO ID 0690067	29	0.141	7	0.028	7	0.028

Table 16, Pages 27-39, KPDES Fact Sheet KY 0021466, May 17, 2019

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
010	Active	A net bag is on the end of the outfall pipe. This CSO discharges only combined sewage.	Carmel Manor Rd ID 0030017	Elevated overflow pipe in manhole
011	Active	Also called Government Sewer CSO. A net bag is on the end of the outfall pipe. This CSO discharges only combined sewage.	Mary Ingles Hwy ID 0200066	Elevated overflow pipe in manhole
012	Active	A tideflex valve and net bag are on the end of the outfall pipe. This CSO discharges only combined sewage.	Tower Hill Rd ID 0330099	Weir dam and orifice in manhole
013	Active	A net bag is on the end of the outfall pipe. This CSO discharges only combined sewage.	Manor Ln ID 0340044	Elevated overflow pipe in manhole
014	Active	A tideflex valve and net bag are on the end of the outfall pipe. This CSO discharges only combined sewage.	Burnet Ridge ID 0340034	Elevated overflow pipe in manhole
015	Eliminated	Elsmar St CSO ID 0350079 to Unnamed Tributary of Ohio River Outfall elimination certified 8/17/2018		
016	Active	Tideflex valve on end of CSO outfall. Bar rack upstream of and Nutrient-Separating Baffle Box on CSO outfall pipe. Combined sewer goes through Dayton Flood Protection System floodwall to Ohio River Interceptor. Gatewell #2 flood gate 0570093 closes at 49.2' river stage on combined sewer upstream of the regulator and all combined sewage is routed to McKinney St Flood PS to Flood PS outfall pipes. This outfall discharges only combined sewage.	McKinney St ID 0570011	Weir dam and orifice in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
017	Active	Tideflex valve on end of CSO outfall. Bar rack upstream of and Nutrient-Separating Baffle Box on CSO outfall pipe. Combined sewer goes through Dayton Flood Protection System floodwall to Ohio River Interceptor. Gatewell #1 flood gate 0570031 closes at 47' river stage on combined sewer upstream of the regulator and all combined sewage is routed to Main St (Dayton) Flood PS to Flood PS outfall pipes. This outfall discharges only combined sewage.	Main St ID 0570030	Weir dam and orifice in manhole
018	Active	A tideflex valve is on the end of the outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Foote Ave ID 0600002	Leaping weir in manhole
019	Active	A tideflex valve is on the end of the outfall pipe. This CSO discharges only combined sewage.	Ward Ave ID 0600016	Leaping weir in manhole
020	Active	A tideflex valve is on the end of the outfall pipe. This CSO discharges only combined sewage.	Washington Ave ID 0610006	Leaping weir in manhole
021	Active	A tideflex valve is on the end of the outfall pipe. This CSO discharges only combined sewage.	Taylor Ave ID 0610080	Leaping weir in manhole
022	Active	A tideflex valve is on the end of the outfall pipe. This CSO discharges only combined sewage.	Lafayette Ave ID 0620015	Leaping weir in manhole
023	Active	This CSO discharges only combined sewage	Patchen St ID 0620031	Leaping weir in manhole
024	Active	A tideflex valve is on the end of the outfall pipe and a flap gate is on the outfall pipe at the regulator chamber. Combined sewer goes through Newport Flood Protection System floodwall to Ohio River Interceptor. Gatewell #2 flood gate 0640082 closes at 48' river stage on combined sewer upstream of the regulator and all combined sewage is routed to Washington St Flood PS and on to the regulator. This outfall discharges only combined sewage.	Washington Ave Chamber ID 0640081	Weir dam and orifice in chamber
025	Active	There is a bar rack upstream of this CSO. This CSO discharges only combined sewage	Geiger Ave ID 0650041	Slide gate and orifice in manhole
026	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Taylor Bottoms ID 0650084	Elevated overflow pipe in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
027	Active	CSO outfall goes through Newport Flood Protection System floodwall. Flood gate 0730001 opens and flood gate 0730103 closes at 59.5' river stage on CSO outfall pipe and all combined sewage stays within the CSS at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Fitzimmons St ID 0730005	Leaping weir in manhole
			12th St #1 ID 0730009	Weir dam and orifice in manhole
028	Active	Combined sewer goes through Newport Flood Protection System floodwall to Ohio River Interceptor. Gatewell #3 flood gate 0770102 closes at 48' river stage on combined sewer upstream of the regulator and all combined sewage stays within the CSS at this outfall. This outfall discharges only combined sewage.	Saratoga St ID 0770006	Leaping weir in manhole
029	Active	A check valve is on the end of the outfall pipe and a flap gate is on the outfall pipe at the regulator chamber. Combined sewer goes through Newport Flood Protection System floodwall towards Ohio River Interceptor. Gatewell #5 flood gate 0820128 closes at 44’ river stage on combined sewer upstream of the regulator and all combined sewage is routed to 4th St Flood PS and on to the regulator. This outfall discharges only combined sewage.	4th St Chamber ID 0820001	Weir dam and orifice in chamber
030	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #1 flood gate 1480198 closes at 45.9’ river stage on CSO outfall pipe and Willow Run Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Willow Run ID 1480116	Weir dam and orifice in manhole
			8th St & Philadelphia St ID 1480129	Leaping weir in manhole
			Dalton St ID 1480123	Leaping weir in manhole
			West 4th St ID 1480108	Leaping weir in manhole
			Crescent Ave ID 1480103	Elevated overflow pipe in manhole
			West 3rd St at I-75 ID 1480097	Leaping weir in manhole
			West 3rd St ID 1480012	Leaping weir in manhole
			5th St ID 1480062	Leaping weir in manhole
			Philadelphia St ID 1470003	Leaping weir in manhole
			Arlington Rd & Dixie Hwy ID 1320093	Elevated overflow pipe in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
			Park Hills-Dixie Hwy ID 1350104	Elevated overflow pipe in manhole
			Short Arlington Rd ID 1380083	Elevated overflow pipe in manhole
			Parkvale Ln ID 1380054	Elevated overflow pipe in manhole
			Marcella Dr ID 1510133	Elevated Overflow pipe in manhole
031	Active	A flapgate is on the end of the outfall pipe and on the outfall pipe at the regulator chamber. The dry weather portion of the CSO flow passes through a bar rack. Combined sewer goes through Newport Flood Protection System floodwall to Ohio River Interceptor. Gatewell #4 flood gate 0790095 closes at 49' river stage on combined sewer and all combined sewage is routed to Columbia St Flood PS and on to the regulator. This outfall discharges only combined sewage.	Columbia St Chamber ID 0790015	Weir dam and orifice in chamber
032	Eliminated	Summit Dr CSO 0870040 to Licking River Outfall elimination certified 10/15/2018		
033	Active	This outfall discharges only combined sewage	Park Dr ID 0870007	Leaping weir in manhole
034	Active	Also called Southern Ave at Myrtle. A tideflex valve is on the end of the outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	38th St ID 0870021	Leaping weir in manhole
			Southern Ave ID 0870039	Leaping weir in manhole
			Glenn Ave ID 0870052	Leaping weir in manhole
			Twin Oaks - South ID 0870019	Leaping weir in manhole
			Twin Oaks - North ID 0870071	Leaping weir in manhole
035	Active	This outfall discharges only combined sewage	33rd St ID 088000	Leaping weir in manhole
036	Active	This outfall discharges only combined sewage	34th St ID 0880017	Leaping weir in manhole
037	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #18 flood gate 0910020 closes at 49.4' river stage on CSO outfall pipe and 24th St (Eastern Ave) Flood PS pumps CSO flow back into CSO outfall pipe. Combined sewer goes through Covington Flood Protection System floodwall to Licking River Interceptor. Gatewell #17	Holmes High School ID 0910025	Leaping weir in manhole
			Eastern Ave - South ID 0910031	Leaping weir in manhole
			Eastern Ave - North ID 0910027	Leaping weir in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
		flood gate 0910070 closes at 62' river stage on combined sewer between regulators 0910007 and 0910005 and combined flow is routed to 24th St (Eastern Ave) Flood PS. This outfall discharges only combined sewage.	Oakland Ave ID 0910007	Elevated overflow pipe in manhole
			Licking River Greenway ID 0910005	Weir dam and orifice in manhole
038	Active	Also known as Eastern Ave CSO. This outfall discharges only combined sewage.	James Ave ID 0910064	Weir dam and orifice in manhole
			28th St ID 0890063	Elevated Overflow Pipe
039	Active	Combined sewer goes through Covington Flood Protection System floodwall towards Licking River Interceptor. Gatewell #11 flood gate 0930108 closes at 51' river stage on combined sewer between regulators and combined flow remains in the collection system at this flood gate. This outfall discharges only combined sewage.	16th St #1 ID 0930002	Weir dam and orifice in manhole
			16th St #2 ID 0930014	Elevated overflow pipe in manhole
040	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #13 flood gate 0930027 closes at 45.5' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges only combined sewage.	17th St ID 0930026	Leaping weir in manhole
041	Active	Also called 19th St and Oakland Ave CSO. CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #14 flood gate 0930065 closes at 45.5' river stage on CSO outfall pipe and 19th St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Glenway Ave - South #1 ID 0930056	Leaping weir in manhole
			Glenway Ave - South #2 ID 0930066	Leaping weir in manhole
			19th St ID 0930041	Leaping weir in manhole
			Glenway Ave - North ID 0930050	Leaping weir in manhole
042	Active	Combined sewer goes through Covington Flood Protection System floodwall. Gatewell #15 flood gate 0930074 closes at 57.1' river stage on combined sewer upstream of regulator and all combined flow remains in the collection system at this flood gate. This outfall discharges only combined sewage.	20th St ID 0930075	Leaping weir in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
043	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #16 flood gate 0930085 closes at 45.5' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges only combined sewage.	Durrett St & Glenway Ave ID 0930083	Leaping weir in manhole
044	Active	A tideflex valve and net bag are on the end of the outfall pipe. CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #9 flood gate 0960004 closes at 51' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges only combined sewage.	15th St ID 0960003	Leaping weir in manhole
045	Active	Also called Oliver St CSO. A larflex valve is on the end of the outfall pipe. CSO outfall goes through Covington Flood Protection System floodwall. At 41'river stage, Patton St PS is shut off and combined flow is routed to the CSO outfall. At 51'river stage, gatewell #10 flood gate 0960025 closes on CSO outfall pipe and Patton St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS	Oliver St ID 0960027	Leaping weir in manhole
			Patton St ID 0960032	Leaping weir in manhole
046	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #6 flood gate 0980004 closes at 55.6' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges only combined sewage.	12th St ID 0980002/0980003	Leaping weir in chamber
047	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #7 flood gate 0980083 closes at 55.6' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges only combined sewage.	13th St ID 0980016	Leaping weir in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
048	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #8 flood gate 0980082 closes at 55.6' river stage on CSO outfall pipe and Pleasant St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Maryland St ID 0980036	Weir dam and orifice in chamber
049	Internal	This CSO no longer discharges to a receiving water and is included in the table of internal release points in Section 4.3.4 below.		
050	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	6th and Garrard St ID 1420004	Elevated overflow pipe in manhole
051	Active	CSO outfall goes through Covington Flood Protection System floodwall. At 41'river stage, 8th St PS is shut off and combined flow is routed to the CSO outfall. Gatewell #1 flood gate 1420017 closes at 54.3' river stage on CSO outfall pipe and 8th St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Sanford St ID 1420028	Leaping weir in manhole
			8th St #1 ID 1420025	Leaping weir in manhole
			Garrard St & 8th St ID 1420022	Leaping weir in manhole
			8th St #2 ID 1420014	Elevated overflow pipe in manhole
052	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #2 flood gate 1420152 closes at 54.3' river stage on CSO outfall pipe and combined flow remains in the collection system at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	9th St ID 1420032	Leaping weir in manhole
053	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #3 flood gate 1420151 closes at 54.3' river stage on CSO outfall pipe and combined flow remains in the collection system at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	10th St ID 1420043	Leaping weir in manhole
054	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #4 flood gate 1420150 closes at 54.3' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Robbins St ID 1420076	Leaping weir in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
055	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #5 flood gate 1420080 closes at 54.3' river stage on CSO outfall pipe and all combined flow remains in the collection system at this outfall. This outfall also discharges separate stormwater that has not entered the CSS.	11th St ID 1420079	Leaping weir in manhole
056	Active	CSO outfall goes through Covington Flood Protection System floodwall. Gatewell #2 flood gate 1440215 closes at 51.3' river stage on CSO outfall pipe and Russell St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	River Center at Russell St ID 1440002	Leaping weir in manhole
			Washington St ID 1440053	Leaping weir in manhole
			Madison Ave ID 1440072	Leaping weir in manhole
			Scott St ID 1440100	Leaping weir in manhole
057	Eliminated	Washington St CSO ID 1440211 to Ohio River Outfall elimination certified 10/15/2018 Regulator now discharges to CSO 056		
058	Eliminated	Madison Ave CSO ID 1440212 to Ohio River Outfall elimination certified 10/15/2018 Regulator now discharges to CSO 056		
059	Active	CSO outfall goes through Covington Flood Protection System floodwall. Flood gate 1440265 closes at 45.9' river stage on pipe to CSO 056 outfall and Russell St Flood PS and all CSO flow goes to CSO 059 outfall. Flood gate 1440216 closes at 51.3' river stage on CSO 059 outfall pipe and combined flow remains in the collection system at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Scott St ID 1440100	Leaping weir in manhole
060	Active	A tideflex valve is on the end of the outfall pipe and a baffle chamber is in the outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Greenup St ID 1440121	Elevated overflow pipe in manhole
061	Active	A tideflex valve is on the end of the outfall pipe and a check valve and baffle chamber are in the outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Garrard St ID 1440156	Leaping weir in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
062	Active	CSO outfall goes through Covington Flood Protection System floodwall. Flood gate 1470004 closes at 45.9' river stage on CSO 062 outfall pipe and all CSO flow goes to CSO 030 outfall and Willow Run Flood PS This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Philadelphia St ID 1470003	Leaping weir in manhole
063	Active	CSO outfall goes through Covington Flood Protection System floodwall. Flood gate 1470096 closes at 52' river stage on CSO outfall pipe and Main St Flood PS pumps CSO flow back into CSO outfall pipe. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Johnson St ID 1470072	Leaping weir in manhole
			Bakewell St ID 1470032	Leaping weir in manhole
			Main St ID 1470052	Leaping weir in manhole
064	Active	This outfall discharges only combined sewage.	Swain Ct ID 1490015	Leaping weir in manhole
065	Active	A netbag is on the end of the outfall pipe. This outfall discharges only combined sewage.	Parkway Ave at Highway Ave ID 1490027	Weir dam and orifice in manhole
066	Active	Also called Altamont St CSO. This outfall discharges only combined sewage.	Post Pl & West St ID 1500010	Leaping weir in manhole
067	Eliminated	Highland Ave CSO ID 1510199 to Unnamed Tributary to Banklick Creek Outfall elimination certified 8/17/2018		
068	Active	A tideflex valve is on the end of the outfall. This CSO discharges only combined sewage.	Adela St ID 1710003	Leaping weir in manhole
069	Active	A tideflex valve is on the end of the outfall. This CSO discharges combined sewage and separate stormwater that has not entered the CSS.	Kenner St ID 1710054	Leaping weir in manhole
070	Active	A tideflex valve is on the end of the outfall. This CSO discharges combined sewage only.	Butler St ID 1710068	Leaping weir in manhole
071	Active	This CSO discharges only combined sewage.	Carneal St ID 1710084	Leaping weir in manhole
072	Active	This CSO discharges only combined sewage.	Ash St (Ludlow) ID 1710098	Leaping weir in manhole
073	Active	A LarFlex valve is on the end of the outfall. This CSO discharges combined sewage only.	Lagoon St ID 1720005	Leaping weir in manhole
074	Active	This CSO discharges combined sewage and separate stormwater that has not entered the CSS.	Rohman St ID 1730008	Leaping weir in manhole
075	Active	This CSO discharges only combined sewage.	Pleasant St ID 1730029	Elevated overflow pipe in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
076	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Church St - North ID 1850150	Weir dam and orifice in chamber
			Church St - West ID 1850024	Leaping weir in manhole
			Church St - East ID 1850032	Leaping weir in manhole
077	Eliminated	Victory Ave - South CSO ID 1870189 to Unnamed Tributary to Banklick Creek Outfall elimination certified 10/15/2018		
078	Active	A tideflex valve is on the end of the outfall. This CSO discharges only combined sewage.	Decoursey Ave ID 1870025	Leaping weir in manhole
079	Active	This CSO discharges only combined sewage.	47th St ID 1870031	Leaping weir in manhole
080	Active	A tideflex valve is on the end of the outfall pipe. This outfall also discharges separate stormwater that has not entered the CSS.	44th St ID 1880010	Leaping weir in manhole
			Baltimore St ID 1880028	Leaping weir in manhole
081	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	45th St & Virginia Ave ID 1880021	Leaping weir in manhole
082	Eliminated	Victory Ave - North CSO ID 1870197 to Unnamed Tributary to Banklick Creek Outfall elimination certified 8/17/2018		
083	Active	CSO outfall goes through Newport Flood Protection System floodwall. Gatewell No. 1 flood gate 0630056 closes at 48' river stage on CSO outfall pipe and all combined sewage stays within the CSS at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Riverside Dr ID 0630001	Weir dam and orifice in manhole
084	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Ash St (Silver Grove) ID 0010001	Elevated overflow pipe in manhole
085	Active	A tideflex valve and net bag are on the end of the outfall pipe. This CSO discharges only combined sewage.	Anchor Inn ID 0360018	Elevated overflow pipe in manhole
086	Active	A tideflex valve and net bag are on the end of the outfall pipe. This CSO discharges combined sewage and separate stormwater that has not entered the CSS.	O'Fallon Ave ID 0600041	2 Elevated overflow pipes in manhole
087	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Van Voast Ave ID 0600037	Elevated overflow pipe in manhole
088	Active	A tideflex valve is on the end of the outfall pipe. This CSO discharges only combined sewage.	South Ward Ave ID 0550024	Elevated overflow pipe in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
089	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Taylor & Retreat ID 0540055	Elevated overflow pipe in manhole
090	Active	This CSO discharges only combined sewage	Covert Run Lafayette ID 0540044	Weir dam and orifice in manhole
091	Active	This CSO discharges only combined sewage	Covert Run Berry Ave ID 0540009	Weir dam and orifice in manhole
092	Active	This CSO discharges only combined sewage	Glazier Ave ID 0650053	Elevated overflow pipe in manhole
093	Active	A tideflex valve and net bag are on the end of the outfall pipe. This CSO discharges only combined sewage.	Wildcat ID 0650025	Elevated overflow pipe in manhole
094	Active	When Newport Flood Protection System flood controls are activated, flood gate 0660057 closes at 48' river stage on combined sewer at regulator and all flow is routed to CSO outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Linden Ave & 9th St ID 0660057	Sluice gate and orifice and weir dam in manhole
095	Active	When Newport Flood Protection System flood controls are activated, flood gate 0630039 closes at 48' river stage on combined sewer at regulator and all flow is routed to CSO outfall. This outfall discharges only combined sewage.	Linden Ave & Nelson Pl ID 0630039	Sluice gate and orifice and weir dam in manhole
096	Active	CSO outfall goes through Newport Flood Protection System floodwall. At 44’ river stage, flood gate 0840005 closes in the regulator and all CSO flow goes to CSO outfall. At 49.5' river stage, flood gate 0840005 opens and 9th St Gatewell flood gate 0840117 closes on CSO outfall pipe and all combined sewage stays within the CSS at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	9th St at KY9 #1 ID 0840003	Leaping weir in manhole
			9th St at KY9 #2 ID 0840132	Leaping weir in manhole
			9th St at KY9 #3 ID 0840005	Sluice gate and orifice and weir dam in chamber

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
097	Active	Regulator has 2 diversion pipes from a single junction chamber. CSO outfall goes through Newport Flood Protection System floodwall. At 44' river stage, flood gate 0840027 closes in the regulator and all combined flow goes to CSO outfall. At 49.5' river stage, flood gate 0840027 opens and 10th St Gatewell flood gate 0840118 closes on CSO outfall pipe and all combined sewage stays within the CSS at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS..	10th St at KY9 ID 0840027/0840028	Sluice gate and orifice and weir dam in chamber
098	Active	Combined sewer from regulator 1440149 goes through Covington Flood Protection System towards the Ohio River Interceptor and part of CSO outfall goes through Covington Flood Protection System. Flood gates 1440149, 1440143, 1440144 and 1440146 close at 64.1' river stage and all combined flow to regulator 1440149 is routed to Kennedy St Flood PS which pumps flow back into the CSO outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Kennedy St ID 1440145	Elevated overflow pipe in manhole
			Kennedy St Flood Gate ID 1440149	Sluice gate and orifice and weir dam
099	Active	This outfall discharges only combined sewage	Eastern Ave - Meinken ID 0910055	Leaping weir in manhole
100	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Adams St ID 0910039	Elevated overflow pipe in manhole
101	Active	Also called Latonia Ave CSO. This outfall discharges only combined sewage.	33rd St & Emerson Ave ID 1840072	Elevated overflow pipe in manhole
			33rd St & Carlisle Ave ID 1840069	Elevated overflow pipe in manhole
			33rd St & Latonia Ave ID 1840055	Elevated overflow pipe in manhole
102	Active	Combined sewer goes through Covington Flood Protection System floodwall towards Willow Run Interceptor. Flood gate 1480199 closes at 65.7' river stage on combined sewer downstream of regulator and all flow is routed to CSO outfall. This outfall discharges only combined sewage.	Highway Ave at Wright St ID 1480017	Elevated overflow pipe in manhole

Outfall No.	Status	Summary[1]	Regulator Name/Identifier	Regulator Description
103	Active	CSO outfall goes through Newport Flood Protection System floodwall. Flood gate 0840062 opens and flood gate 0840127 closes on CSO outfall pipe at 56.5' river stage and all combined sewage stays within the CSS at this outfall. This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	12th St #2 ID 0730028	Weir dam and orifice in manhole
104	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Moore St AI 1730053	Elevated overflow pipe in manhole
105	Active	This outfall discharges combined sewage and separate stormwater that has not entered the CSS.	Monmouth St & Carothers Rd ID 0690034	Weir dam and orifice in manhole
			Monmouth St ID 0690008	Weir dam and orifice in manhole
N/A	Eliminated	1st St & Maple St CSO ID 0010228 to Unnamed Tributary to Ohio River Outfall elimination certified 8/17/2018 This outfall has been converted to a separate storm sewer outfall.		
N/A	Eliminated	O'Fallon Ave #2 CSO ID 0600095 This was a second outfall pipe from the regulator for CSO 086.		
N/A	Eliminated	Levassor Ave CSO ID 0910067 to Licking River Outfall elimination certified 8/17/2018 This outfall has been converted to a separate storm sewer outfall.		
N/A	Eliminated	Highland Ave CSO ID 1510229 to Unnamed Tributary to Banklick Creek Outfall elimination certified 8/17/2018		
N/A	Eliminated	East Henry Clay CSO ID 1510245 to Unnamed Tributary to Banklick Creek Outfall elimination certified 8/17/2018		
N/A	Eliminated	Bromley PS CSO ID 1730261 to Ohio River Outfall elimination certified 10/15/2018		

[1]River stage is measured at USGS gauge 03255000 OHIO RIVER AT CINCINNATI, OH 39.094444°N, 84.510556°W

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- **CSO Outfall No. 098** (O'Fallon Ave CSO 0600096): A failed Tideflex duckbill valve was removed from the end of outfall pipe and a new in-line Tideflex Checkmate valve was installed inside the outfall pipe on July 17, 2019. The new Checkmate valve is installed near the end of the pipe.
- **CSO Outfall No. 083** (Riverside Dr. CSO 0630061): The end of CSO outfall was originally submerged in the Ohio River and partially collapsed. In spring of 2019, the outfall was shorted, a new manhole was installed, and a headwall and flapgate was installed at the end of the pipe. New latitude is 39.100126 and new longitude is -84.491976.

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- **Outfall 056** (River Center at Russell St CSO): A small, tapered weir wall with height of 6 inches, depth of 12 inches, and width of 22 inches was installed in regulating manhole 1440053 to protect against river water intrusion up to an elevation of 475.64 feet.
- **Outfall 063** (Main St Covington CSO 1470093): Replaced manhole 1470053, in between the regulator and the floodwall, with a 10-ft by 11-ft vault. Installed a 48-inch flapgate in the vault to protect against river water intrusion.
- **Outfall 065** (Parkway & Highway Ave CSO 1490132): Modified headwall at CSO outfall and installed a 60" flapgate to protect against river water intrusion.
- **Outfall 071** (Carneal St CSO 1710121): Installed 24-inch Tideflex Checkmate in-line check valve inside the pipe at the end of CSO outfall 1710121 to protect against river water intrusion.
- **Outfall 072** (Ash St Ludlow CSO 1710124): Replaced headwall and installed a 48-inch flapgate at the end of CSO outfall 1710124 to protect against river water intrusion.
- **Outfall 074** (Rohman St CSO 1730263): Replaced manhole 1730270, in between the regulator and the outfall, with a 7-ft by 9.5-ft vault and installed a 30-inch Tideflex Checkmate in-line check valve inside the new vault to protect against river water intrusion.
- **Outfall 075** (Pleasant St CSO 1730259): Installed a 36-inch Tideflex Checkmate in-line check valve at the end of the CSO outfall 1730259 to protect against river water intrusion.

Appendix D: SSO Characterization

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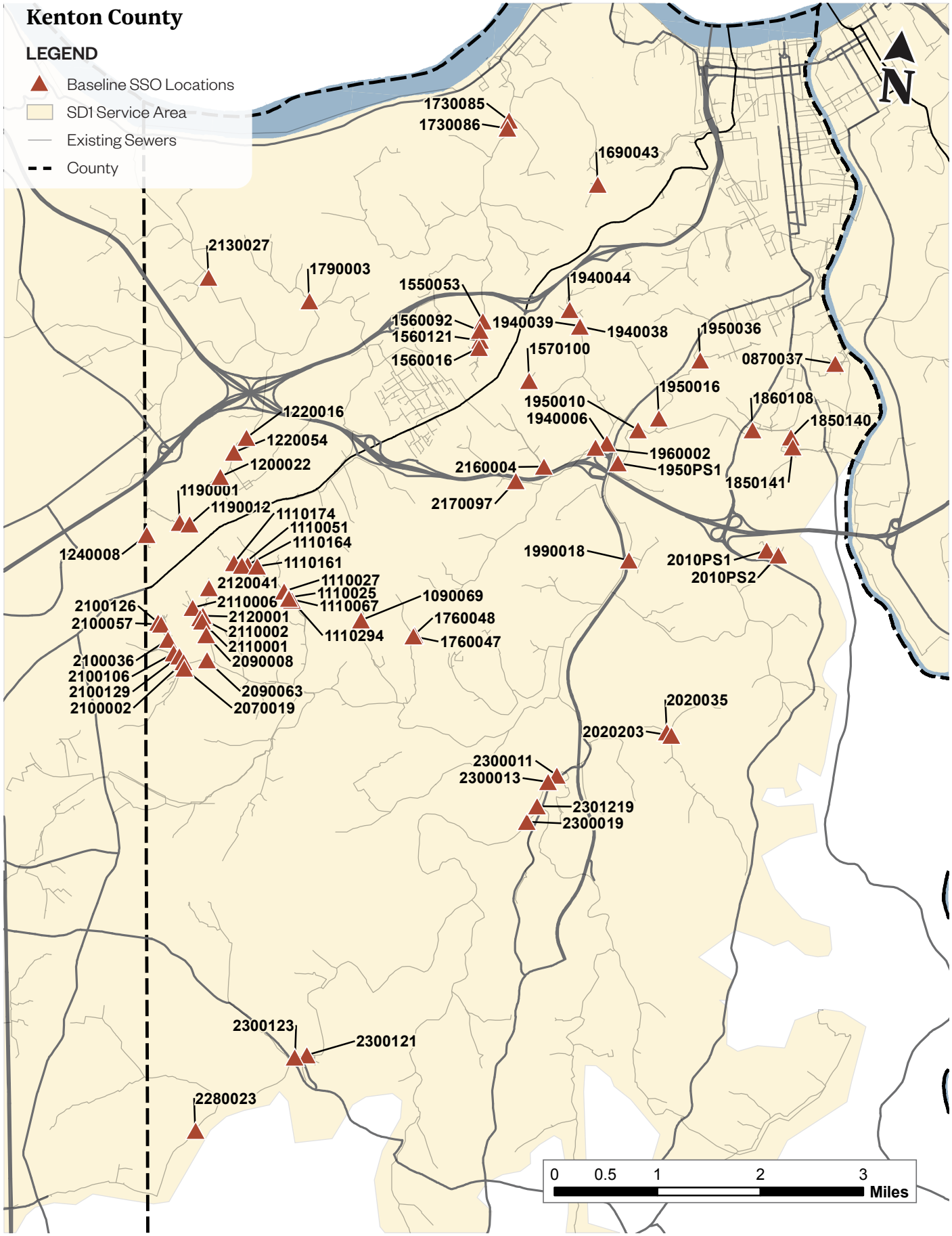
Campbell County
LEGEND
Baseline SSO Locations
SD1 Service Area
Existing Sewers
County
N
0440074
0390007
0430006
0430007
0380005
0530083
0530119
0400002
0370001
0400034
0410010
0410019
0300035
1010002
1010026
1010027
0490137
0500047
0490032
0280001
0270026
0230016
0260002
0220058
0220056
1930010
1930008
0220086
1930007
0150024
0040003
0050022
0060001
0860001
0150009
0150086
0110002
0060002
0150399
0060004
0050PS1
0110010
0150065
0150064
0100001
0150063
0020007
0020032
0020006
0020008
1920097
1920086
0
0.5
1
2
3
Miles


Boone County
LEGEND
Baseline SSO Locations
SD1 Service Area
Existing Sewers
County
N
2370003
2390002
2410387
0
0.5
1
2
3
Miles


Kenton County
LEGEND
Baseline SSO Locations
SD1 Service Area
Existing Sewers
County
N
1730085
1730086
1690043
2130027
1790003
1550053
1940044
1560092
1560121
1560016
1940039
1940038
1570100
1950036
0870037
1950016
1860108
1850140
1850141
1950010
1940006
1960002
1950PS1
1220016
1220054
1200022
1190001
1190012
2160004
2170097
1240008
1110174
1110051
1110164
1110161
1990018
2010PS1
2010PS2
2120041
1110027
1110025
1110067
2110006
2120001
2110002
2110001
2090008
2090063
2070019
2100126
2100057
2100036
2100106
2100129
2100002
1090069
1760048
1760047
1110294
2020035
2020203
2300011
2300013
2301219
2300019
2300123
2300121
2280023
0
0.5
1
2
3
Miles

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
0020006	N/A	4586 Mary Ingles Hwy	-84.418123, 39.042277	Fourmile Creek	31	4.639	0	0
0020007	N/A	4594 Mary Ingles Hwy	-84.416948, 39.041655	Fourmile Creek	22	0.261	0	0
0020008	N/A	4618 Mary Ingles Hwy	-84.415802, 39.041027	Fourmile Creek	18	0.170	0	0
0020032	N/A	4730 Dodsworth Ln	-84.419846, 39.042638	Duck Creek	4	0.382	0	0
0040003	N/A	369 RIVER RD	-84.443599, 39.058364	UT Threemile Creek	3	0.088	0	0
0050022	N/A	415 RIVER RD	-84.443133, 39.057312	UT Threemile Creek	3	0.022	0	0
0050PS1	Highland Heights PS SSO	3956 BLANGEY RD	-84.433353, 39.053919	Threemile Creek	46	16.211	0	0
0060001	N/A	3893 BLANGEY RD	-84.435151, 39.053749	UT Threemile Creek	6	0.199	0	0
0060002	N/A	3822 BLANGEY RD	-84.435877, 39.053526	UT Threemile Creek	4	0.168	0	0
0060004	N/A	3822 BLANGEY RD	-84.436315, 39.053093	UT Threemile Creek	4	0.151	0	0
0100001	N/A	4 TESSENEER DR (I-471 RAMP)	-84.459115, 39.043725	UT Threemile Creek	4	0.315	0	0
0110002	N/A	4414 WATER ST	-84.458123, 39.053177	Threemile Creek	1	0.003	0	0
0110010	N/A	4498 WATER ST	-84.455989, 39.048830	Threemile Creek	9	0.479	0	0
0150009	N/A	10 CREEKWOOD DR	-84.481907, 39.053425	North Branch Threemile Creek	11	1.992	0	0
0150024	N/A	WOODLAND HILLS DR	-84.477807, 39.059876	North Branch Threemile Creek	2	0.015	0	0
0150063	N/A	140 THREE MILE RD	-84.480415, 39.048373	Threemile Creek	10	0.025	0	0
0150064	N/A	105 THREE MILE RD	-84.479495, 39.048569	Threemile Creek	11	1.095	0	0
0150065	N/A	106 THREE MILE RD	-84.478396, 39.048556	Threemile Creek	10	1.165	0	0
0150086	N/A	164 BONNIE LYNN TER	-84.460735, 39.053303	Threemile Creek	5	0.340	0	0
0150399	N/A	THREE MILE RD	-84.483918, 39.049304	Threemile Creek	20	4.684	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
0220056	N/A	60 RAINBOW TER	-84.454804, 39.066994	North Branch Threemile Creek	4	0.096	0	0
0220058	N/A	60 RAINBOW TER	-84.454360, 39.067635	North Branch Threemile Creek	4	0.106	0	0
0220086	N/A	628 ALEXANDRIA PIKE	-84.456303, 39.064285	North Branch Threemile Creek	2	0.005	0	0
0230016	N/A	37 GREENWOOD AVE	-84.460345, 39.071407	UT North Branch Threemile Creek	2	0.009	0	0
0260002	N/A	19 PEBBLE CREEK CIR	-84.453132, 39.071343	North Branch Threemile Creek	2	0.006	0	0
0270026	N/A	67 VERNON LN	-84.451222, 39.074989	North Branch Threemile Creek	4	0.232	0	0
0280001	N/A	625 MARY INGLES HWY	-84.440902, 39.075061	UT Ohio River	2	0.005	0	0
0300035	N/A	141 WOODSIDE PL	-84.446180, 39.084106	UT Ohio River	3	0.077	0	0
0370001	N/A	514 WATERWORKS RD	-84.457865, 39.089676	UT Woodlawn Creek	4	0.108	0	0
0380005	N/A	64 STRATHMORE AVE	-84.451739, 39.092277	UT Woodlawn Creek	4	0.087	0	0
0390007	N/A	14 MITCHELL HL	-84.456644, 39.101019	Covert Run	2	0.015	0	0
0400002	N/A	160 WATERWORKS RD	-84.451777, 39.089568	UT Woodlawn Creek	16	0.655	0	0
0400034	N/A	160 WATERWORKS RD	-84.451060, 39.089197	UT Woodlawn Creek	2	0.017	0	0
0410010	N/A	570 WATERWORKS RD	-84.461262, 39.088912	Woodlawn Creek	8	0.093	0	0
0410019	N/A	85 MAYFIELD AVE	-84.459029, 39.086080	UT Woodlawn Creek	7	0.177	0	0
0430006	N/A	1249 WATERWORKS RD	-84.470536, 39.095103	Woodlawn Creek	12	0.140	0	0
0430007	N/A	1250 WATERWORKS RD	-84.469462, 39.095031	Woodlawn Creek	12	0.297	0	0
0440074	N/A	7 COVERT PL	-84.459567, 39.102626	Covert Run	2	0.008	0	0
0490032	N/A	2028 NEW LINDEN RD	-84.479128, 39.078595	UT Taylor Creek	1	0.001	0	0
0490137	N/A	2026 NEW LINDEN RD	-84.479448, 39.078708	UT Taylor Creek	3	0.008	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
0500047	N/A	2001 NEW LINDEN RD	-84.480473, 39.079133	UT Taylor Creek	4	0.096	0	0
0530083	N/A	1175 WATERWORKS RD	-84.473394, 39.093628	Woodlawn Creek	10	0.453	0	0
0530119	N/A	1103 WATERWORKS RD	-84.475230, 39.091264	Woodlawn Creek	3	0.024	0	0
0860001	Licking River Siphon SSO	LICKING PIKE (IPSCO TUBULARS)	-84.494621, 39.052515	Licking River	50	46.518	0	0
0870037	N/A	504 38TH ST	-84.494850, 39.046409	None: Returns to CSS	4	0.496	0	0
1010002	N/A	491 MAINE AVE	-84.459673, 39.084794	Woodlawn Creek	4	0.049	0	0
1010026	N/A	85 MAYFIELD AVE	-84.456992, 39.083802	Woodlawn Creek	2	0.015	0	0
1010027	N/A	85 MAYFIELD AVE	-84.456180, 39.083566	Woodlawn Creek	2	0.015	0	0
1090069	N/A	3251 MADONNA DR	-84.575876, 39.004466	UT Bullock Pen Creek	1	0.002	0	0
1110025	N/A	604 STEVENSON RD	-84.589290, 39.006693	Rice Creek	1	0.004	0	0
1110027	N/A	574 STEVENSON RD	-84.590242, 39.007487	Rice Creek	2	0.095	0	0
1110051	N/A	3520 SUSAN LEWIS DR	-84.598219, 39.010608	UT Rice Creek	2	0.184	0	0
1110067	N/A	619 STEVENSON RD	-84.589221, 39.006569	Rice Creek	4	0.393	0	0
1110161	N/A	418 STEVENSON RD	-84.595484, 39.010650	UT Rice Creek	1	0.061	0	0
1110164	N/A	3515 SUSAN LEWIS DR	-84.597225, 39.010722	UT Rice Creek	1	0.030	0	0
1110174	N/A	228 PALACE AVE	-84.599667, 39.010843	UT Rice Creek	1	0.019	0	0
1110294	N/A	608 STEVENSON RD	-84.588649, 39.006329	Rice Creek	4	0.047	0	0
1190001	N/A	310 FOREST AVE	-84.610075, 39.015782	UT Dry Creek	1	0.001	0	0
1190012	N/A	205 JAMES AVE	-84.608249, 39.015680	UT Dry Creek	9	0.472	0	0
1200022	N/A	409 LOCUST AVE	-84.603567, 39.022725	UT Dry Creek	4	0.234	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
1220016	N/A	424 SILVERLAKE AVE	-84.599485, 39.028552	UT Dry Creek	6	0.117	0	0
1220054	N/A	3167 WOODWARD AVE	-84.601512, 39.026306	UT Dry Creek	5	0.490	0	0
1240008	N/A	4229 LAFAYETTE AVE	-84.615784, 39.013657	UT Dry Creek	14	0.428	0	0
1550053	N/A	145 DEAUVILLE CT	-84.558901, 39.047894	UT Pleasant Run Creek	4	0.179	0	0
1560016	N/A	58 THOMPSON RD	-84.559151, 39.044140	Pleasant Run Creek	1	0.025	0	0
1560092	N/A	110 GREENBRIAR AVE	-84.559279, 39.046501	Pleasant Run Creek	4	0.449	0	0
1560121	N/A	95 GREENBRIAR AVE	-84.559066, 39.045134	Pleasant Run Creek	1	0.002	0	0
1570100	N/A	49 LEATHERS RD	-84.549621, 39.040148	UT Moser's Branch	3	0.030	0	0
1690043	N/A	1502 AMSTERDAM RD	-84.540460, 39.068509	UT Pleasant Run Creek	1	0.002	0	0
1730085	N/A	683 BROMLEY CRESCENT SPRINGS RD	-84.557496, 39.076334	UT Pleasant Run Creek	1	0.050	0	0
1730086	N/A	693 BROMLEY CRESCENT SPRINGS RD	-84.557641, 39.075237	UT Pleasant Run Creek	4	1.232	0	0
1760047	N/A	3049 MAGNOLIA CT	-84.566260, 39.002867	UT Bullock Pen Creek	6	0.334	0	0
1760048	N/A	3047 MAGNOLIA CT	-84.566090, 39.003054	UT Bullock Pen Creek	4	0.210	0	0
1790003	N/A	703 MEADOW WOOD DR	-84.590424, 39.048497	UT Dry Creek	2	0.013	0	0
1850140	N/A	4721 VICTORY AVE	-84.501651, 39.035532	Banklick Creek	28	8.210	0	0
1850141	N/A	4721 VICTORY AVE	-84.501171, 39.034191	Banklick Creek	39	3.980	0	0
1860108	N/A	648 GRAND AVE	-84.508653, 39.036049	Banklick Creek	4	0.151	0	0
1920086	N/A	INDUSTRIAL RD	-84.433046, 39.029121	Duck Creek	3	0.007	0	0
1920097	N/A	INDUSTRIAL RD	-84.433140, 39.028130	Duck Creek	4	0.069	0	0
1930007	N/A	107 MOOCK RD	-84.480292, 39.062501	UT North Branch Threemile Creek	4	0.051	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
1930008	N/A	25 ALEXANDRIA PIKE	-84.480428, 39.063232	UT North Branch Threemile Creek	4	0.067	0	0
1930010	N/A	301 WALNUT ST	-84.480276, 39.064371	UT North Branch Threemile Creek	3	0.127	0	0
1940006	N/A	499 ORPHANAGE RD	-84.534619, 39.032334	Moser's Branch	4	0.325	0	0
1940038	N/A	1864 HIGHLAND AVE	-84.541344, 39.048361	Moser's Branch	4	0.030	0	0
1940039	N/A	1864 HIGHLAND PIKE	-84.541255, 39.048431	UT Moser's Branch	5	0.190	0	0
1940044	N/A	56 ORCHARD RD	-84.543486, 39.050617	Moser's Branch	4	0.116	0	0
1950010	N/A	3375 MADISON PIKE	-84.529224, 39.034633	Banklick Creek	5	1.333	0	0
1950016	N/A	2049 LAKEVIEW DR	-84.525694, 39.036515	Banklick Creek	1	0.004	0	0
1950036	N/A	2809 HOWARD LITZLER RD	-84.519178, 39.045160	UT Banklick Creek	5	1.747	0	0
1950PS1	Lakeview PS SSO	1045 EATON DR	-84.532228, 39.029363	Banklick Creek	3	1.042	0	0
1960002	N/A	499 ORPHANAGE RD	-84.536594, 39.031643	Horse Branch	3	0.018	0	0
1990018	N/A	3792 LAKE PARK DR	-84.528748, 39.016262	Banklick Creek	3	0.874	0	0
2010PS1	Keavy PS SSO	5144 KEAVY DR	-84.504028, 39.019889	UT Licking River	3	0.010	0	0
2010PS2	Meadow Lane PS SSO	688 MEADOW LN	-84.501802, 39.019427	UT Licking River	1	0.002	0	0
2020035	N/A	2750 WAYMAN BRANCH RD	-84.519138, 38.992666	UT Banklick Creek	6	0.386	0	0
2020203	N/A	2750 WAYMAN BRANCH RD	-84.518312, 38.992253	UT Banklick Creek	2	0.033	0	0
2070019	N/A	126 SANDERS DR	-84.606894, 38.995471	UT Banklick Creek	4	0.092	0	0
2090008	N/A	1110 BLUEGRASS ST	-84.603557, 39.000542	UT Banklick Creek	13	0.422	0	0
2090063	N/A	1150 EDWARDS RD	-84.602913, 38.996859	Bullock Pen Creek	3	0.034	0	0
2100002	N/A	7734 COVERED BRIDGE DR	-84.607080, 38.996357	Bullock Pen Creek	4	0.191	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
2100036	N/A	300 EASTERN AVE	-84.610259, 38.999242	Bullock Pen Creek	4	0.025	0	0
2100057	N/A	100 EASTERN AVE	-84.611764, 39.001294	UT Bullock Pen Creek	4	0.019	0	0
2100106	N/A	126 SANDERS DR	-84.608995, 38.997419	Bullock Pen Creek	4	0.269	0	0
2100126	N/A	66 EASTERN AVE	-84.612300, 39.001555	UT Bullock Pen Creek	3	0.016	0	0
2100129	N/A	126 SANDERS DR	-84.607924, 38.997091	Bullock Pen Creek	16	1.916	0	0
2110001	N/A	1134 EDWARDS RD	-84.604424, 39.002259	UT Bullock Pen Creek	9	0.221	0	0
2110002	N/A	1134 EDWARDS RD	-84.604809, 39.002713	UT Bullock Pen Creek	7	0.276	0	0
2110006	N/A	432 CALDWELL DR	-84.606363, 39.004057	UT Bullock Pen Creek	3	0.039	0	0
2120001	N/A	816 LYTLE AVE	-84.604417, 39.003058	UT Bullock Pen Creek	5	0.119	0	0
2120041	N/A	526 SPRING ST	-84.603772, 39.007017	UT Bullock Pen Creek	3	0.035	0	0
2130027	N/A	2999 AMSTERDAM RD	-84.608932, 39.050507	Dry Creek	1	0.016	0	0
2160004	N/A	ORPHANGE RD + HORSEBRANCH RD	-84.545576, 39.028318	UT Horse Branch	2	0.013	0	0
2170097	N/A	740 CENTRE VIEW BLVD	-84.550366, 39.025928	UT Horse Branch	3	0.005	0	0
2280023	N/A	745 MAHER RD	-84.597272, 38.930835	Wolf Pen Branch	3	0.208	0	0
2300011	N/A	277 MADISON PIKE	-84.538188, 38.985182	UT Banklick Creek	2	0.025	0	0
2300013	N/A	277 MADISON PIKE	-84.539668, 38.984153	Banklick Creek	8	0.847	0	0
2300019	N/A	3449 RICHARDSON RD	-84.542845, 38.978340	Banklick Creek	2	0.152	0	0
2300121	N/A	1056 BATTLERIDGE DR	-84.578530, 38.942832	Banklick Creek	11	1.880	0	0
2300123	N/A	10241 BANKLICK RD	-84.580660, 38.942331	Banklick Creek	6	0.856	0	0
2301219	N/A	278 MADISON PIKE	-84.541256, 38.980638	Banklick Creek	6	1.554	0	0

MHID	SSO Name	Nearest Street Address or Facility	XY (WGS84)	Receiving Water	Baseline TY Occurrences	Baseline TY Volume	Post-UWSP TY Occurrences	Post-UWSP TY Volume
2370003	N/A	3043 PETERSBURG RD	-84.738540, 39.074793	Woolper Creek	1	0.105	0	0
2390002	N/A	3561 BURLINGTON PIKE	-84.747059, 39.028199	Allen Fork	1	0.010	0	0
2410387	N/A	1698 SHADY COVE	-84.689242, 39.005352	UT Gunpowder Creek	1	0.013	0	0

Appendix E: Future Development Workshop Slides

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Future Development Workshop

March 1, 2019

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Agenda

- Goal and Key Metrics
- Review of Background Data Sources
  - Kentucky State Data Center
  - Traffic Analysis Zone (TAZ) Data
  - SD1 Tap Records
- Summary of Kenton, Boone & Campbell County Input
- Future Land Use Model Assumptions
- Development in Combined System
- Projected 2029 & 2040 Growth – Maps and Numbers

Goal of Current Effort

- Develop proposed residential and commercial/industrial growth by location for 2029 and 2040.
- Present extent of growth in a future development workshop with SD1.
- Develop thematic maps in GIS showing the extent of growth (acres) and increase in projected ADWF for each study area.
- **The goal of the workshop is to create consensus moving forward with the growth models.**

Key Metrics for Modeling Future Development

1. Population – how many more people will be sending flow to SD1
2. Number of taps – how many more houses will there be
3. Growth areas – where will the houses (with people) be, along with associated commercial/industrial facilities

We need firm estimates for each of these at 2029 and 2040 in order to build models

Review of Background Data Sources

POPULATION

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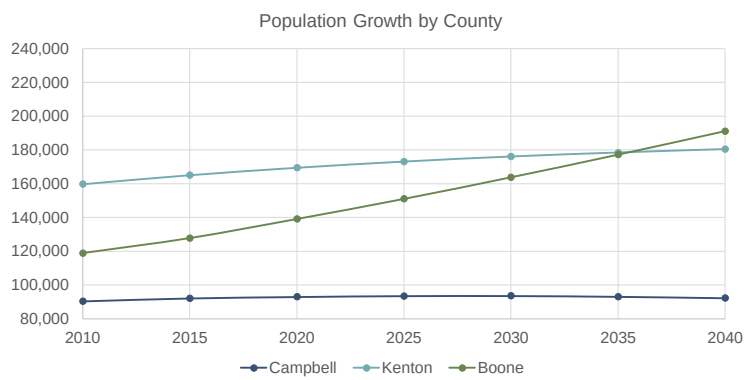
Population - KY State Data Center

County	Census 2010	Estimate 2015	Projections	
			2030	2040
Campbell	90,336	92,066	93,473	92,192
Kenton	159,720	165,012	176,039	180,412
Boone	118,811	127,712	163,722	191,093
TOTAL	**368,867**	**384,790**	**433,234**	**463,697**



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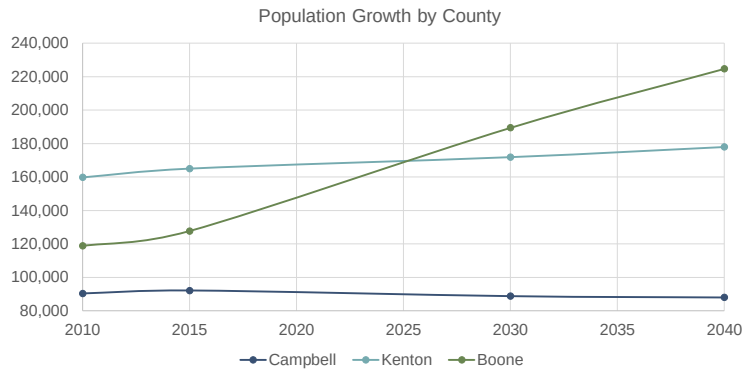
Population - Traffic Analysis Zone (TAZ) Data

County	Census 2010	Estimate 2015	Projections	
			2030	2040
Campbell	90,336	92,067	88,786	88,012
Kenton	159,720	165,008	171,885	177,963
Boone	118,811	127,709	189,395	224,687
TOTAL	**368,867**	**384,784**	**450,066**	**490,662**



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Conclusions on Population

- Fairly good correlation between two sources of regional population data.
- Similar projections in Campbell County and Kenton County.
- TAZ projects higher growth in Boone County.

- OVERALL CONCLUSION: Put greater faith in a true regional perspective and use KY Data Center projections

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Review of Background Data Sources

NUMBER OF TAPS and GROWTH AREAS

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SD1 Tap Records – By County

Year	Total Permits	Boone	Kenton	Campbell
2001	1,774	1,044	621	109
2002	1,826	1,085	631	110
2003	2,306	1,335	814	157
2004	2,383	1,327	894	162
2005	2,013	999	828	186
2006	1,516	652	576	288
2007	1,202	662	379	161
2008	843	383	327	133
2009	695	344	258	93

Year	Total Permits	Boone	Kenton	Campbell
2010	608	306	218	84
2011	525	259	168	98
2012	479	224	178	77
2013	625	330	204	91
2014	601	267	217	117
2015	684	304	227	153
2016	798	376	280	142
2017	785	354	277	154
2018	782	380	278	124
Annual Average	**1,136**	**591**	**410**	**135**

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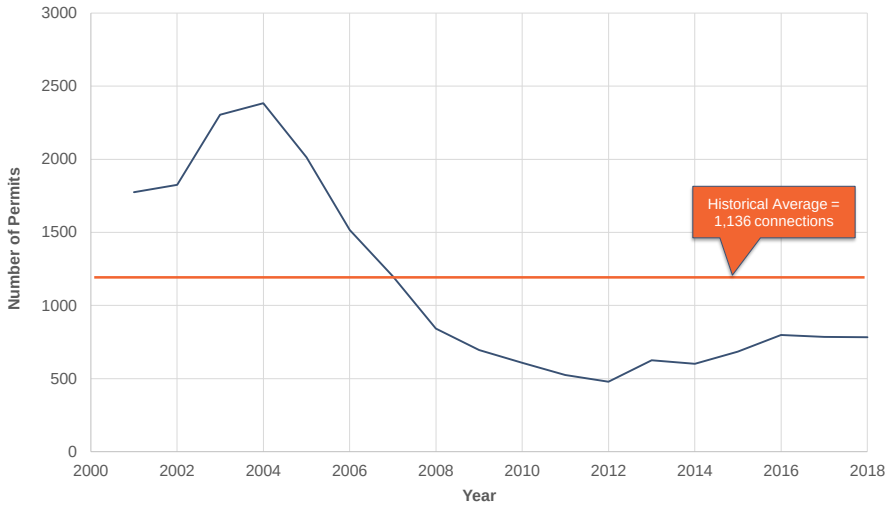
SD1 Tap Records - Total



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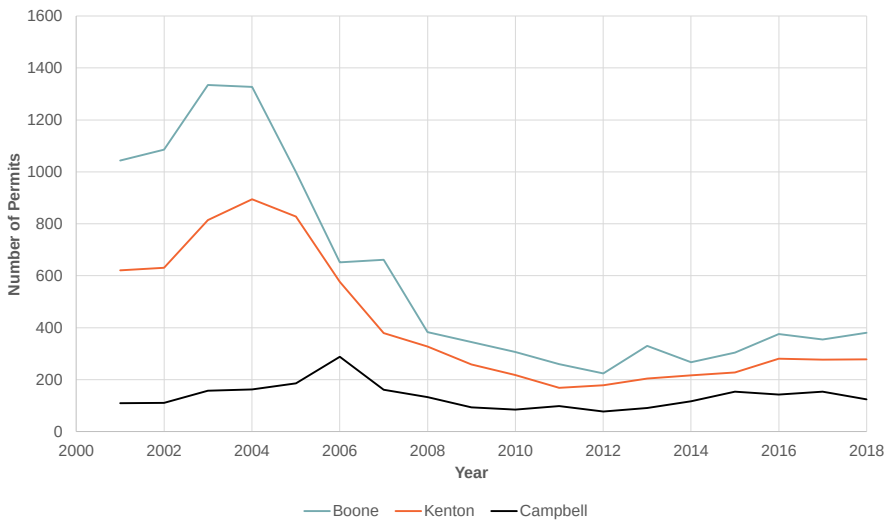
SD1 Tap Records – By County



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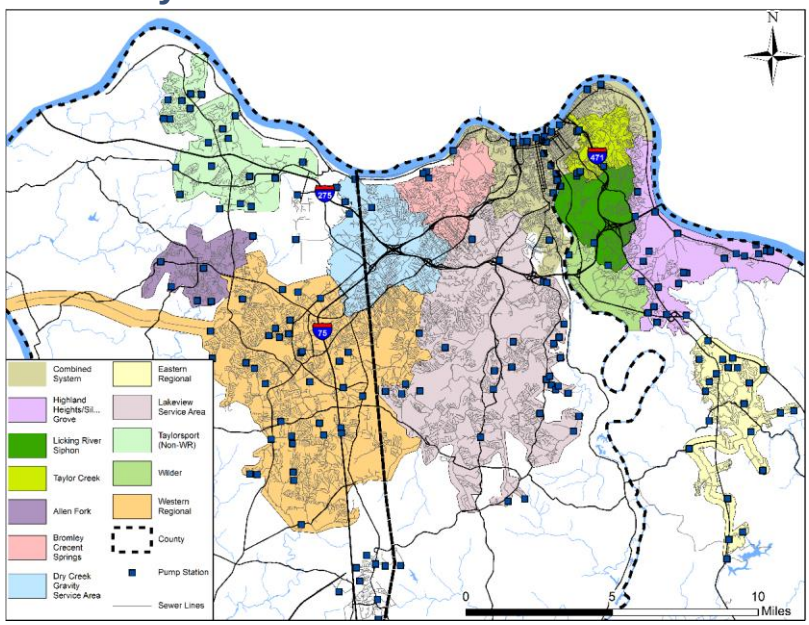
SD1 Study Areas



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SD1 Tap Records – By Study Area

Year	2001-2018 Permits	Annual Average	% Total
Allen Fork	1,349	75	6.6
Dry Creek Gravity Service Area	371	21	1.8
Eastern Regional	1,166	65	5.7
Taylorsport (Non-WR)	**2,873**	**160**	**14.1**
Western Regional (includes W6)	**7,285**	**405**	**35.6**
Lakeview Service Area	**5,414**	**301**	**26.5**
Wilder	426	24	2.1
Combined System	497	28	2.4
Bromley Crescent Springs	428	24	2.1
Taylor Creek	220	12	1.1
Licking River Siphon	174	10	0.9
Highland Heights/Silver Grove	242	13	1.2
Total	**20,445**	**1,136**	**100**

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PRELIMINARY Conclusions on Tap Records

- From 2001 – 2018, SD1 accepted an average of 1,136 new taps per year.
- This period balances a boom cycle (through 2005) and a bust cycle (2006-2012) – so represents a fair average
- **A preliminary recommended projection of 1,100 - 1,200 taps/per year through 2040 is proposed as reasonable.**

TRUTH-CHECKING TAP PROJECTIONS…

- Tap projections are tied to population projections – because you need people to fill those taps
- So, a final check on a projection of 1,100 - 1,200 taps per year is required.
- We have to back-calculate number of homes using independent KY Data Center projections, to confirm consistency with tap projections

Tap Projections Checked with KY Data Center Projections

	Population Data			Tap Connections
County	Projected Increase in Population/Year (2015-2040)	Projected People/Home (2030)	CALCULATED Average # of Homes/Year based on Pop increase	Average # of Homes/Year based on Tap Connection Rate
Boone	2,535	2.5	1014	591
Campbell	5	2.3	2	135
Kenton	616	2.4	257	410
TOTAL	**3,156**		**1,273**	**1,136**

Both "Projected Increase in Population" and "Projected People/Home" are independent estimates from KY Data Center

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Conclusions on Tap Connections

- Good correlation between proposed tap connection projections and assumed population projections.
- OVERALL CONCLUSION: Propose using 1,200 taps/year to project future growth

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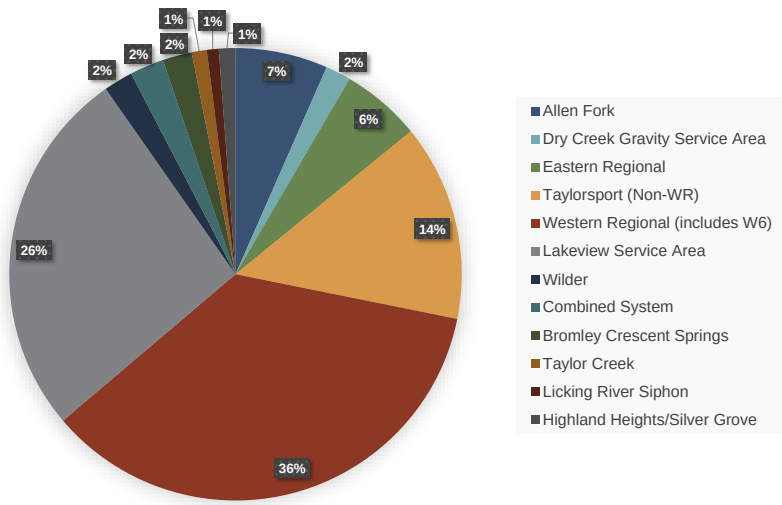
Where Will Growth Occur?

- 1,200 taps/year is a reasonable number, but where will growth occur?
- SD1 2001-2018 tap records again come into play, as a good first indicator of growth distribution.

With Historical Connections As Our Guide

Study Area	Annual Connection Average	% Total
Allen Fork	79	6.6
Dry Creek Gravity Service Area	22	1.8
Eastern Regional	68	5.7
Taylorsport (Non-WR)	169	14.1
Western Regional (includes W6)	428	35.6
Lakeview Service Area	318	26.5
Wilder	25	2.1
Bromley Combined System	29	2.4
Bromley Crescent Springs	25	2.1
Taylor Creek	13	1.1
Licking River Siphon	10	0.9
Highland Heights/Silver Grove	14	1.2
Total	**1,200**	**100**

SD1 Tap Records – By Study Area



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Conclusion

- Use historical patterns to distribute taps to new growth.
- Consistent with high expected growth in Lakeview, Taylorsport, and Western Regional - approximately 75% of new growth would occur in these areas.

- Identifying specific locations for taps within SD1 study areas becomes the next question.

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Summary of Boone, Kenton & Campbell County Input

GROWTH AREAS

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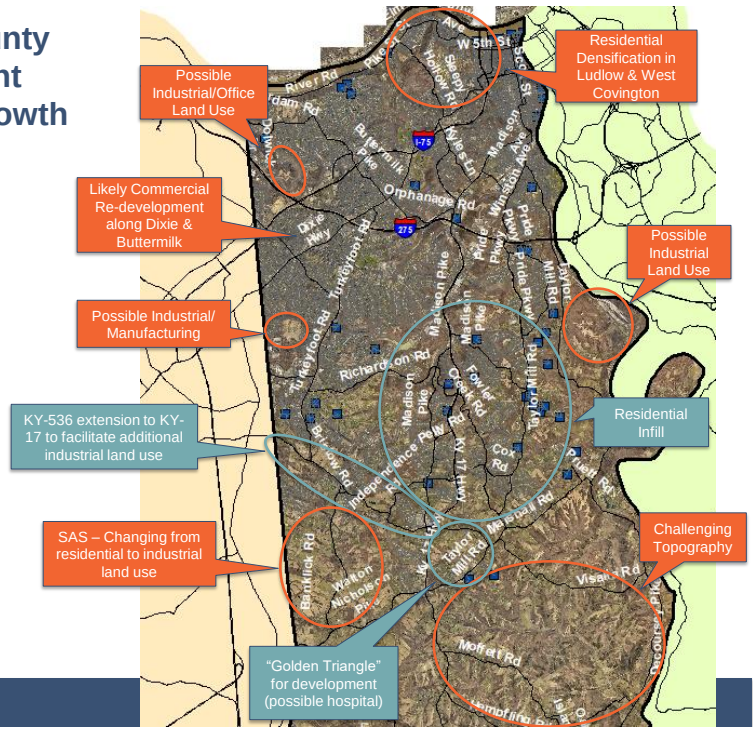
County Input Received in Several Ways

- Comprehensive Plans – useful as good qualitative background, but not for specifics.
- Face-to-face meetings – extremely useful, one of our key sources for projecting growth areas
- GIS files of future land use, etc. - extremely useful

Kenton County Development Input on Growth Areas



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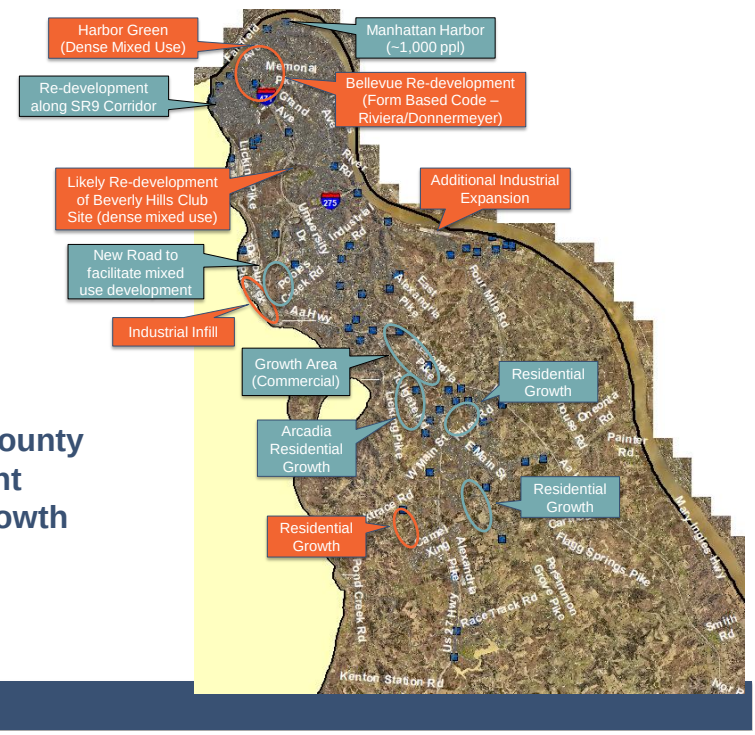

Campbell County Development Input on Growth Areas

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Boone County Development Input



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Future Land Use Model Assumptions

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Future Land Use Model Flow Assumptions

- Dry Weather
  - Residential (scales with taps) – 200 gpd/home
  - Commercial/Industrial (scales with acres) – 400 gpd/acre
- Wet Weather
  - Sanitary System (scales with taps)
    - Use new development I/I parameters
    - Assume standard effective area for each residential unit
  - Combined System (scales with acres)
    - Incorporate SD1 Stormwater Rules and Regulations

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Development in Combined System

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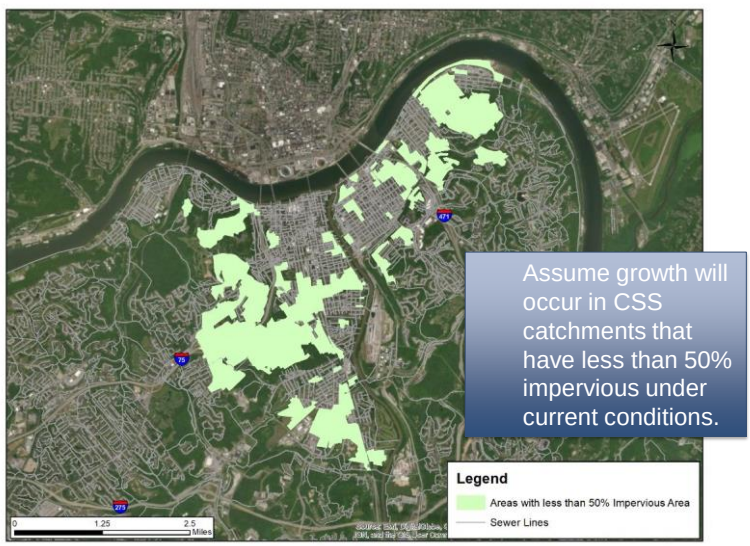
Development in Combined System

- County meetings did not provide full detail on CSS development – some ideas were suggested, but there was no system-wide perspective.
- Propose continuing assumption from original WSP - development in CSS takes the form of 10 impervious acres per year, replacing current pervious area.
- Truth check – current capacity reservations add 51 acres of area over 5 years, consistent with 10 ac/yr.

Development Areas in Combined System



DWF for CSS catchments

- 29 taps/year
- Spread over 10 acres results in 2.9 dwelling units per acre

WWF for CSS catchments

- Wet-weather flow from CSS catchments will incorporate SD1 stormwater regulations
- Discussion topic: Should we assume NEW DEVELOPMENT, or RE-DEVELOPMENT, or a combination of the two?

Projected 2029 and 2040 Growth Areas

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Summary of Key Assumptions

Net effect is that future condition flows will decrease relative to original WP

Metric	Original WP	Recommendation for Updated Plan	Impact on System-Wide New Development Flows
2030 Population	468,200 (original WP) 466,078 (OKI 2008)	433,234	Reduction
Taps/Year	1,830	1,200	
Residential DWF	270 gpd/home	200 gpd/home	Reduction
Residential area	17,179 acres	15,416 acres	
Non-residential DWF	500 gpd/acre	400 gpd/acre	Increase
Non-residential area	4,840 acres	6,273 acres	
Combined System	10 acres/year, uncontrolled runoff	10 acres/year, controlled runoff	Reduction

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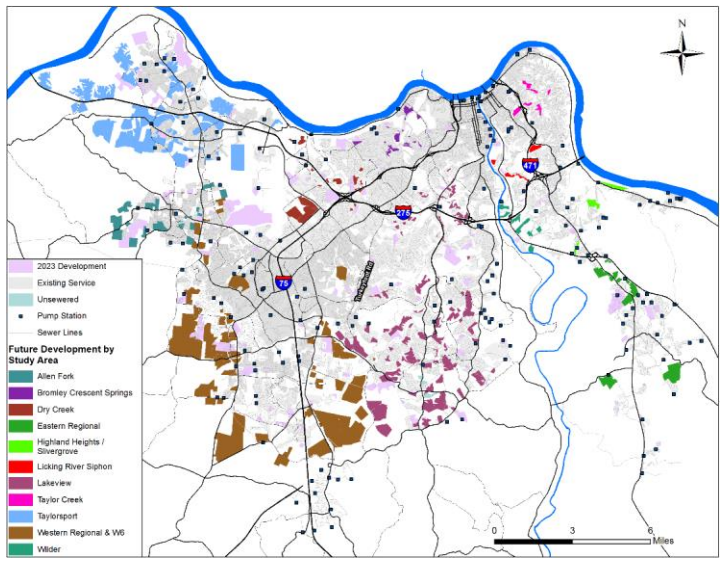
Putting It All Together – Overview of 2040 Growth Areas



2023 Development Summary

- Previously Determined Increased 2023 Metrics:

	ADWF (MGD)	Area (Ac)
Residential	2.26	3,515
Non-Residential	1.31	1,695
Total	3.57	5,210

- All flows and areas summarized in following slides are beyond 2023.

Summary of Growth Areas: Flow by Land Use

Development Date	Residential Flow (MGD)	Non-Residential Flow (MGD)	Total Flow
2029	1.57	0.98	2.55
2040	4.21	2.20	6.41

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Summary of Growth Areas: Acreage by Land Use

Development Date	Residential Area (Ac)	Non-Residential Area (Ac)	Total Area (Ac)
2029	4,535	2,092	6,627
2040	11,768	5,161	16,929

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2029 Future Model Areas

Study Area	Residential Area	Non-Residential Area	Additional Area
Allen Fork	216	53	269
Dry Creek Gravity Service Area	53	366	419
Eastern Regional	239	30	269
Taylorsport (Non-WR)	699	503	1,202
Western Regional (includes W6)	1,771	782	2,553
Lakeview Service Area	1,238	316	1,554
Wilder	58	18	76
Bromley Combined System	60		60
Bromley Crescent Springs	85	0	85
Taylor Creek	56	6	62
Licking River Siphon	24	6	30
Highland Heights/Silver Grove	36	12	48
Total	**4,535**	**2,092**	**6,627**

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2040 Future Model Areas

Study Area	Residential Area	Non-Residential Area	Additional Area
Allen Fork	713	152	865
Dry Creek Gravity Service Area	103	447	550
Eastern Regional	585	115	700
Taylorsport (Non-WR)	2,647	1,850	4,497
Western Regional (includes W6)	4,533	1,907	6,440
Lakeview Service Area	2,369	510	2,878
Wilder	185	51	236
Bromley Combined System	170		170
Bromley Crescent Springs	161	49	210
Taylor Creek	132	17	149
Licking River Siphon	68	17	85
Highland Heights/Silver Grove	102	46	148
Total	**11,768**	**5,161**	**16,929**

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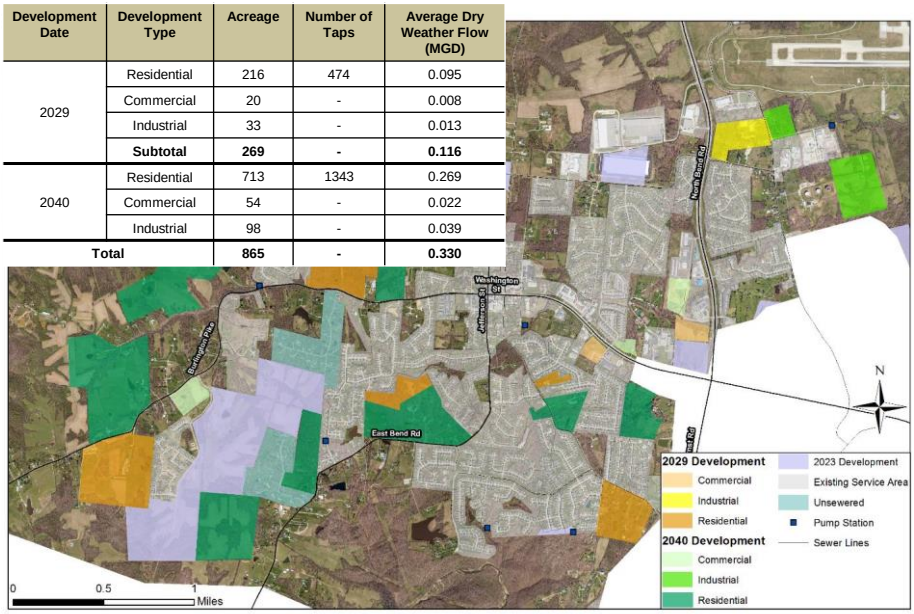
Allen Fork

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	216	474	0.095
	Commercial	20	-	0.008
	Industrial	33	-	0.013
	Subtotal	**269**	**-**	**0.116**
2040	Residential	713	1343	0.269
	Commercial	54	-	0.022
	Industrial	98	-	0.039
Total		**865**	**-**	**0.330**



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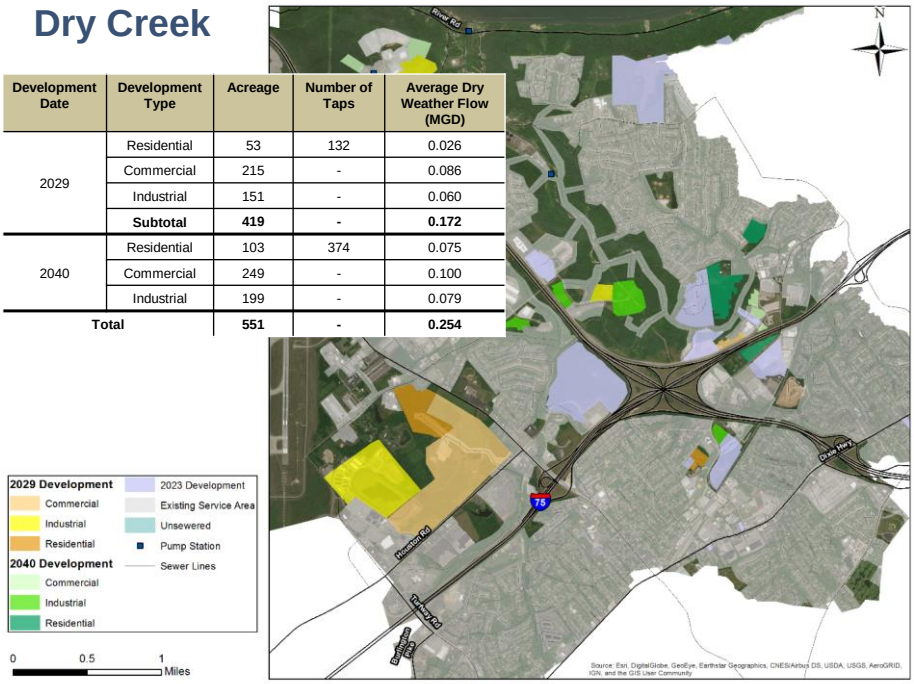
Dry Creek

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	53	132	0.026
	Commercial	215	-	0.086
	Industrial	151	-	0.060
	Subtotal	**419**	**-**	**0.172**
2040	Residential	103	374	0.075
	Commercial	249	-	0.100
	Industrial	199	-	0.079
Total		**551**	**-**	**0.254**



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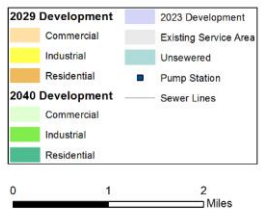
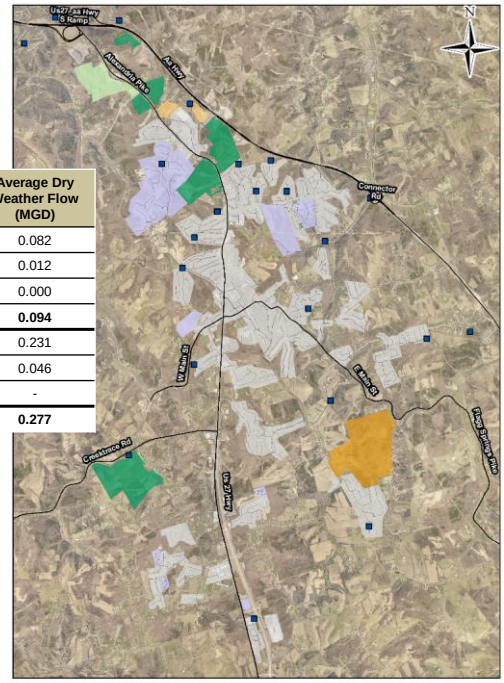
Eastern Regional

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	239	408	0.082
	Commercial	30	-	0.012
	Industrial	0	-	0.000
	Subtotal	**269**	**-**	**0.094**
2040	Residential	585	1156	0.231
	Commercial	115	-	0.046
	Industrial	-	-	-
Total		**700**	**-**	**0.277**





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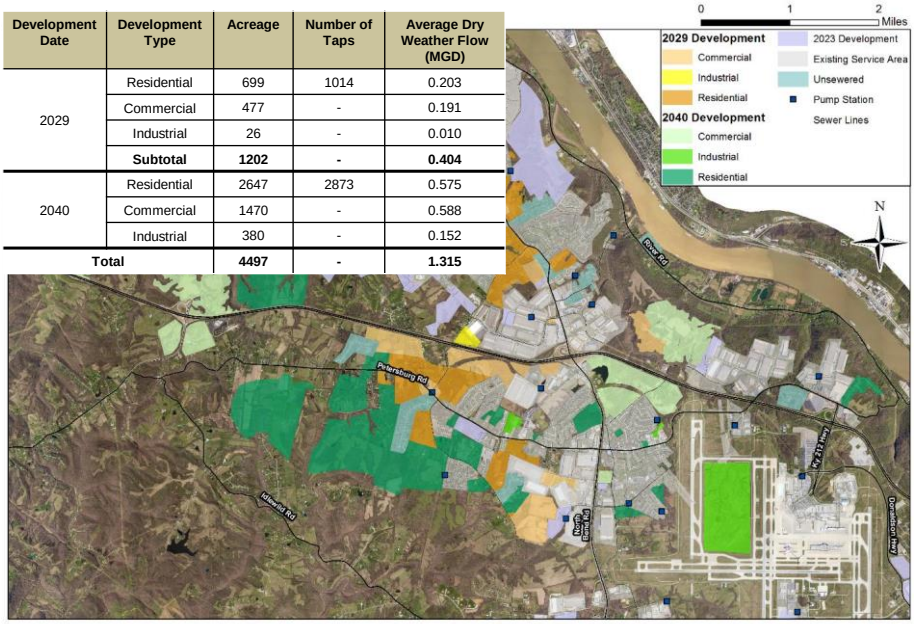
Taylorsport

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	699	1014	0.203
	Commercial	477	-	0.191
	Industrial	26	-	0.010
	Subtotal	**1202**	**-**	**0.404**
2040	Residential	2647	2873	0.575
	Commercial	1470	-	0.588
	Industrial	380	-	0.152
Total		**4497**	**-**	**1.315**



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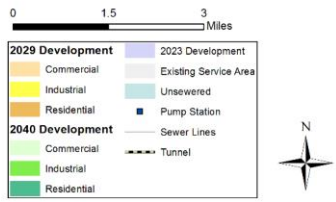
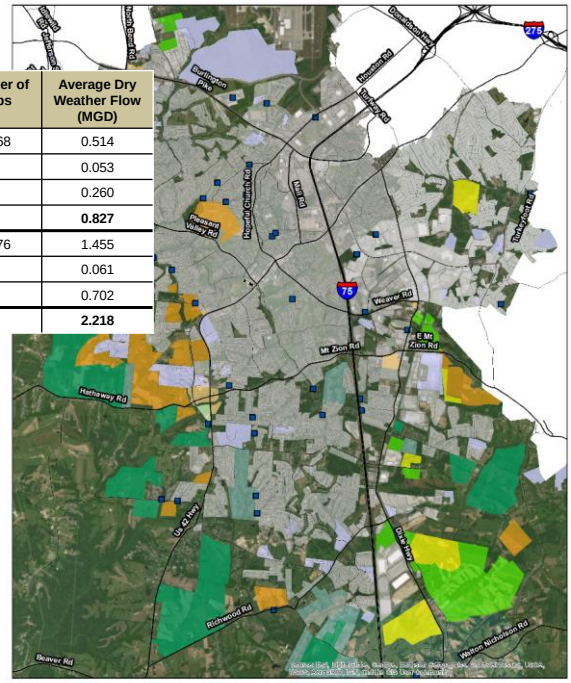
Western Regional

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	1,771	2568	0.514
	Commercial	132	-	0.053
	Industrial	650	-	0.260
	Subtotal	**2553**	**-**	**0.827**
2040	Residential	4533	7276	1.455
	Commercial	153	-	0.061
	Industrial	1754	-	0.702
Total		**6440**	**-**	**2.218**





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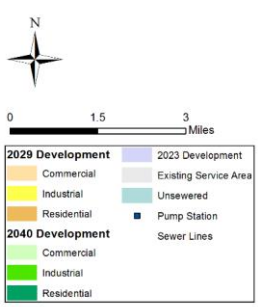
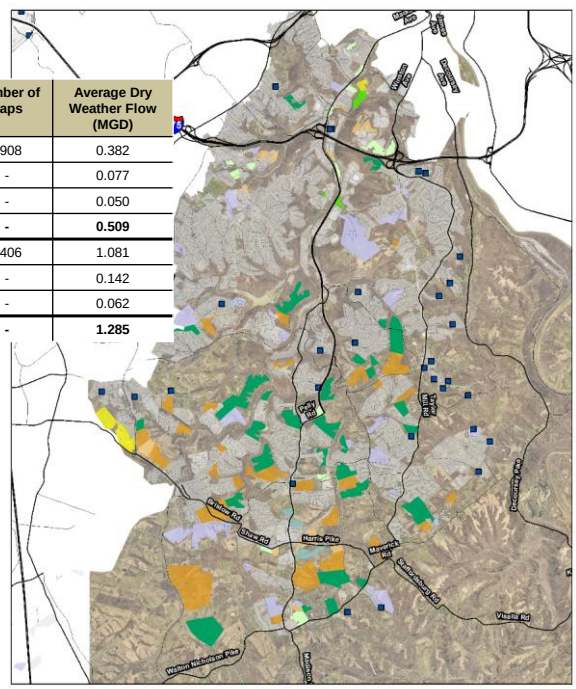
Lakeview

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	1,238	1908	0.382
	Commercial	192	-	0.077
	Industrial	124	-	0.050
	Subtotal	**1554**	**-**	**0.509**
2040	Residential	2368	5406	1.081
	Commercial	355	-	0.142
	Industrial	155	-	0.062
Total		**2878**	**-**	**1.285**





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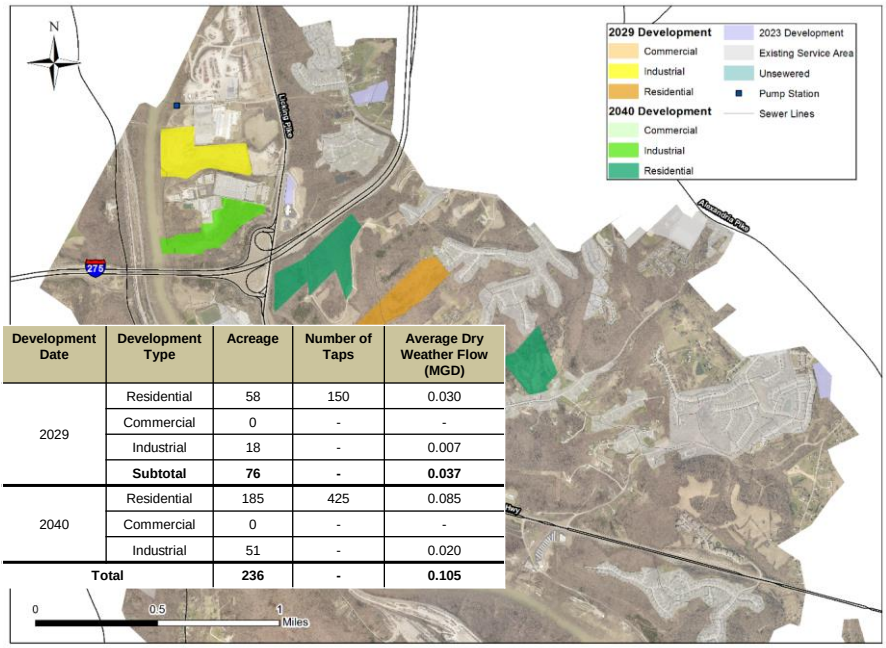
Wilder



Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	58	150	0.030
	Commercial	0	-	-
	Industrial	18	-	0.007
	Subtotal	**76**	**-**	**0.037**
2040	Residential	185	425	0.085
	Commercial	0	-	-
	Industrial	51	-	0.020
Total		**236**	**-**	**0.105**

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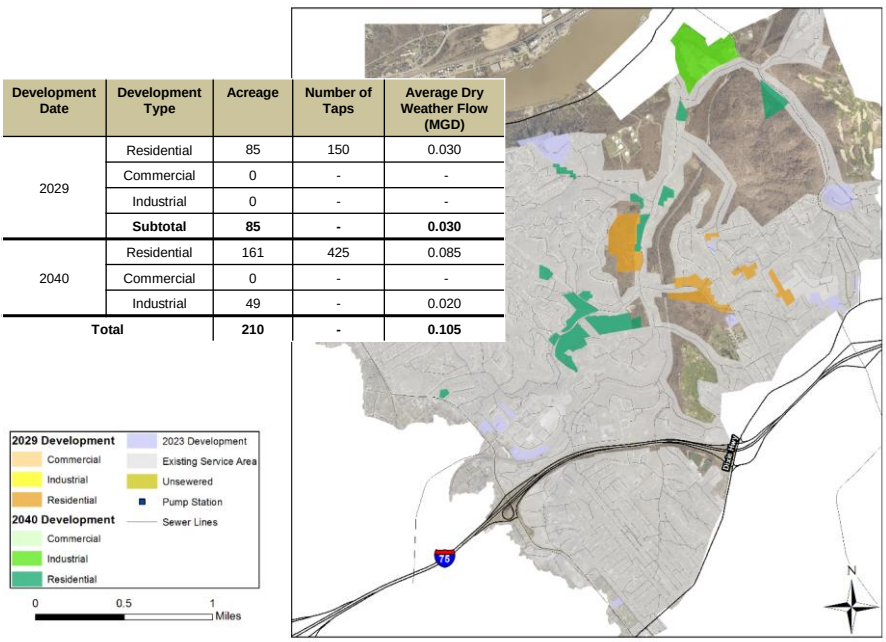
Bromley Crescent Springs

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	85	150	0.030
	Commercial	0	-	-
	Industrial	0	-	-
	Subtotal	**85**	**-**	**0.030**
2040	Residential	161	425	0.085
	Commercial	0	-	-
	Industrial	49	-	0.020
Total		**210**	**-**	**0.105**



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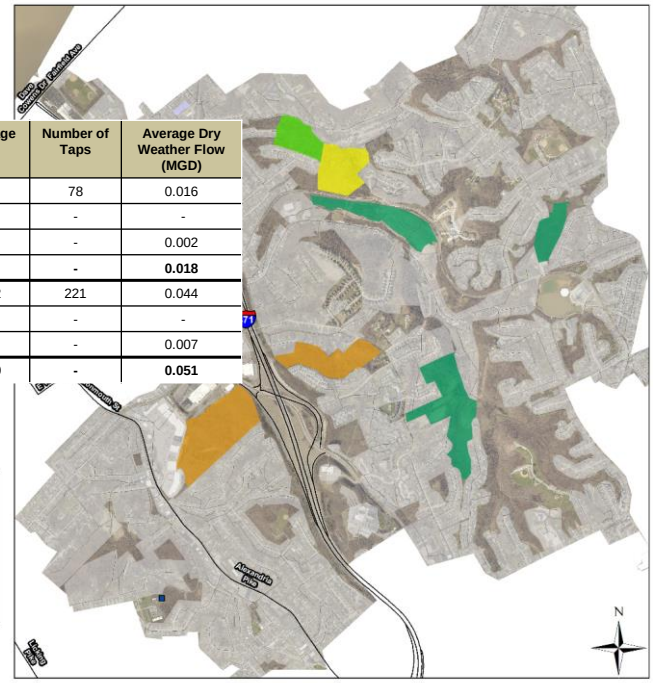
Taylor Creek

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	56	78	0.016
	Commercial	0	-	-
	Industrial	6	-	0.002
	Subtotal	**62**	**-**	**0.018**
2040	Residential	132	221	0.044
	Commercial	0	-	-
	Industrial	17	-	0.007
Total		**149**	**-**	**0.051**



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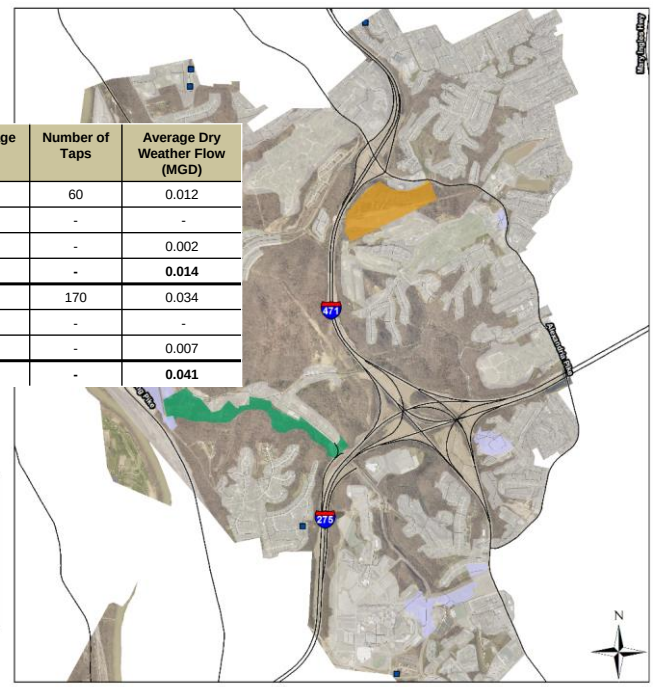
Licking River Siphon

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	24	60	0.012
	Commercial	0	-	-
	Industrial	6	-	0.002
	Subtotal	**30**	**-**	**0.014**
2040	Residential	68	170	0.034
	Commercial	0	-	-
	Industrial	17	-	0.007
Total		**85**	**-**	**0.041**



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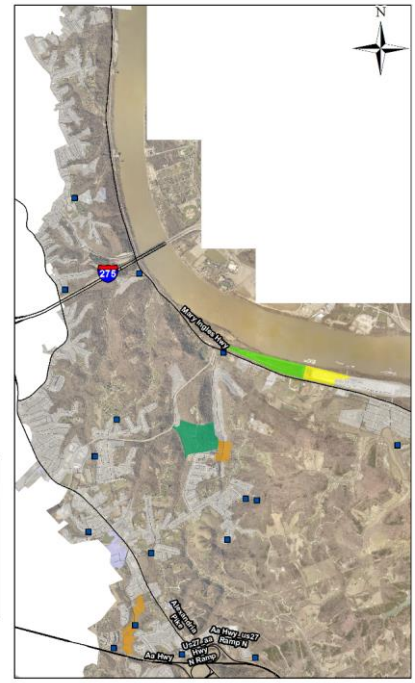
Highland Heights / Silvergrove

Development Date	Development Type	Acreage	Number of Taps	Average Dry Weather Flow (MGD)
2029	Residential	36	84	0.017
	Commercial	0	-	-
	Industrial	12	-	0.005
	Subtotal	**48**	**-**	**0.022**
2040	Residential	102	238	0.048
	Commercial	0	-	-
	Industrial	46	-	0.018
Total		**148**	**-**	**0.066**





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Appendix F: Future Development Technical Memorandum

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Hazen *Technical Memorandum*

August 1, 2017

To: Joe Verst, P.E., Project Engineer
Greg Stacy, P.E., Director of Infrastructure Capital Planning

From: Seth Bradley, P.E., Hazen and Sawyer
Ethan Hypes, EIT, Hazen and Sawyer
Sean FitzGerald, P.E., Hazen and Sawyer

Re: Evaluation of Future Development Flow used in Model Capacity Analysis

Evaluation of Future Development Flow used in Model Capacity Analysis

DRAFT STATUS

Introduction

Accurately representing flow from future residential development plays an important part in hydraulic modeling capacity analysis. In the recent past, the Sanitation District No. 1 of Northern Kentucky (SD1) utilized a dry weather flow of 400 gallons per day (gpd) per household, which was based on Kentucky Division of Water (KDOW) recommendations. As part of the *Watershed Plans for Northern Kentucky*, SD1 used a dry weather flow of 270 gpd per household for future residential development. The change was based on the fact that the calibrated model, as well as other available data and other sources such as *Ten States Standards*, showed that 400 gpd per household was too conservative. For example, *Ten States Standards* recommends a dry weather flow (including base infiltration) of 100 gpd per capita. Analysis performed by SD1 for the *Watershed Plans for Northern Kentucky* found an average of 2.7 people per household in the SD1 service area. More details relating to the assumptions used to calculate future residential dry weather flow can be found in the *Watershed Plans for Northern Kentucky* by SD1 (SD1 2-117). For modeling purposes, the sanitary component was assumed to be 75 gpd per capita and a base infiltration and inflow (I/I) of 25 gpd per capita.

Future development wet weather flows are generated in SD1's hydraulic model by I/I parameters that were calibrated in 2008 to approximately one-year of flow data. These parameters were well calibrated at that time, and included a significant groundwater I/I component that was evident in the flow data. These I/I parameters generate approximately 1,440 gpd/home in the 2-year 6-hour design storm. The model wet weather flows represent the development after approximately 10-15 years, and therefore include some aging of the development.

Model assumptions used for future development flows must be periodically re-evaluated to ensure flows reflect current trends. For example, according to a recent report published by the Water Research

Foundation in April 2016, residential indoor water use in single-family homes has decreased by 22% per household over the past 17 years. This reduction is primarily due to improved water consumption efficiency of household appliances such as clothes washers and toilets (DeOreo et al 8).

To ensure both dry and wet weather flows are represented accurately for future development capacity analysis, SD1 retained Hazen to evaluate the average flow per household for recent development. This memorandum provides recommendations on any changes needed to the assumed dry weather flow of 270 gpd per household currently used in capacity analysis, as well as the I/I parameters used to generate wet weather flows.

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1. Analysis Approach

This memo summarizes analysis for both dry and wet weather flow from new residential development. For dry weather flow, this study examines flow monitoring and water usage billing data from new developments across the SD1 service area. Flow monitoring data from recent developments provides dry weather flows with both sanitary and baseflow components. Water usage data from recent developments provides an estimate of the sanitary component of dry weather flow. For this analysis, water usage data is only taken from winter months to exclude additional water usage during the summer season that doesn't contribute to dry weather flow (e.g. watering lawns, washing cars, etc.). The Hazen-Flex software was used to analyzed flow data and obtain average dry weather flows (ADF) for each development. An equivalent flow/home was calculated by dividing ADF by the number of homes in the development. For water usage billing data, SD1 provided meter readings from various water districts throughout the service area. Depending on the water district, water meters are read either monthly or quarterly. Water consumption data was provided for each billing interval and for all accounts from 2004 – 2015, and represented actual water meter reading results and were not factored. For this analysis, the water consumption data was imported into a database, and converted to an average usage per day by dividing consumption for each billing interval by the number of days since the last meter reading.

For the wet weather flow analysis, this study examined flow data from three recently constructed residential developments. The Hazen-Flex software was used to analyze flow data and obtain the peak RDII flow, peaking factor, and rainfall return period. Model wet weather flows generated by the existing new development I/I parameters were compared to observed flows to determine the accuracy and validity of the model flows. In addition, model flows were further verified by examining historical flow data from two other recently constructed residential developments, and comparing model predicted flows with this data.

2. Flow Monitoring

In 2015, SD1 undertook a flow monitoring effort to verify and refine the average dry weather flow of 270 gpd per household. Flow monitors were installed in nine (9) recent residential developments across the district as shown in Figure 1. The flow monitors were installed at various times throughout the year with monitoring periods ranging from 30 to 60 days. After the monitoring period, flow meter data was reviewed and compared with the average 2014 billed water usage for each development.

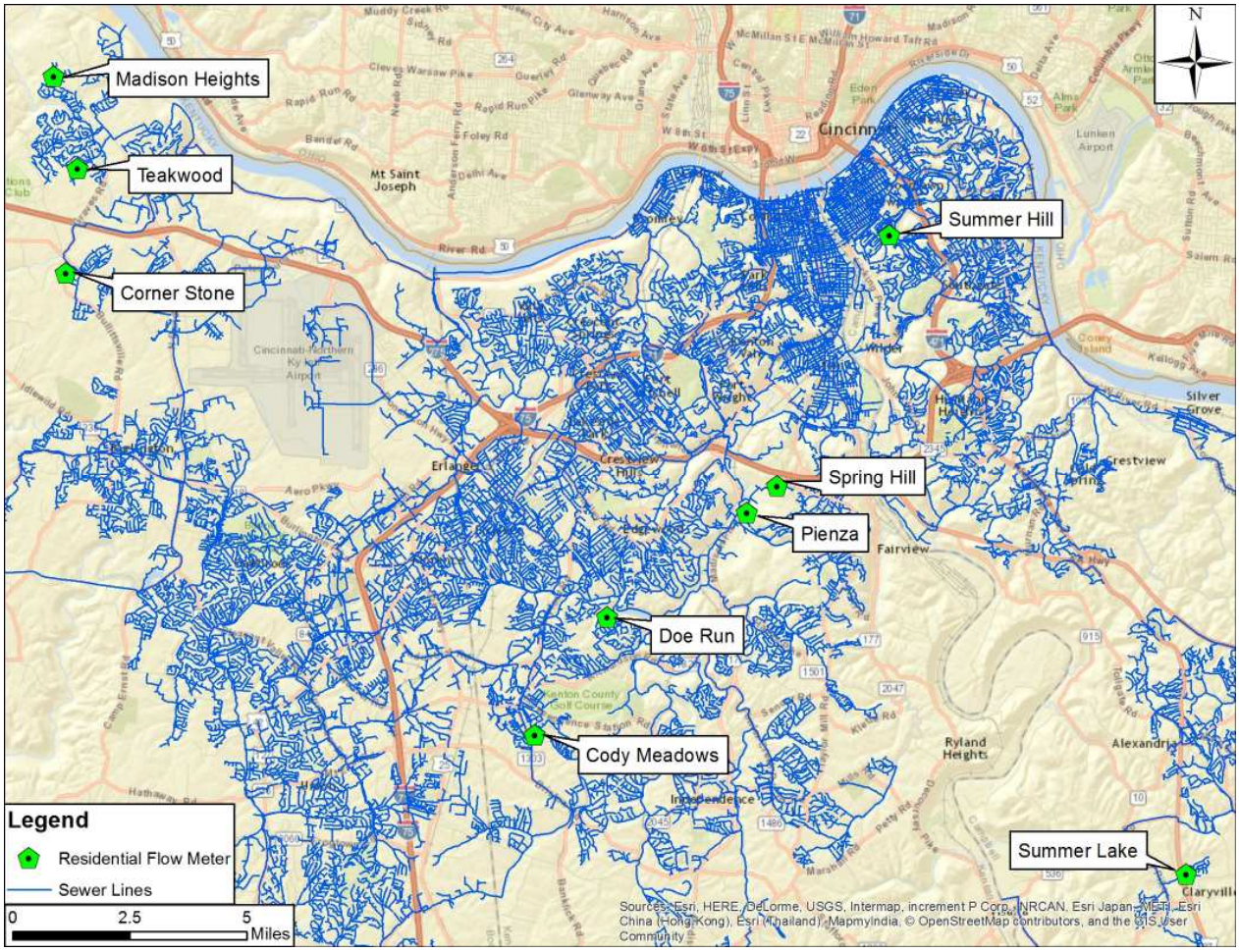

Figure 1: 2015 Residential Flow Monitoring Locations.

2.1 Flow Monitoring and Water Billing Data Review

For each development shown in Figure 1, average daily flow (ADF) was calculated using the corresponding flow monitoring data and water billing data and results are tabulated in Table 1. In many instances, the development average flow did not show good correlation between the flow monitoring data and water billing data, and only added additional uncertainty as to what the appropriate daily flow per household should be. It was concluded that the flow data was inadequate for this analysis due to the flow rate measurements being very low for each of the developments. Figure 2, for example, displays the flow monitor data from the Madison Heights development area with monitor levels around one inch and velocity readings very close to 0 ft/s. Low flows are mainly due to the small number of homes for each monitored development, with eight (8) out of the nine (9) developments having fewer than 100 homes, and several developments having less than 10 homes. Flow monitoring in developments with very low-flow can result in inconsistent flow patterns due to the velocity range limitations of a flow monitor. The large discrepancies between the flow monitoring results and the water billing data shown in Table 1 illustrates the need for continued flow monitoring in developments with more homes.

Table 1: Summary of Flow Meter Data for New Developments in SD1*.

Development	Number of Homes	Meter ADF (GPD)	Billing Data ADF (GPD)	Meter Gal/Home/ Day	Billing Data Gal/Home/ Day
Cody Meadows	45	23,500	5,100	522	112
Cornerstone	25	3,100	4,200	124	169
Doe Run	51	19,600	7,300	384	143
Madison Heights	8	3,600	900	450	108
Pienza	36	5,800	10,000	161	278
Spring Hill	48	7,200	6,100	150	128
Summer Hill	5	400	40	80	8
Summer Lake	118	3,600	15,000	31	127
Teakwood	59	11,500	7,600	195	129

* Meter flows based on an average of 30-60 days.

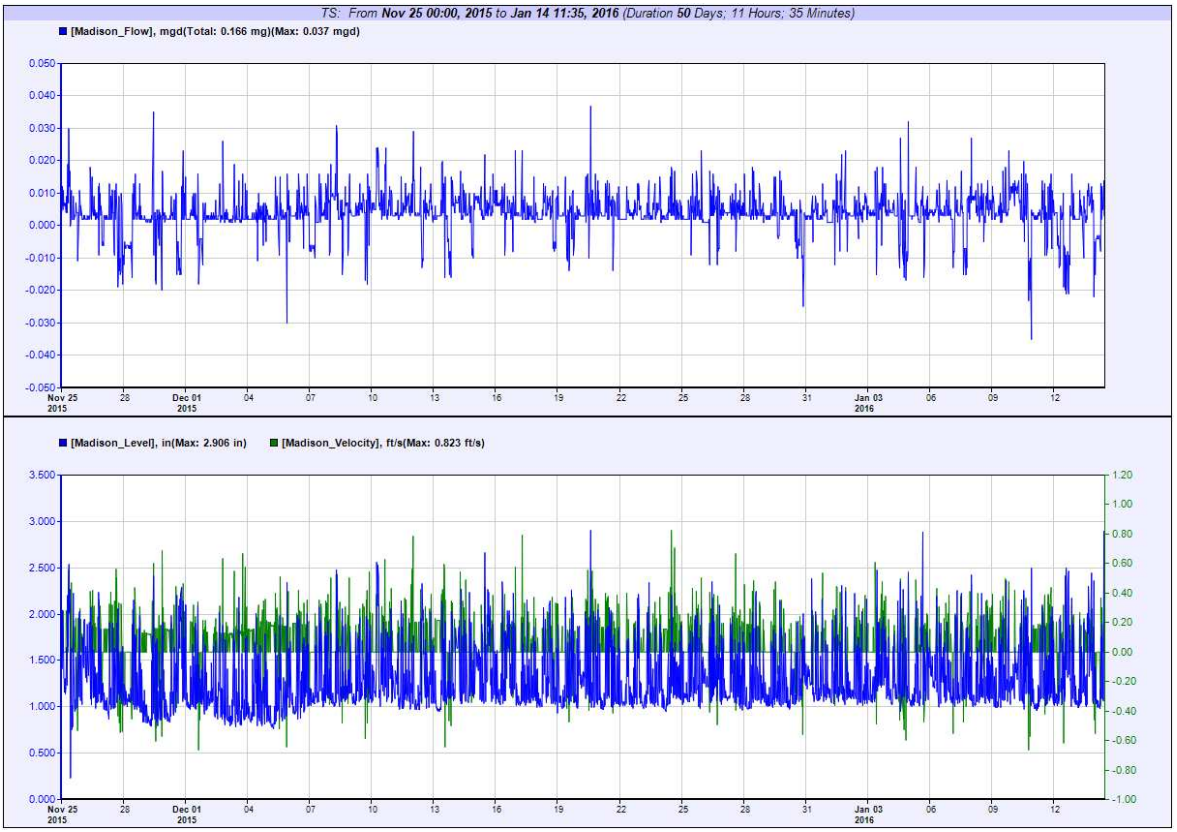

Figure 2: Flow Meter Data from Madison Heights. Top: Flow Rate (MGD). Bottom: Level (in) and Velocity (ft/s).

2.2 Additional Flow Monitoring

Hazen identified three additional locations for flow monitoring and water consumption in recent residential developments with at least 200 homes. These locations are located in each of the three counties SD1 serves, providing a sample from across the service area. These developments are:

- Gunpowder Trails (Boone County), 328 homes, built between 2004 and 2015
- Granite Springs (Campbell County), 421 homes, built between 2005 and 2013
- Bristow Lakes (Kenton County), 215 homes, built between 2005 and 2015

Maps for each of the developments can be seen in Appendix A. Approximately one year of flow monitoring data was available for each of the three developments. The goal of the additional flow monitoring was to collect better data to confirm both dry and wet weather flows, as well as measure groundwater baseflow due to antecedent moisture conditions. Data collected in this effort was of much better quality than previous monitoring efforts. Table 2 summarizes dry weather data for each of the three developments (wet weather data summarized in Section 4), and Table 3 compares flow monitoring data with average daily water consumption data for winter 2016. The average dry weather flow per house is lower than the current standard of 270 gal/household/day for all developments.

Table 2: Future Developments Flow Monitoring Summary

Development	Meter ADF (GPD/house)	Meter Base GWI (GPD/house)	Meter ADSF (GPD/house)
Gunpowder Trails	187	52	135
Granite Springs[1]	265	65	200
Bristow Lakes	160	15	145
Average	**204**	**44**	**160**

[1]Grainte Springs includes both single family and multi-family residential land use.

Table 3: Residential Per Capita Flows for Future Flow Monitoring Developments.

Development	Meter ASDF (GPD/house)	Average Daily 2016 Winter Consumption (GPD/house)[1]	Average Household Size (ppl/house)[2]	Flow Per Capita (GPD/person)
Gunpowder Trails	135	148	2.9	51.4
Granite Springs	200	202	1.9	112.1
Bristow Lakes	145	136	2.8	47.9
Average	**160**	**162**	**2.5**	**70**

[1]Winter bills taken from December to March.
[2]Based on 2010 Census Data.

3. Residential Water Consumption Data

3.1 Water Consumption Data

For the data provided, average daily water consumption was calculated per year for each account. Table 3 below summarizes this analysis, and shows how consumption varies seasonally between summer and fall versus winter. The data summarized in Table 4 considered only residential accounts, and excludes bills with greater than 50 HCF/month and less than 0 HCF/month water consumption to avoid bias from outlier values. As expected, the data shows a significant seasonal difference in water consumption. The data summarized herein only includes residential accounts, and does not distinguish between single family and multi-family consumption. In addition, the data below considers all residential accounts across the service area regardless of age of construction.

Table 4: Billing Data - Water Consumption Records*.

Year	Average Daily Consumption (GPD)	Average Daily Consumption – Summer and Fall (GPD)	Average Daily Consumption - Winter (GPD)
2004	159	163	149
2005	158	167	149
2006	152	159	147
2007	170	195	145
2008	166	185	150
2009	156	163	149
2010	164	185	146
2011	157	170	146
2012	161	180	142
2013	149	157	141
2014	148	154	142
2015	147	153	139
2016	144	153	136
Average	**156**	**168**	**145**

* Summer and fall time frame: June to November.

* Winter time frame: December to March

3.2 Water Consumption Data – Recent Boone County Development

Given that a significant amount of recent development has occurred in Boone County, further analysis was performed on the water consumption data from recent residential development in that area. For this analysis, only residential development built after January 1, 2000 was considered. In addition, SD1 parcel data was used to exclude multi-family accounts and only include single family accounts. For this subset, average winter meter readings were summarized from 2012 – 2016. Winter consumption greater than 50 HCF/month and less than 0 HCF/month was excluded from the analysis to avoid bias from outlier values. Winter consumption was calculated by dividing the winter usage for each billing interval by the number of days since the last meter reading and converting to units of gpd/customer. Then, the average winter daily consumption was calculated for each year. Table 5 shows results for recent Boone County development winter consumption. As Table 5 shows, the average winter consumption for recent Boone County development has been approximately 150 gallons/day/household for recent years.

Table 5: Winter Consumption for Recent Residential Development in Boone County.

Year	Winter Consumption (GPD per Residential Customer)
2012	149
2013	150
2014	151
2015	149
2016	147
Average	**149**

3.3 Water Consumption Data – System Wide

Building upon the analysis conducted for recent Boone County development, a similar analysis was performed across the entire SD1 service area. In this data analysis, only residential parcels were considered, and no distinction was made between single family and multi-family consumption. As previously, winter consumption greater than 50 HCF/month and less than 0 HCF/month were excluded from the analysis to avoid bias from outlier values. Winter consumption was calculated by dividing the winter usage for each billing interval by the number of days since the last meter reading and converting to units of gpd/customer. Then, the average winter daily consumption was calculated for each year.

In addition to summarizing average daily metered consumption using raw water meter data from winter months (December – March), this analysis also compared the average annual water meter readings over the entire year. Table 6 shows the results of this analysis. As expected, the average annual daily consumption per household was higher than the average winter daily consumption, with an average of 156 gpd/household for recent years. The average winter daily consumption averaged approximately 144 gpd/household, which is very close to the average winter consumption from recent Boone County development (149 gpd/household). The system wide average is likely less than recent Boone County development due to less people/household. As stated earlier, the Boone County analysis only included

single-family residential landuse, whereas the system wide analysis included both single and multi-family residential landuse.

Table 6: Winter Consumption Comparison for SD1 System Wide Residential Landuse*.

Year	Average Daily Consumption (GPD/customer)	Average Winter Daily Consumption (GPD/customer)
2012	169	146
2013	155	145
2014	154	146
2015	153	143
2016	151	141
Average	**156**	**144**

* Includes only residential accounts. Commercial accounts not included in calculation.
* Excludes bills greater than 50 HCF and equal to 0 HCF water consumption.
* Winter bills taken from December to March.

4. Wet Weather Flow

4.1 Flow Verification with Current Flow Data

Flow meters installed for the developments discussed in Section 2.2 were also analyzed for wet weather flows. The meters were installed in August 2016, and there were several rainfall events equal to or greater than a 1-year return period at each of the developments. Table 7 summarizes the significant wet weather events for each development, and the corresponding wet weather flow and peaking factor observed.

Table 7: Wet Weather Flow Summary

Development	Date	Approximate Return Period[1]	Peak Flow (MGD)	Peaking Factor
Granite Springs	8/17/16	2-yr 2-hr	0.40	3.4
	8/28/16	10-yr 30-min	0.48	4.0
	4/29/16	2-yr 2-hr	0.54	4.5
Gunpowder Trails	8/15/16	2-yr 10-min	0.16	2.7
	4/29/17	1-yr 2-hr	0.29	4.9
Bristow Lakes	10/19/16	10-yr 15-min	0.60	12.5
	4/29/17	2-yr 1-hr	0.31	6.4

[1]Return Period for Granite Springs taken from Silver Grove RG, Gunpowder Trails from Burlington RG and Bristow Lakes from Union RG.

To compare with model flows, SD1's hydraulic model was simulated for these developments with the existing new development I/I parameters. Figures 3 through 8 provide plots showing a comparison of model flows versus meter flows. For each figure, model flow (red) is plotted versus meter flow (blue) on the top portion of the graph, with the bottom portion displaying model level (red) versus meter level (blue), and model velocity (pink) versus meter velocity (green).

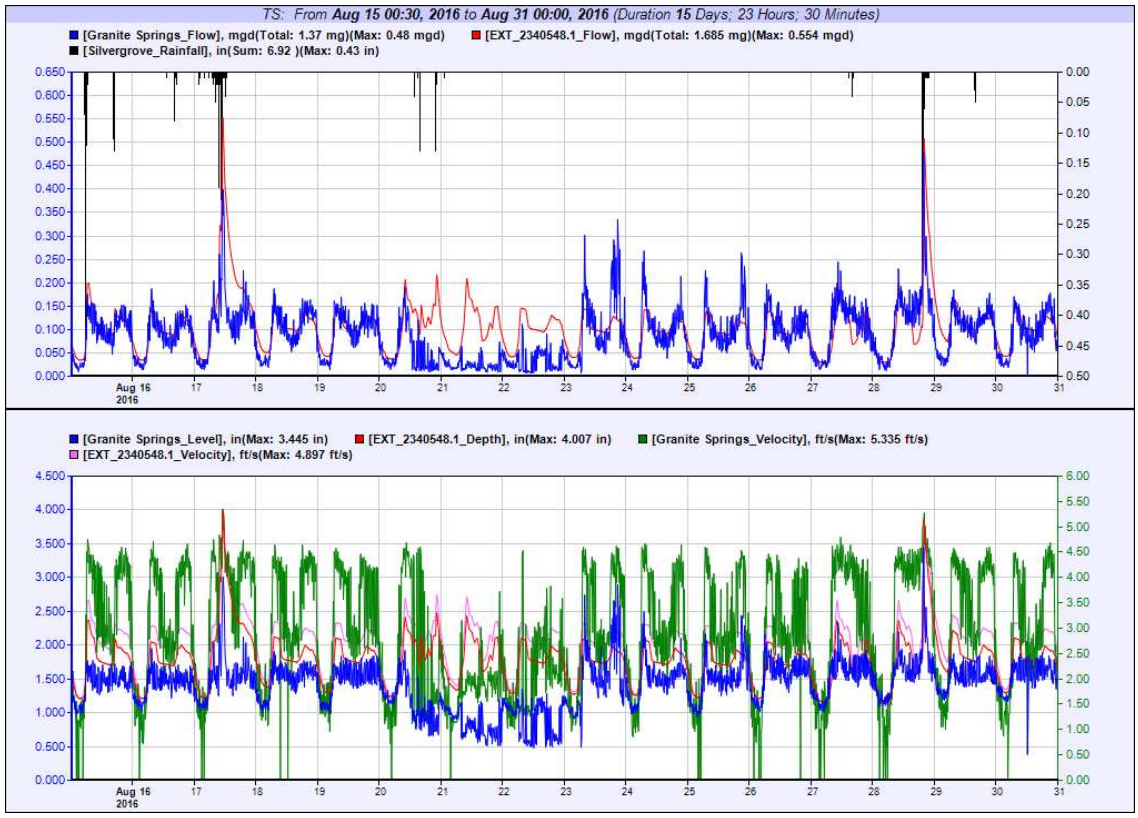

Figure 3: Granite Springs - 8/17/16 & 8/28/16 Storm Events

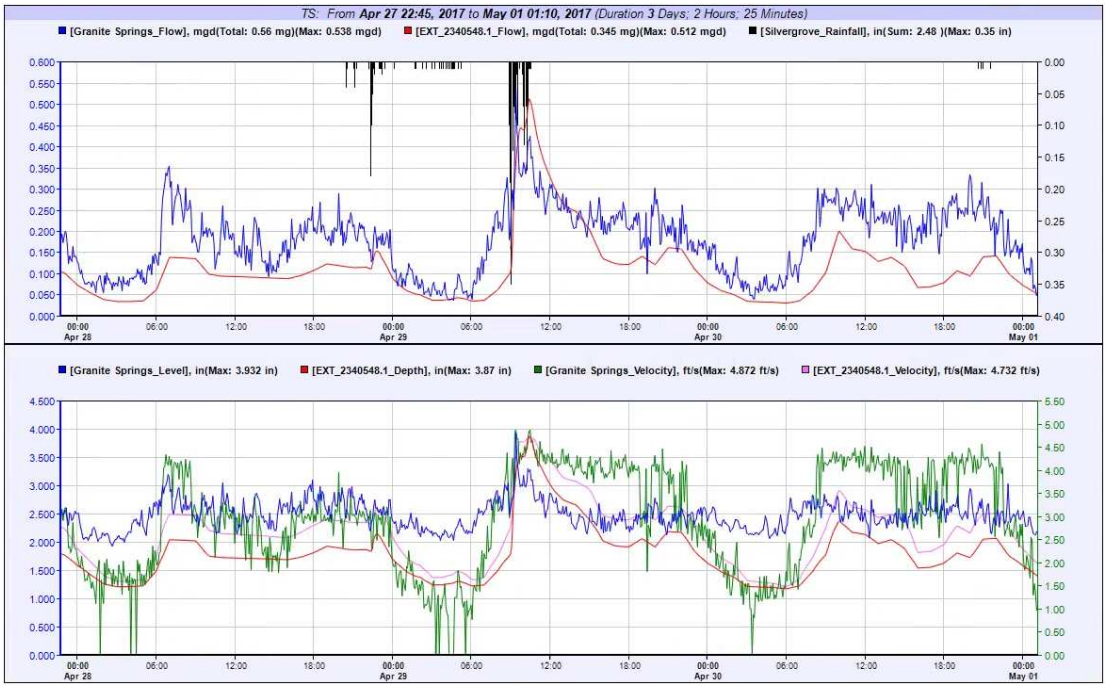

Figure 4. Granite Springs - 4/29/17 Storm Event

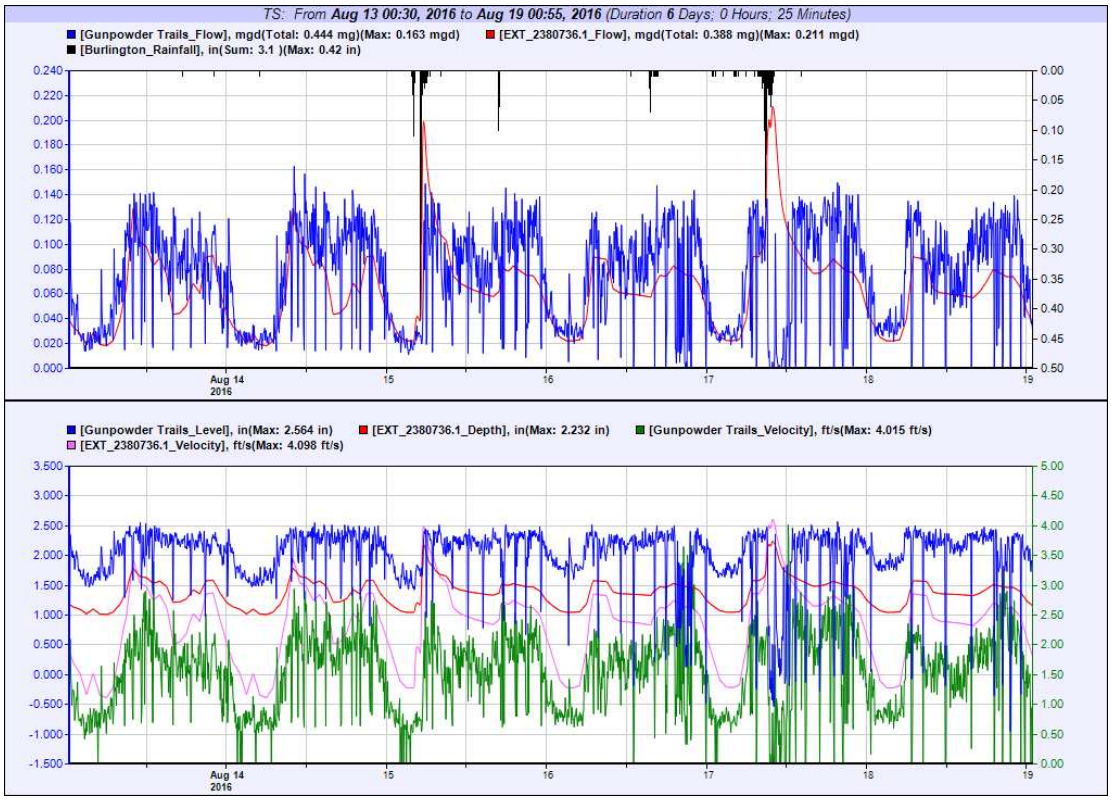

Figure 5: Gunpowder Trails - 8/15/2016 Storm Event

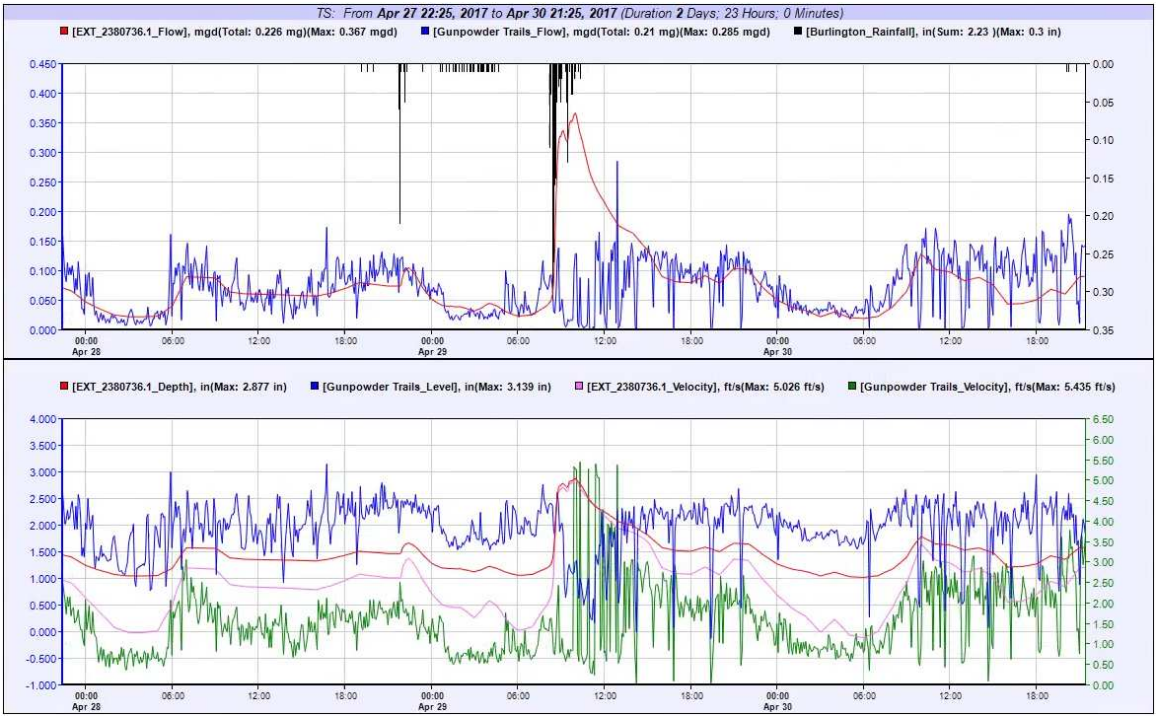

Figure 6: Gunpowder Trails - 4/29/2017 Storm Event

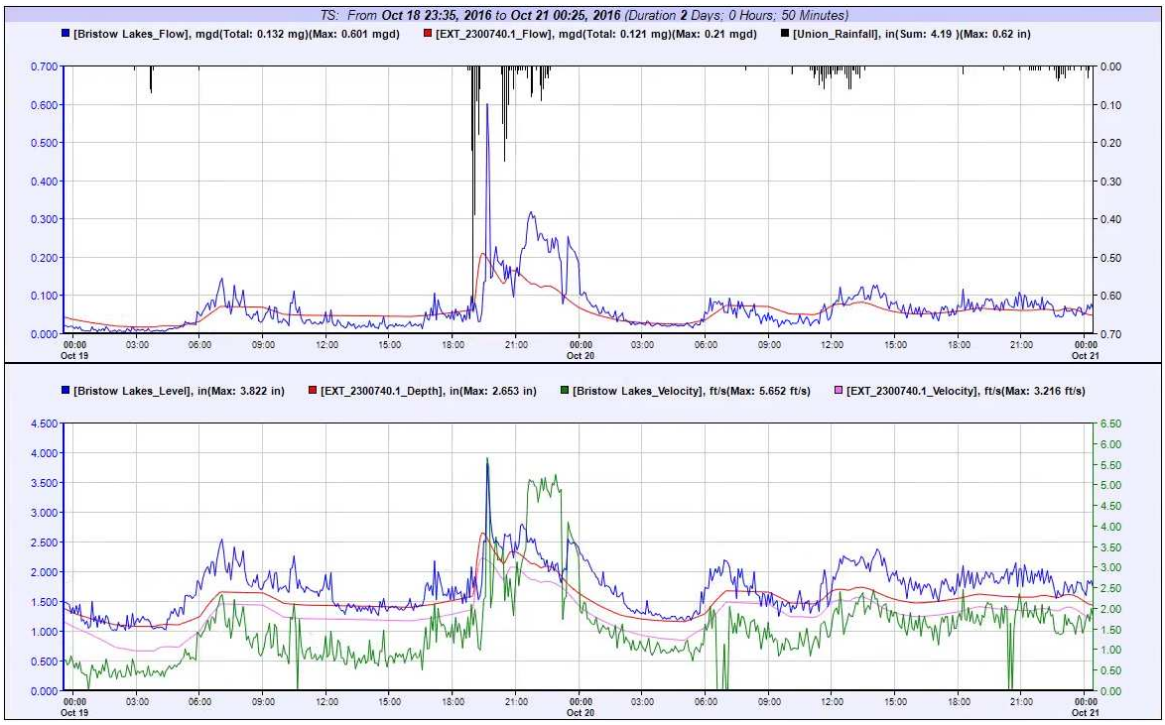

Figure 7: Bristow Lakes - 10/19/2016 Storm Event

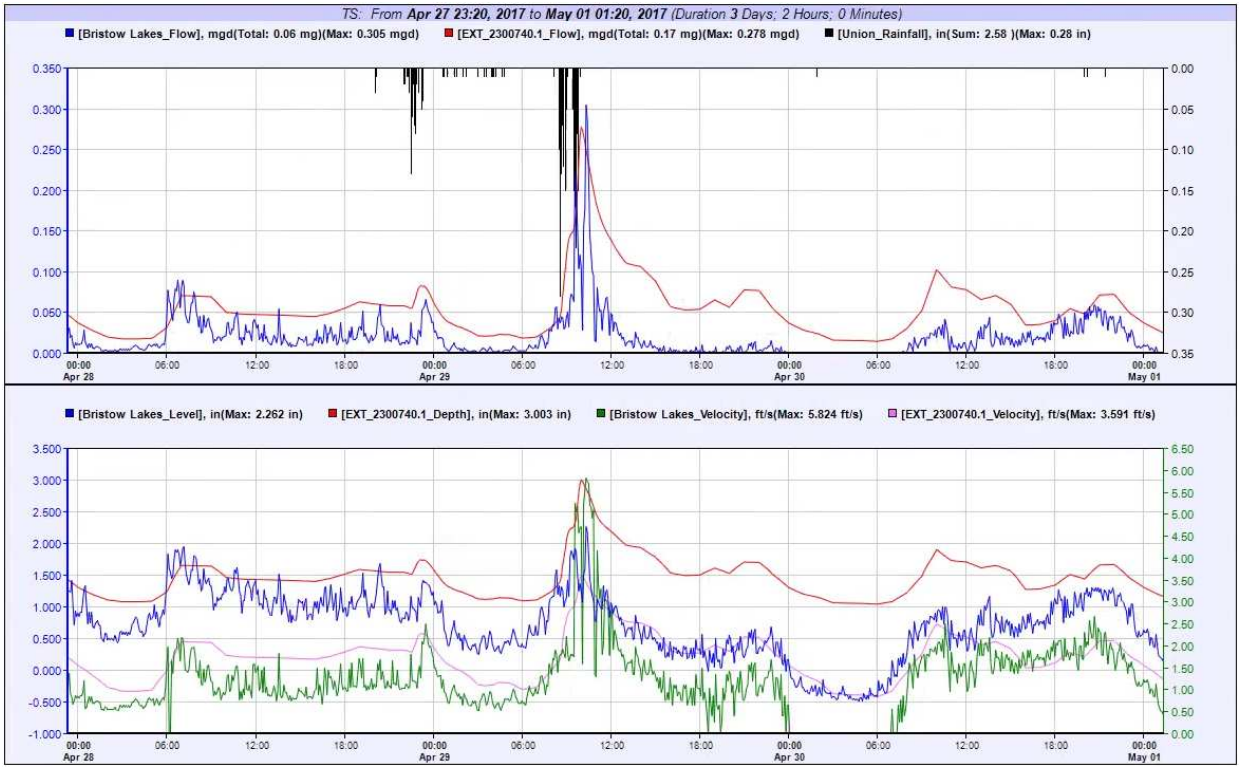

Figure 8: Bristow Lakes - 4/29/2017 Storm Event

Table 8 provides a summary comparison of the wet weather model flows and meter flows. Generally, model flows compare well with metered flows for each of the storm events. Four of the six events summarized, excluding the 10/19/16 event for Bristow Lakes, would be within WaPUG wet weather model calibration criteria for peak flow. Therefore, this data does not suggest that the model new development I/I parameters are overly conservative. The new development I/I parameters may tend to slightly over-predict I/I during summer months with dry antecedent moisture conditions since they include a significant groundwater I/I component that was used to calibrate responses during wetter antecedent moisture conditions in the winter and spring months.

Table 8: Model Flow vs. Meter Flow Comparison for Wet Weather Events

Development	Date	Approximate Return Period[1]	Meter Peak Flow (MGD)	Model Peak Flow (MGD)	% Difference
Granite Springs	8/17/2016	2-yr 2-hr	0.40	0.55	+ 32
	8/28/2016	10-yr 30-min	0.48	0.51	+ 6
	4/29/2017	2-yr 2-hr	0.54	0.51	- 6
Gunpowder Trails	08/15/16	2-yr 10-min	0.16	0.21	+ 27
	4/29/2017	1-yr 2-hr	0.29	0.37	+ 24
Bristow Lakes	10/19/2016	10-yr 15-min	0.60[2]	0.21	- 96
	4/29/2017	2-yr 1-hr	0.31	0.28	- 10

[1]Return Period for Granite Springs taken from Silver Grove RG, and for Gunpowder Trails from Burlington RG.
[2]Poor quality flow data during this storm event.

4.2 Flow Verification with Historical Flow Data

As a further check on the new development I/I parameters, Hazen analyzed historical flow data from meters used in other analysis that included predominately newer residential development. These included two meters from the Sand Run analysis (SR03 & SR06), and one meter from the Richwood PS analysis (RW01). Table 9 summarizes key statistics for the areas tributary to these meters.

Table 9: SR03, SR06 & RW01 Tributary Area Summary

Flow Meter	Number of Homes Tributary	Average House Age	Meter Base GWI (GPD/house)	Meter ADF (GPD/house)
SR03	483	11 years	41	174
SR06	401	12 years	32	224[1]
RW01	1,430	15 years	77	223[2]
		Average	**50**	**207**

[1]Flow includes North Pointe Elementary School.
[2]Estimating non-residential portion of flow at ~ 50,000 gpd.

Table 10 summarizes significant wet weather events observed for each of these meters, and the corresponding wet weather flow and peaking factor observed. It should be noted these storms were selected from winter/spring months to provide flows with wetter antecedent moisture conditions.

Table 10: SR03, SR06 & RW01 Wet Weather Flow Summary

Flow Meter	Date	Approximate Return Period[1]	Peak Flow (MGD)	Peaking Factor
SR03	02/03/16	6-mo 6-hr	0.53	6.3
SR06	02/03/16	6-mo 6-hr	0.34	3.8
RW01	12/27/15	4-mo 3-hr	2.08	5.9

[1]Return Period for SR03 & SR06 taken from Wyndemere RG, and for RW01 from Union RG.

As previously mentioned, the new development I/I parameters result in a peak weather flow of approximately 1,440 gpd per household for future residential development during a 2-year 6-hour storm event. Table 11 provides a summary of the model predicted 2-year 6-hour flow for each of the three meters in this analysis. Considering the data and peaking factors shown in Table 10, the 2-year 6-hour flows and peaking factors shown in Table 11 do not appear unreasonable. The average peak wet weather flow/house is 1,415 gpd, and very close to the model generated flow of 1,440 gpd. This is further validation that the new development I/I model parameters are providing reasonable flows for capacity analysis.

Table 11: Calibrated Model Flows for 2-Year 6-Hour Design Storm

Flow Meter	Peak 2-yr 6-hr Flow (MGD)	Peaking Factor	Peak Flow/Home (GPD)
SR-03	0.51	6.4	1,100
SR-06	0.58	6.4	1,446
Richwood East	2.45 (res)	7.3	1,700
		Average	**1,415**

5. Conclusions and Recommendations

The average winter consumption for recent development is approximately 150 gpd/household based on the results presented herein. Moving forward Hazen recommends that the average residential sanitary flow be 150 gpd/household. This number is further validated by the *Residential End Uses of Water, Version 2: Executive Report* which concludes the current average indoor daily water usage is approximately 138 gpd/household based on a sampling of cities across the United States and Canada.

It is important to remember that dry weather flow has two components: sanitary flow, and base groundwater flow. For base groundwater, Hazen recommends using 50 gpd/household, which is lower than previous value of 25 gpd per capita. Therefore, considering both sanitary and base groundwater flow components, a based dry weather flow of 200 gpd/household is recommended for future residential development in capacity analysis. This number is consistent with the average dry weather observed from both current and historical flow monitoring of newer residential developments as discussed in this memo.

The current wet weather model approach appears to represent development aged at 10-15 year conditions reasonably well, which was the target age. The estimated 2-year 6-hour flow of 1,440 gpd/house appears to be a reasonable number and appropriately conservative based on analysis of several new residential developments across SD1's system. To ensure 1,440 gpd/house in the 2-year 6-hour design storm, it is recommended that future development be adjusted to an equivalent area for 2.3 homes/acre if the density is known. For example, if the actual density is 1.5 homes/acre for 500 homes, the wet weather equivalent model surface area would be 333 acres X ($^{1.5}/_{2.3}$), or 217 acres. This will ensure the model wet weather flow is 1,440 gpd/house. Table 12 provides a summary of both the current and recommended flow assumptions for model capacity analysis, and how both compare to KDOW assumptions for a theoretical 500 home development.

Table 12: Current and Recommended Future Development Flow Assumptions

	DWF/Home	2-year 6-hour Flow/Home	Theoretical 500 Home Development		
			Average DWF	2-year 6-hour Flow	Peaking Factor
Current	270 GPD	1,510 GPD	0.135 MGD	0.76 MGD	5.6
Recommended	200 GPD	1,440 GPD	0.100 MGD	0.72 MGD	7.2
KDOW	400 GPD	-	0.200 MGD	0.74 MGD	3.7[1]

[1]Peaking Factor as calculated from Figure 1 of *Ten States Standards* assuming a population of 1,350 people (2.7ppl/home)

References

DeOreo, William B., Peter Mayer, Benedykt Dziegielewski, and Jack Kiefer. *Residential End Uses of Water, Version 2: Executive Report*. Publication. Water Research Foundation, Apr. 2016. Web. 7 June 2016. <www.waterrf.org/4309>.

SD1. *Watershed Plans for Northern Kentucky*. Report. Sanitary District No. 1, March 2016.

Health Research, Inc. *Recommended Standards for Wastewater Facilities*. Report. Health Research, Inc., Health Education Services Division, 2014.

Appendix A: Future Flow Monitoring Developments


Gunpowder Trails
~ 328 Homes
Built between 2004 - 2015
MH 2380732
Legend
Station with Force Main
Proposed Flow Meter
Sewer Lines
Gravity Line
Force Main
Proposed Gravity Line
Main Trunk Gravity
Abandoned Line
Development Parcels
0
0.125
0.25
Miles


Granite Springs
~ 421 Homes
Built between 2005 - 2013
MH 2340547
Legend
Proposed Flow Meter
Sewer Lines
Gravity Line
Force Main
Proposed Gravity Line
Main Trunk Gravity
Abandoned Line
Development Parcel
Poplar Creek Rd
Creekstone Ct
Springhouse Dr
Millstone Ct
Alexandria Pike
Buning Ln
Founders Ct
Limestone Ct
Matinee Blvd
Sandstone Rdg
Flint Rdg
Slate Vw
Ledgerock Way
Dallas Dr
Silver Ledg
Granite Spring Dr
Boulder Vw
Riverrock Way
Crystal Vw
Quartz Vly
Marble Way
Dry Creek Rd
Morgan Rd
0
0.125
0.25
Miles


Bristow Lakes
MH 2300739
~ 215 Homes
Built between 2005 - 2015
Hogreffe Rd
Cannonball Way
Calvary Rd
Flintrock Blf
Market Cir
Brigade Rd
Bristow Lakes Dr
Audas Ct
Bankfick Rd
Everwood Ln
Bristow Rd
Williamswoods Dr
Pinewood Dr
Pepperwood Dr
Laurelwood Ln
Gatewood Ln
Legend
Proposed Flow Meter
Sewer Lines
Gravity Line
Force Main
Proposed Gravity Line
Main Trunk Gravity
Abandoned Line
Development Parcels
0
0.125
0.25
Miles

Appendix G: Relationship Between Recommended Projects and Project-Specific Selection Criteria

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Table G-1: Relationship Between Recommended Projects and Project-Specific Selection Criteria

Project	Identified in ACD Appendix C[1]	Benefits Priority Area from Original WP[2]	Reduces High-Volume Overflow(s)	Addresses Asset Management Need	Mitigates Stream Hydromodification Concerns	Supports Flood Mitigation Objectives	Informs Decisions on Future Improvements	Provides Capacity for Future Development	Required to Fully Utilize New Facility Improvements	Avoids Costly Conveyance Improvements
CSS										
Willow Run Detention Basin Pilot Project		YES	YES			YES	YES			
Targeted Separation Projects	YES	YES	YES			YES				
Ash Street EQ	YES	YES								
Bromley PS Improvements	YES		YES	YES						
RWI Mitigation Phases I, II, III	YES	YES	YES							
Willow Run RTC		YES	YES				YES			
Willow Run ILS		YES	YES				YES			
3 Campbell County Basins		YES				YES	YES			
4th Street ILS		YES					YES			
Bromley Consolidation Piping									YES	
Taylor Creek EQ		YES	YES							
Taylor Creek RTC Diversion		YES							YES	
Taylor Creek ILS		YES								
Taylor Creek Consolidation Piping		YES	YES						YES	
Willow Run Consolidation Piping			YES						YES	
8th Street Consolidation Piping		YES	YES						YES	
4th Street Consolidation Piping		YES							YES	
James Ave Consolidation Piping		YES	YES						YES	
Patton Street Consolidation Piping		YES	YES						YES	
Dry Creek WWTP Improvements								YES	YES	
Taylorsport FM Extension								YES	YES	
2nd Street PS VFD			YES						YES	

Project	Identified in ACD Appendix C[1]	Benefits Priority Area from Original WP[2]	Reduces High-Volume Overflow(s)	Addresses Asset Management Need	Mitigates Stream Hydromodification Concerns	Supports Flood Mitigation Objectives	Informs Decisions on Future Improvements	Provides Capacity for Future Development	Required to Fully Utilize New Facility Improvements	Avoids Costly Conveyance Improvements
Licking River Interceptor Upsizing		YES								
Diversion Weir Adjustments		YES								
Additional Licking River Detention Basins		YES				YES	YES			
Licking River Storage (Tunnel or EQ Tanks)		YES	YES							
SSS										
HH/SG EQ		YES	YES							
LRS Double Siphon		YES	YES							
LRS EQ		YES	YES							
2029 LRS Conveyance Piping		YES	YES						YES	
W6 PS/EQ	YES	YES	YES					YES		
W6 Conveyance Piping		YES			YES			YES	YES	
Lakeview PS EQ		YES	YES					YES		
Bullitsville PS Improvements	YES			YES				YES		
Waterworks Road Conveyance				YES	YES					
2029 Bromley Crescent Springs Conveyance				YES						
LRS Conveyance		YES	YES	YES	YES				YES	
Keavy Rd & Meadow Lane PS Storage		YES								
Lakeview EQ Tank 1		YES	YES					YES		
Lakeview EQ Tank 8		YES	YES					YES		
Lakeview EQ Tank 2		YES						YES		
Lakeview Conveyance Piping		YES	YES	YES	YES			YES	YES	
Lester Lane PS & FM		YES								
Bivouac PS & FM		YES								

Project	Identified in ACD Appendix C[1]	Benefits Priority Area from Original WP[2]	Reduces High-Volume Overflow(s)	Addresses Asset Management Need	Mitigates Stream Hydromodification Concerns	Supports Flood Mitigation Objectives	Informs Decisions on Future Improvements	Provides Capacity for Future Development	Required to Fully Utilize New Facility Improvements	Avoids Costly Conveyance Improvements
Highland Heights PS Upgrade		YES		YES						
Highland Heights FM Extension		YES								
Highland Heights/Silver Grove Conveyance		YES		YES					YES	
Highland Heights Targeted I/I Removal		YES								YES
Taylor Creek Conveyance				YES	YES					
Taylor Creek Targeted I/I Removal										YES
Dry Creek Conveyance					YES					
Dry Creek Targeted I/I Removal										YES
Bromley Crescent Springs Conveyance					YES					
Western Regional Conveyance					YES			YES		
Taylorsport EQ								YES		
Enzweiler PS Upgrade				YES				YES		
Kees PS Upgrade								YES		
Eastern Regional Conveyance								YES		
Wolpert PS/FM Re-direct								YES	YES	
AA Highway/US 27 Improvements	YES							YES		
Banklick EQ		YES	YES							
Banklick Conveyance		YES	YES						YES	

Notes:

(1) Projects identified in ACD Appendix C were previously identified as high priority using multiple selection criteria.

(2) Priority Areas identified in the original WP were defined as such using multiple selection criteria, including protection of human health.

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Appendix H: Comprehensive Listing of UWSP Projects

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Sanitary System Projects

Milestone	Project Name	Capital Cost (2019 $M)	SSO Benefit (MG)	Project Completion Date	SSOs Eliminated
2023	Vernon Lane I/I Removal	-	4.4	Complete	0260002
	Elsmere Corridor Capacity Upgrade	-	3.5	Complete	2070019, 2090008, 2090063, 2100002, 2100036, 2100106, 2100129, 2110001, 2110002
	Richwood PS & FM	-	3.6	Complete	2280023
	Allen Fork PS Upgrade	-	0.01	Complete	2390002
	SG/HH EQ	15.0	22.0	12/1/2021	0020007, 0020008, 0020032
	LRS Double Siphon	1.2	42.0	7/1/2023	-
2029	LRS EQ	20.5	5.0	1/1/2025	0860001
	LRS Conveyance Piping	7.4	5.0	1/1/2028	0150009, 0150061, 0150063, 0150064, 0150065, 0150198, 0150399
	Lakeview EQ	24.1	6.5	7/1/2027	1950015, 1950PS1
	W6 PS & FM	26.6	9.8	7/1/2028	2300019, 2300027, 2300107, 2300047, 2300060, 2311036
	Bullitsville PS Improvements	10.0	1.0	1/1/2029	2370003, 2370534
	BCS Conveyance	7.3	1.3	1/1/2027	1730085, 1730086
	Waterworks Rd. Conveyance (PH I & II)	8.9	2.0	1/1/2028	0370001, 0380005, 0400002, 0400034, 0410037, 0410039, 0430006, 0430007, 0530083, 0530119
2034	2034 LRS Conveyance and Lift Station (PH 2)	$12.1	1.6	1/1/2034	0100001, 0100004, 0110010, 0150086
	Lakeview PS EQ - Leathers, Keavy, Meadow Lane	$0.4	0.04	7/1/2034	1570100, 2010PS1, 2010PS2
	Lakeview EQ Tank 1	$13.8	3.5	7/1/2034	2300011
	Lakeview EQ Tank 8	$11.6		1/1/2034	1950036, 1950027
	Lakeview EQ Tank 2	$2.6		7/1/2034	-
	2034 Lakeview Conveyance	$30.2	1.3	7/1/2034	1520124, 1940006, 1940024, 1940026, 1940038, 1940039, 1940044, 1950010, 1960002, 1980001, 1990018, 1990028, 1990032, 1990203, 2010042, 2160004, 2170097
	Taylor Creek Conveyance	$17.7	0.3	7/1/2034	0410010, 0410019, 0490032, 0490137, 0500047, 0710071, 1010002, 1010027, 0720027, 0720028
	RDII Reduction - TC	$11.5	0.2	7/1/2034	0390007, 0440074, 1010026
	Bromley Crescent Springs Conveyance PH II - Downstream	$8.9	1.5	1/1/2031	1730104, 1690043
	Bromley Crescent Springs Conveyance PH II - Upstream			1/1/2033	1550053, 1560092, 1560016, 1560121
	Western Regional Conveyance	$24.7	121.5	7/1/2034	1750201, 2300121, 2300123, 2280004, 2280010, 2280011, 2320520, 2410387, 2410459
	W6 EQ	$11.7	5.0	7/1/2031	-
	Wolpert PS & FM Re-Direct	$3.0	0.2	7/1/2032	1920086, 1920097, 1920PS7, 0020006
	AA/US27 Improvements	$16.8	0.4	1/1/2031	2230123
	Banklick EQ	$7.7	6.5	1/1/2031	1850140
	Banklick Conveyance	$0.37	0.7	1/1/2032	1850141, 1870018, 1860108
2040	2040 LRS Conveyance	$7.1	0.4	1/1/2040	0150024, 0220056, 0220058, 0220086, 0230016, 0270026, 1930007, 1930008, 1930009, 1930010, 1930012
	2040 Lakeview Conveyance	$23.6	5.9	7/1/2037	1090069, 1110025, 1110027, 1110051, 1110067, 1110103, 1110104, 1110106, 1110150, 1110161, 1110164, 1110174, 1110294, 1760047, 1760048, 1760055, 2020035, 2020203, 2100057, 2100081, 2100126, 2100156, 2110006, 2110008, 2120001, 2120023, 2120041, 2300013, 2301219, 2311211, 2350005, 2350008, 2350055, 2350681, L17-282
	Lester Lane PS & Screen	$4.6	1.4	1/1/2040	0010PS6, 0040003, 0050022, 0050131, 0050PS1, 0060001, 0060002, 0060004, 0280001, 0360005, 0570130
	Bivouac PS & Screen	$3.4		1/1/2040	
	Lester Lane & Bivouac Force Main	$7.6		1/1/2040	
	Highland Heights PS Upgrade	$4.1		7/1/2038	
	Highland Heights FM Extension	$4.0		7/1/2038	
	HH/SG Conveyance	$10.1		7/1/2038	
	RDII Reduction - HHSG	$10.8	0.9	1/1/2040	0300035
	Dry Creek Conveyance	$10.3	1.1	1/1/2038	1190001, 1190012, 1240008, 1790003, 1790004, 2130027, 1790109, 1220054, 1220016
	RDII Reduction - DC	$6.6	0.7	1/1/2040	1200022
	Taylorsport EQ	$3.9	0.2	1/1/2039	2360024
	Upgraded Enzweiler PS	$0.7	0.3	7/1/2039	2210050
	Upgraded Kees PS	$1.2		7/1/2039	2210009
	Eastern Regional Conveyance	$3.0		7/1/2038	-

Any changes to the scope and or schedule of approved watershed projects identified in this Appendix H will be non-material modifications made in writing by all parties in accordance with paragraph 84 of the Amended Consent Decree. Failure to timely complete projects may result in stipulated penalties in accordance with paragraph 52 of the Amended Consent Decree in the event the 2023, 2029, 2034, or 2040 metrics are not met.

Combined System Projects - Licking River EQ Tank Solution

Milestone	Project Name	Capital Cost (2019 $M)	CSO Benefit (MG)	Project Completion Date	CSOs Addressed
2023	RWI Mitigation Phases I & II	7.9	116	7/1/2023	0880081, 0880082, 0910065, 0910068, 0930105, 0960063, 1420142, 1440206, 1440209, 1470093, 1480187, 1490132, 1710116, 1710119, 1710121, 1710124, 1720109, 1730259
	Targeted Sewer Separation	1.1	7	1/1/2021	0610071, 0620077, 0640090, 0770096, 1420142, 1470093, 1850158, 1870193, 1880090, 1880091
	Ash St EQ	2.2	1.5	12/1/2021	0010220
2029	Willow Run Pilot Detention Basins	1.8	154.0	7/1/2028	1480187
	RWI Mitigation Phase III	6.3	107.0	7/1/2027	0790086, 0570089, 1480187, 1440206, 1470093, 1710116, 1710119, 1710121, 1710124, 1720109, 0610071, 0620075, 0640090, 0650090, 0790084, 0840112
	Bromley PS Short-Term Improvements	1.8	60.0	1/1/2028	1440209, 1470093, 1480187, 1490132, 1710116, 1710119, 1710121, 1710124, 1720109, 1730259
	SR9 Sewer Separation	1.9	10.0	1/1/2026	0730129, 0790084, 0790086, 0840111, 0840112, 0840116
2034	Misc. Diversion Weir Adjustments	$0.55	6.2	7/1/2034	0960064, 0980081, 1440206, 1490132, 1870193
	Bromley Consolidation Piping	$3.9	4.1	1/1/2031	1710116, 1720109
	Taylor Creek EQ	$25.2	29.4	7/1/2032	0640090, 0650098, 0650090, 1480187, 0570089
	Taylor Creek RTC Diversion	$0.25			
	Taylor Creek Inline Storage Control Structure	$1.9	0.5	1/1/2030	0640090, 1480187
	Taylor Creek Consolidation Piping	$20.9	74.3	7/1/2032	0600097, 0600094, 0610071, 0620075, 0630061, 0640090, 0790084
	Willow Run Consolidation Piping	$5.8	39.8	7/1/2033	1440209, 1470093, 1470089
	Willow Run RTC Diversion	$9.1	14.8	7/1/2032	1480187
	Willow Run 2 Inline Storage Control Structures	$7.6	42.4	7/1/2033	1480187
	4th Street Inline Storage Control Structure	$1.2	10.2	1/1/2032	0790086
	24-inch Taylorsport Forcemain	$3.2	4.4	1/1/2034	1710116, 1440209, 1470093, 1480187
	2nd Street PS VFD	$4.5	11.2	7/1/2034	1440209, 1470093, 1480187
	LRI 24-inch Upsizing	$0.67	0.7	1/1/2033	1880090, 1880091
	Riverpointe Drive Basin	$0.23	0.6	7/1/2030	0570090
	Dayton Pike Basin	$0.99	1.7	1/1/2030	0570090
	Grant Park Development Basins	$0.28	11.2	7/1/2029	0570089
	James Avenue Basin 1	$1.3	8.4	7/1/2034	0910065
	James Avenue Basin 3	$6.4	23.5	1/1/2034	0910065
	James Avenue Basin 5	$1.7	6.0	1/1/2033	0910065
	Packaging Unlimited Basin	$0.17	26.1	1/1/2032	0910068
	22nd & Russell	$2.0	4.5	1/1/2034	0910068
	19th & Glenway	$3.6	9.3	1/1/2032	0930105
	Dry Creek WRF Improvements	$40.5	-	7/1/2034	-
2040	4th Street EQ & Consolidation Piping	$10.5	34.3	7/1/2037	0650090, 0790086, 0840111, 0840112, 0840116
	Patton Street EQ & Consolidation Piping	$18.2	41.2	1/1/2039	0880081, 0880082, 0910065, 0910068, 0960063, 1420142, 1480187
	James Avenue EQ & Consolidation Piping	$63.0	146.5	1/1/2040	0870078, 0870079, 0880081, 0880082, 0910065, 0930105, 0870037 (SSO)
	8th Street EQ & Consolidation Piping	$3.8	39.5	1/1/2039	0980081, 1420142

Any changes to the scope and or schedule of approved watershed projects identified in this Appendix H will be non-material modifications made in writing by all parties in accordance with paragraph 84 of the Amended Consent Decree. Failure to timely complete projects may result in stipulated penalties in accordance with paragraph 52 of the Amended Consent Decree in the event the 2023, 2029, 2034, or 2040 metrics are not met.

Combined System Projects - Licking River Tunnel Solution

Milestone	Project Name	Capital Cost (2019 $M)	CSO Benefit (MG)	Project Completion Date	CSOs Addressed
2023	RWI Mitigation Phases I & II	7.9	116	7/1/2023	0880081, 0880082, 0910065, 0910068, 0930105, 0960063, 1420142, 1440206, 1440209, 1470093, 1480187, 1490132, 1710116, 1710119, 1710121, 1710124, 1720109, 1730259
	Targeted Sewer Separation	1.1	7	1/1/2021	0610071, 0620077, 0640090, 0770096, 1420142, 1470093, 1850158, 1870193, 1880090, 1880091
	Ash St EQ	2.2	1.5	12/1/2021	0010220
2029	Willow Run Pilot Detention Basins	1.8	154.0	7/1/2028	1480187
	RWI Mitigation Phase III	6.3	107.0	7/1/2027	0790086, 0570089, 1480187, 1440206, 1470093, 1710116, 1710119, 1710121, 1710124, 1720109, 0610071, 0620075, 0640090, 0650090, 0790084, 0840112
	Bromley PS Short-Term Improvements	1.8	60.0	1/1/2028	1440209, 1470093, 1480187, 1490132, 1710116, 1710119, 1710121, 1710124, 1720109, 1730259
	SR9 Sewer Separation	1.9	10.0	1/1/2026	0730129, 0790084, 0790086, 0840111, 0840112, 0840116
2034	Misc. Diversion Weir Adjustments	$0.55	6.2	7/1/2034	0960064, 0980081, 1440206, 1490132, 1870193
	Bromley Consolidation Piping	$3.9	4.1	1/1/2031	1710116, 1720109
	Taylor Creek EQ	$25.2	29.4	7/1/2034	0640090, 0650098, 0650090, 1480187, 0570089
	Taylor Creek RTC Diversion	$0.25			
	Taylor Creek Inline Storage Control Structure	$1.9	0.5	7/1/2032	0640090, 1480187
	Taylor Creek Consolidation Piping	$20.9	74.3	7/1/2032	0600097, 0600094, 0610071, 0620075, 0630061, 0640090, 0790084
	Willow Run Consolidation Piping	$5.8	39.8	7/1/2033	1440209, 1470093, 1470089
	Willow Run RTC Diversion	$9.1	14.8	7/1/2032	1480187
	Willow Run 2 Inline Storage Control Structures	$7.6	42.4	7/1/2033	1480187
	4th Street Inline Storage Control Structure	$1.2	10.2	1/1/2032	0790086
	24-inch Taylorsport Forcemain	$3.2	4.4	1/1/2034	1710116, 1440209, 1470093, 1480187
	2nd Street PS VFD	$4.5	11.2	7/1/2034	1440209, 1470093, 1480187
	LRI 24-inch Upsizing	$0.67	0.7	1/1/2033	1880090, 1880091
	Riverpointe Drive Basin	$0.23	0.6	7/1/2030	0570090
	Dayton Pike Basin	$1.0	1.7	1/1/2030	0570090
	Grant Park Development Basins	$0.28	11.2	7/1/2029	0570089
	Twin Oaks Golf Course Basin	$2.2	11.7	1/1/2032	0870079
	East 36th Street and Park Avenue	$2.6	7.4	7/1/2031	0880081
	Packaging Unlimited Basin	$0.17	26.1	7/1/2031	0910068
	22nd & Russell	$2.0	4.5	1/1/2033	0910068
	Dry Creek WRF Improvements	$40.5	-	7/1/2034	-
2040	120-inch Tunnel	$63.2	-	1/1/2040	-
	Dewatering PS	$9.1	-	1/1/2039	-
	4th Street Drop Shafts & Screening	$9.1	48.0	7/1/2038	0650090, 0790086, 0840111, 0840112, 0840116
	4th Street Consolidation Piping	$0.4		7/1/2038	
	Patton Street Drop Shafts & Screening	$4.1	118.7	7/1/2038	0880081, 0880082, 0910065, 0910068, 0930105, 0960063, 1420142, 1480187
	Patton Street Consolidation Piping	$6.6		7/1/2038	
	James Avenue Drop Shafts & Screening	$12.6	135.8	7/1/2038	0870078, 0870079, 0880081, 0880082, 0910065, 0930105, 0870037 (SSO)
	James Avenue Consolidation Piping	$13.9		1/1/2039	
	8th Street Drop Shafts & Screening	$7.9	38.3	7/1/2038	0980081, 1420142
	8th Street Consolidation Piping	$1.1		1/1/2040	

Any changes to the scope and or schedule of approved watershed projects identified in this Appendix H will be non-material modifications made in writing by all parties in accordance with paragraph 84 of the Amended Consent Decree. Failure to timely complete projects may result in stipulated penalties in accordance with paragraph 52 of the Amended Consent Decree in the event the 2023, 2029, 2034, or 2040 metrics are not met.

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Appendix I: SD1's RDII Reduction Strategy

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The significant removal of rainfall derived infiltration and inflow (RDII) was a key component of the original WSP. The goal was to reduce the RDII by 50% in all areas with a total annual average R-value of 2% or greater, which included almost 40% the entire separate sanitary sewer system. The assumption was that RDII removal would comprise both public and private removal activities.

For public RDII removal, the strategy was comprehensive rehabilitation across the entire sewershed. This was based on evidence from other projects that RDII migrated to other locations if rehabilitation only targeted the portions of the system with obvious defects. For the purposes of the WSP, comprehensive rehabilitation in the public system was defined as the following activities in a removal area:

- CIPP lining or replacement of all gravity sewers including end seals.
- Lining of all manholes with cementitious or epoxy coating.
- CIPP lining of all laterals for at least the first 3' from the main.

For private I/I the following activities were assumed:

- Detailed SSES studies including CCTV, smoke testing, dye testing.
- Removal of all connected downspouts and area drains.

Based on previous studies that showed RDII is approximately 50% private and 50% public, it was assumed that an equal 25% (of total) reduction would be achieved in each system, resulting in a reduction of 50% in total RDII.

This goal of 50% RDII removal was recognized as a very aggressive goal. For that reason, the original strategy was intended to be tested and validated through various early RDII removal projects conducted as part of the five-year implementation plan. SD1 subsequently tested RDII removal in several areas, with three of the primary locations for these activities being as follows:

- Lakeside Park (where over 90% of the system was already CIPP lined).
- Vernon Lane (numerous direct connections from downspouts and area drains).
- Area tributary to Crestview Pump Station (PS).

The implementation of the RDII removal activities in these areas provided mixed results at best. RDII removal in Lakeside Park and Crestview PS did not remove enough RDII to significantly affect the peak flows or volumes. Some reasons for that could include the challenges associated with implementing the work on private property, which precluded much of the planned downspout redirection work from taking place in these two areas. Another key discovery was the amount of time needed to implement these few projects. The goal was to have a definitive view of the efficacy and cost-effectiveness of RDII removal by the end of the first five-year plan; this goal proved unrealistic once the true duration for projects of this type became apparent.

These projects also revealed that an exhaustive effort was necessary for public education and to solicit input from each homeowner on how to redirect their downspouts and preferred designs for their property. In essence, each property represents an individual project given the necessary interaction with each property owner and the resulting negotiated solutions. This challenge is compounded by the difficulty SD1 faces in enforcing District regulations within the many local governmental jurisdictions when property entry or action by the property owners is required.

Despite all of the real challenges noted above, however, SD1 has discovered that early data from the Vernon Lane project is promising. While the data collected to date is limited, assessment of that data indicates that the reduction in RDII could be close to 60%. An indication of this success can be seen in Figures G-1, G-2, amd G-3:

- Figure G-1 compares pre-rehabilitation and post-rehabilitation flow monitoring data, comparing data from a meter downstream of the Vernon Lane project area to a control meter. Use of the control meter, located in a similar area that was not rehabilitated, is one way to minimize the impact of different rainfall events on a comparison of pre- and post-rehabilitation responses. The figure compares the R-factor, or percent of rainfall entering the system, between the two meters for multiple individual events. While significant scatter in RDII data is typical, the chart shows that for any given R-factor at the control meter (on the x-axis), the Vernon Lane meter (on the y-axis) tends to show a lower R-factor after rehabilitation.
- Figure G-2 is similar to G-1, but compares peak flows (instead of R-factors) between the two meters. A similar and even more pronounced conclusion that the rehabilitation reduced RDII in the Vernon Lane system can be drawn from the peak flow comparison.
- Figure G-3 presents a different kind of comparison, this time using the model to compare pre- and post-rehabilitation conditions. Available post-rehabilitation data has been used for a preliminary re-calibration of SD1's ICM model, which was then used to generate a comparison to pre-rehabilitation conditions during the 2-year, 6-hour storm.

Figure G-1: R-Factor Comparisons Between Vernon Lane and Control Meters, Pre- and Post-Rehab

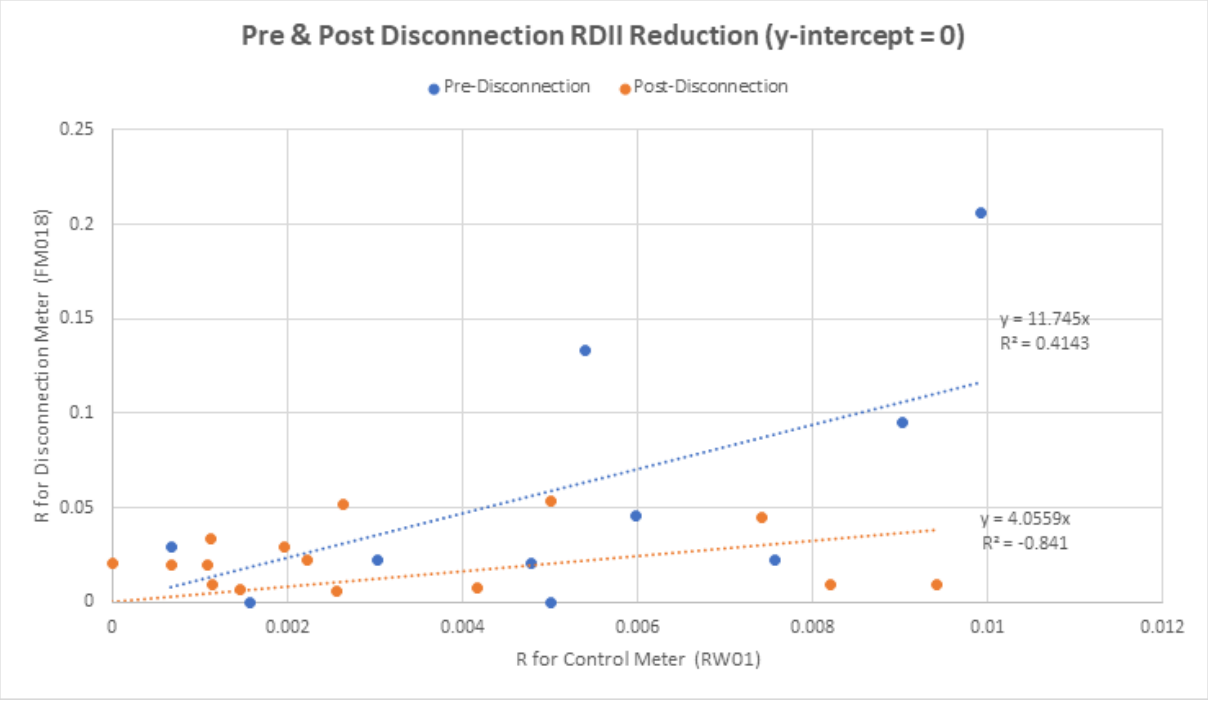


Figure G-2: Peak Flow Comparisons between Vernon Lane and Control Meters, Pre- and Post-Rehab

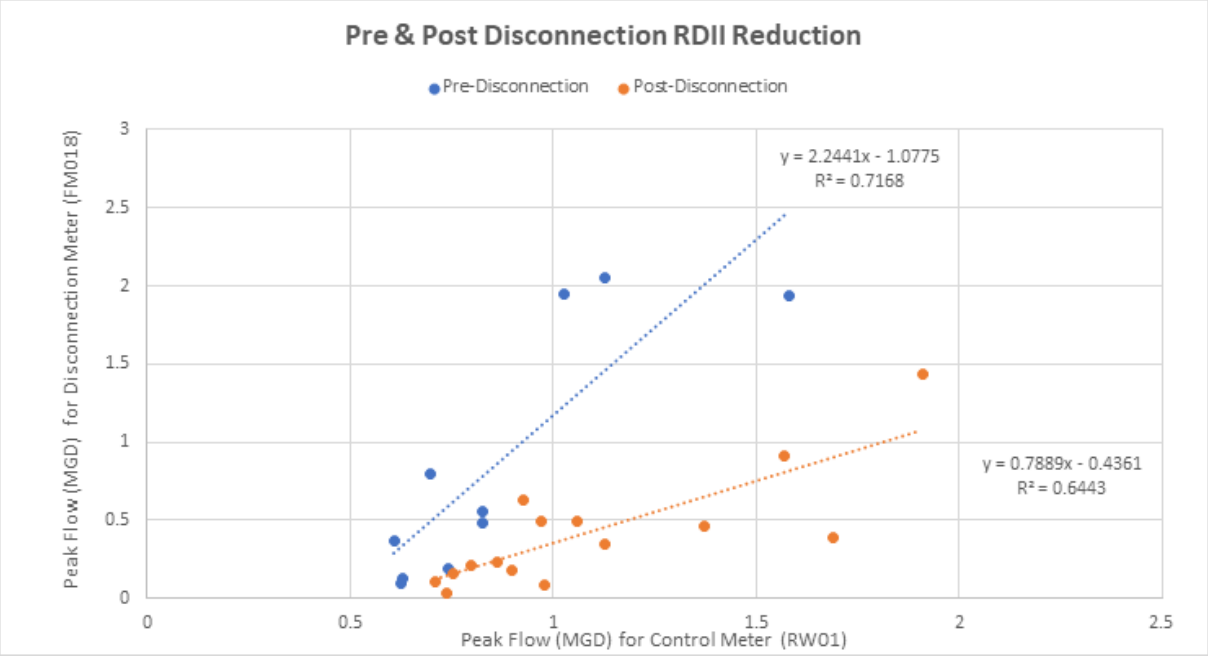
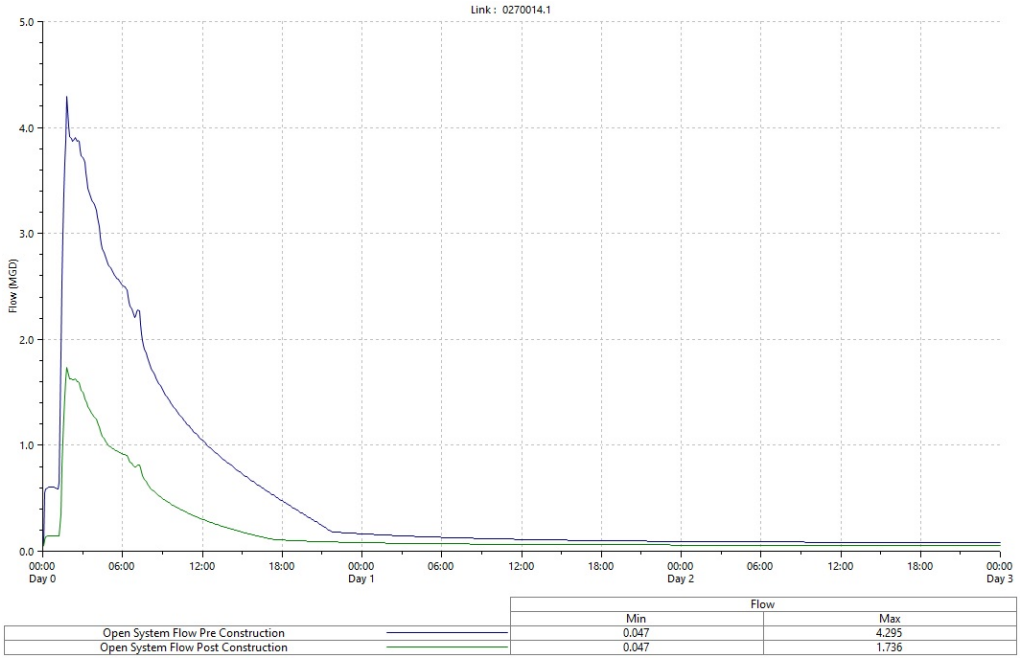


Figure G-3: Model Predicted Peak Flows from 2-Year Storm in Vernon Lane, Pre- and Post-Rehab



SD1 continues to collect data in the Vernon Lane area, and once enough data has been collected a full conclusion on the level of success and associated success factors will be developed. The potential success in RDII removal in Vernon Lane could be attributed greatly to the high level of initial RDII, the amount

of preliminary SSES work to identify RDII sources, and the significant effort to remove both private and public sources of RDII.

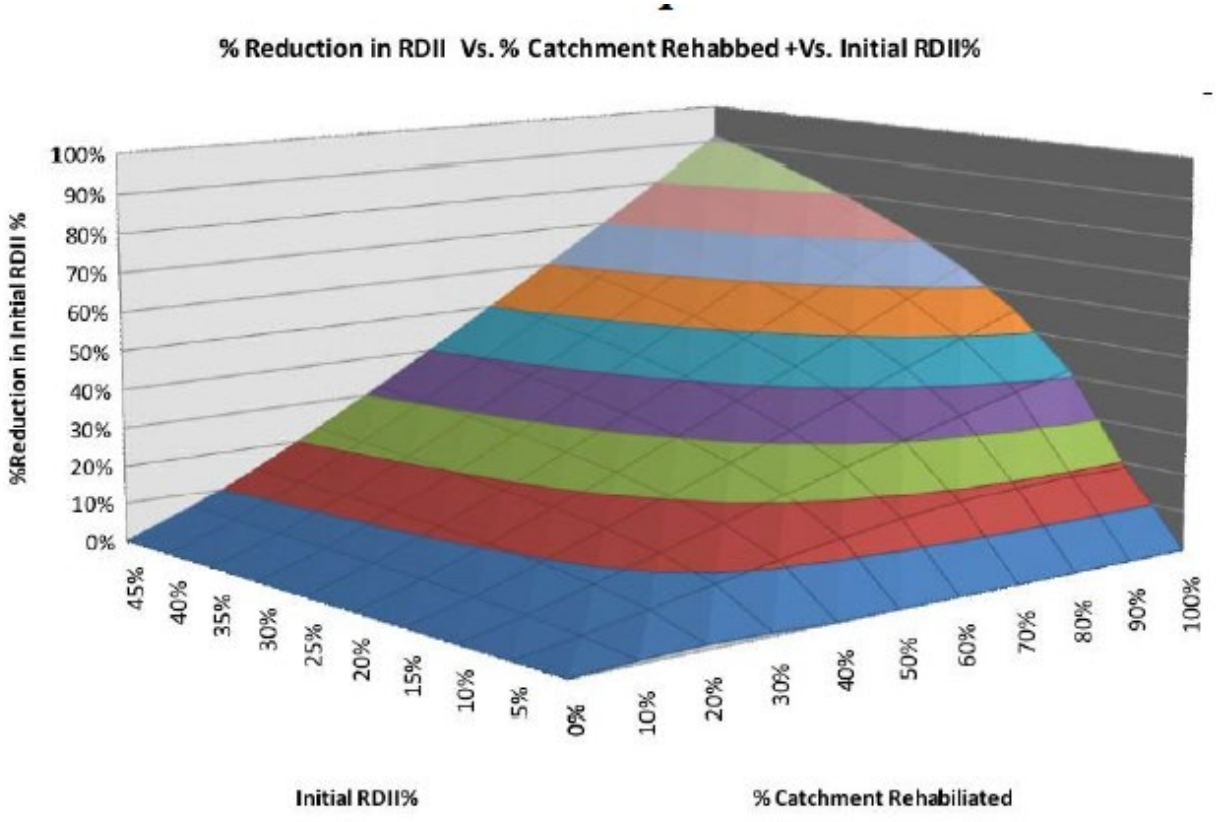
Another important step in refining SD1's RDII removal strategy is to carefully consider the total costs for the pilot projects compared to the cost assumptions in the original WSP. The WSP estimated that comprehensive RDII removal would cost approximately $1.2 Million per mile of sewer in the removal area. The total estimated capital cost for the Vernon Lane project was approximately $4.5 million, which results in a cost of over $2.2 million per mile of sewer. This cost did include some storm sewer work and stormwater BMP costs, which would lower the RDII costs. That said, while Vernon Lane was successful, the costs were higher than expected, especially for the private source reduction.

The overall RDII removal results in SD1's completed pilot areas point to the following conclusions:

- RDII removal was successful in only one of three pilot areas and costs were higher than expected.
- Significant effort and financial resources are required on private property to make RDII removal successful.
- Robust source identification, public and private, is critical.
- These projects are time-intensive as evidenced by the five years of effort to complete the three pilot studies.
- These three projects represent a tiny fraction of the areas identified for RDII removal (342 of 17,700 acres or 1.9% of the total area) – this means that scaling the effort up to the full target area may be time-prohibitive relative to the UWSP schedule.
- Comprehensive rehabilitation results in lining of many pipes which are in good structural condition.

In evaluating the continued efficacy of RDII removal for SD1, available data from other sources was reviewed to determine if SD1's results are consistent with industry experience. A valuable reference is a major study conducted in New Zealand where 10 years of RDII removal work was analyzed by the North Shore City Council. The analysis resulted in the development of an RDII removal model that predicts volumetric and peak flow reductions as a function of pre-rehabilitation RDII and the percent of the area rehabilitated. It is important to note that the percent rehabilitation used in the study applies to the combined total private and public system. Figure G-4 shows the results of the study for volume reduction. The figure clearly shows two of the key conclusions from the study, specifically that percent removal is highly dependent on the percent of the catchment rehabilitated and the initial RDII. For example, the model indicates that if the initial R value is 5%, the highest expected RDII removal is 20%. Alternately, if the initial RDII is 20%, comprehensive rehabilitation could result in up to 65% removal. Interestingly, the total R value in Vernon Lane was 22%. It is important to note that the study also concluded that the success of RDII removal was highly variable.

Figure G-4: RDII Removal Prediction Curve Taken From "Confidently Predicting Effectiveness of Sewer Rehabilitation," NZWA Conference 2008



Based on SD1's pilot results, the experience of other utilities, and the available time to meet the Consent Decree goals, it is not recommended to rely heavily on RDII removal as a cost-effective approach to addressing SSOs as part of the UWSP. Here are the primary reasons:

1. RDII removal success has a high degree of uncertainty and depends heavily on significant work on private property.
2. SD1 is challenged with their jurisdictional authority to work on private property for investigation and actual implementation, and so must rely on partnering with property owners. Completed pilot studies have shown that this situation presents many practical challenges for SD1.
3. Implementing the required SSES studies as well as resulting rehabilitation takes a significant amount of time. It is impracticable to complete a significant number of these projects and also conduct robust post-construction monitoring in the time frame required by the UWSP.
4. RDII removal was not consistently successful for SD1, with the best likely success in Vernon Lane, which had a very high number of known connections and over 20% initial RDII.

While RDII removal is no longer recommended as a major component of the strategy to address SSOs, RDII removal should clearly be maintained as a targeted solution component for potential application in the following areas:

1. Areas where the initial RDII percentages are dramatically high (at least 20% or greater) and are upstream of SSOs.
2. Areas tributary to SSOs that are upstream of under-sized major trunk sewers, where RDII reduction can significantly reduce the need for downstream pipe upsizing.

Finally, SD1 should continue to investigate enforcement strategies to target known issues with direct connections to the sanitary sewers from private property. Eliminating direct connections via enforcement cannot be forecast sufficiently to be included in a compliance plan at this time. With ongoing monitoring and the adaptive opportunities available in ACD, it is possible that future infrastructure sizing could be adjusted based on reduction of RDII.

Appendix J: Update of Previously Approved NFA Analysis

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Hazen *Technical Memorandum*

NOTE: THE FOLLOWING IS A REVISED VERSION OF THE ORIGINAL APRIL, 15, 2020 TECHNICAL MEMORANDUM INCLUDED IN SD1'S DRAFT UPDATED WATERSHED PLAN. THE SECOND PARAGRAPH AND TABLE 1 WERE EXPANDED TO ADDRESS REGULATORY COMMENTS.

April 15, 2020

To: SD1

From: Sean FitzGerald, Hazen
W. James Gellner, Hazen
Steven Reese, Hazen

Re: DRAFT PRIVILEGED AND CONFIDENTIAL - Updated Dry Creek WRF NFA

Introduction

A No Feasible Alternatives (NFA) Analysis for the Dry Creek WRF was originally completed in 2014 and submitted as part of the Original Watershed Plan for SD1. The NFA included evaluation of three potential secondary treatment capacities at the plant: 100 MGD, 130 MGD, and 160 MGD. Based on the information available at the time, and the overall WSP CSO control strategy, a target peak hydraulic capacity of 160 MGD (including enhanced primary and disinfection) and a peak secondary capacity target of 100 MGD was selected as the preferred option. In addition, all separate sanitary sewer flows would receive full secondary treatment. Since the original WSP was submitted, SD1 has moved forward with various improvements targeted in the original NFA and are shown in Table 1.

In accordance with the Amended CD, and as part of the UWSP effort, the 2014 NFA was reviewed and revised based the UWSP CSO control strategy. This Memorandum summarizes the work to date, as well as the revised NFA at the Dry Creek WRF to achieve compliance with the CSO Policy and the Amended CD. Table 1 below is a summary of the Dry Creek WRF improvements listed in the 2014 NFA with updated status, remaining capital costs in $2019 for all original NFA improvements, and remaining capital costs in $2019 for the revised NFA improvements (i.e. those required under the UWSP), with projected implementation periods.

Job no

Table 1: 2014 NFA Dry Creek WRF Improvements Summary and Status

Description	Improvement Status	RemainingCIP Total ($Millions - 2019) Under 2014 NFA	RemainingCIP Total ($Millions - 2019) Under Revised NFA	Projected Implementation Period Under Revised NFA
Preliminary Treatment	Completed	-	-	Completed
Primary Treatment		12.7	12.7	2029-2034
Aeration Basins		15.1	15.1	2029-2034
Final Clarifier Mods (including 7th Clarifier)	RAS Improvements and Clarifier Rehab Completed	27.0	Not Needed	Not Needed
UV System – 160 MGD		12.7	12.7	2029-2034
Total Estimated Capital Cost (Remaining Capital Cost)		**67.5**	**40.5**	

No Feasible Alternative Revisions

The preferred CSO control strategy as presented in the UWSP has significantly altered the timing and extent of peak flows to the Dry Creek WRF and has been altered from a remote High Rate Treatment strategy to a more storage and coordinated control-based strategy. In addition, the upgraded Bromley PS capacity will be 45 MGD instead of 60 MGD. Therefore, the cost-effectiveness of spending significant money to achieve 100 MGD peak secondary capacity was revisited. Following is a summary of changes to the 2014 NFA improvements based on the UWSP assessment.

Disinfection Improvements (no changes) - As documented in the original NFA, the current disinfection system is sized for a disinfection capacity of 93 MGD, based on a 10 States Standards requirement for 15 minutes of contact time at peak flow within the outfall. UV improvements, which were included in the original NFA are still planned to increase disinfection capacity to 160 MGD, which matches the outfall hydraulic capacity.

Primary Clarifier Improvements (no changes) - Primary clarifier improvements included in the original NFA are intended to increase the hydraulic capacity of the primary clarifiers to 160 MGD, including ability to send separate sanitary sewer flows directly to the aeration tanks (remaining separated from the combined flow) and to accommodate enhanced primary treatment of peak flows through chemical addition.

Aeration Tank Improvements (no changes)- Aeration tank improvements include modifications to allow step feed / contact stabilization and modified air delivery, including creation of anoxic zone for enhanced settling. These improvements are still needed to significantly increase the biological treatment capacity from 55 MGD to up to 100 MGD. The conceptual level costs shown in Table 1 for these improvements

(i.e. $15.1M in 2019 dollars) are needed to "unlock" aeration tank capacity to allow flows beyond 55 MGD to be treated biologically.

Additional 7th Clarifier (*not needed*) – In the 2014 NFA, the seventh clarifier was intended to provide reliable final clarifier capacity for 100 MGD. Previous sampling and CFD modeling was performed as part of the 2014 NFA to determine capacities of the existing clarifiers and resulting capacity from construction of an additional clarifier. Those findings indicated that up to 100 MGD could be treated through the existing clarifiers under two conditions: 1) step feed contact stabilization and 2) good settling properties (i.e. SVIs at 115 mL/g or less). Even under these conditions, anticipated effluent suspended solids were predicted to be high and would rely on quick return to normal settling to meet weekly and monthly mass limits.

The remaining conceptual level costs associated with the seventh clarifier shown in Table 1 (i.e. $27.0M in 2019 dollars) are associated with construction of the new seventh clarifier, retaining wall additions to preserve the existing access road, and RAS/WAS pumping for the new clarifier. A seventh clarifier is needed to provide a reliable biological capacity of 100 MGD. Based on a hydraulic loading rate of 1,000 gpd/sf, the existing 6 clarifiers have a reliable total capacity of 80 MGD. However, as was shown in the CFD modeling and analysis performed in 2008, higher capacity is possible under the revised aeration tank configuration and when SVIs are in a favorable range. Therefore, SD1 will implement a strategy to maximize its flow through its existing secondary clarifiers rather than spending a significant amount of money to build a 7th clarifier.

This revised plan will achieve a minimum reliable peak secondary capacity of 80 MGD at the Dry Creek WRF, with the potential to treat more under certain situations based on additional evaluation and optimization. Table 2 shows that SD1 will be able to achieve full secondary treatment of a higher percentage of wet weather volume and captured wet weather volume versus the previous plan.

Table 2: Summary of Secondary Treatment of Combined Flow

Scenario	Percent of Combined Flow Receiving Secondary Treatment	Percent of Captured Combined Flow with Secondary Treatment
2014 NFA	79%	82%
Revised NFA	82%	95%

Table 3 below shows the incremental cost and benefits of increasing secondary treatment capacity from 55 MGD to 80 MGD versus the additional benefit of adding the 7th clarifier to provide reliable 100 MGD secondary capacity.

Table 3: Incremental Costs of Increased Secondary Treatment Capacities at the Dry Creek WRF

Secondary Capacity Increase (MGD)	Increase in Typical Year Secondary Treatment (MG/yr)	Incremental Cost ($M - 2019)	Incremental Cost /Benefit ($/gal)
55 to 80	488	15.1[a]	$0.03
80 to 100	19.6	27[b]	$2.14

Notes:
Costs associated with primary treatment and UV improvements not shown.
[a] Cost shown is for aeration basin improvements
[b] Cost shown is for seventh clarifier

The incremental cost for adding the seventh clarifier and increasing secondary treatment capacity at the Dry Creek WRF to 100 MGD is significantly higher than the cost to increase secondary treatment capacity to 80 MGD. The costs of the addition of the seventh clarifier are not justified, particularly when the secondary treatment capacity with the existing clarifiers can be increased beyond 80 MGD under favorable settling conditions.

The aeration basin improvements include the creation of anoxic zones at primary effluent feed locations to improve the settling properties of the solids. This will increase the potential for capacity beyond 80 MGD. When the remaining improvements for Dry Creek WRF are implemented (primary clarifier, aeration basins, and UV disinfection), further study of optimization of secondary treatment capacity will also be performed using WRF modeling and clarifier CFD analysis. Further operational improvements and protocols will be developed and implemented to provide as much secondary capacity as possible.

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Appendix K: FCA Summary Sheets

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EPA Financial Capability Assessment

The District's Amended Consent Decree (ACD) requires that as part of the submittal of each Updated Watershed Plan, the District conduct a Financial Capability Assessment (FCA) as outlined in EPA's CSO Guidance for Financial Capability Assessment and Schedule Development published in March 1997. The EPA FCA consists of ten worksheets. The first two worksheets calculate the Residential Indicator (RI), which is intended to be a measure of the cost per household of wastewater utility projects relative to the median household income (MHI) of the community. The next six worksheets calculate the inputs for the Financial Capability Indicators (FCIs), which are a measure of the financial strength of the permittee and the community as a whole. The measures include debt indicators, socioeconomic indicators, and financial management indicators. The ninth worksheet combines the scores of the FCI worksheets and develops an overall FCI score. The tenth worksheet combines the Residential Indicator score and the FCI score into a matrix to determine the overall burden impact on the community.

In November 2014, EPA released its Financial Capability Assessment Framework for Municipal Clean Water Act Requirements. In this memorandum, EPA reaffirmed the FCA; however, in order to allow for a more comprehensive evaluation of the impact of all Clean Water Act (CWA) requirements, EPA indicated that utilities may include the cost of stormwater management in addition to wastewater. As such, this analysis reflects the District's total operations, including both wastewater and stormwater.

The following presents the assumptions and criteria used to determine the Residential Indicator (RI) and overall Financial Capability Indicator (FCI) based on the EPA Guidance.

A.1 RESIDENTIAL INDICATOR

The Residential Indicator (RI) is intended to measure the financial impact of the current and proposed wastewater treatment (WWT), stormwater management, and CSO/SSO controls on residential households. The first step (Worksheet 1) is to determine the estimated cost per household (CPH) of the current and proposed WWT, stormwater management, and CSO/SSO projects (including other on-going asset management projects). The second step (Worksheet 2) divides the CPH by the median household income (MHI) of the community to determine the Residential Indicator, expressed as a percentage. The RI is then scored as Low, Mid-Range, or High Impact based on the following levels (CPH as % of MHI):

- Low - Less than 1.0% of MHI
- Mid-Range - 1.0% - 2.0% of MHI
- High - Greater than 2.0% of MHI

A.1.1 Worksheet 1 – Cost Per Household

Worksheet 1 develops the cost per household for residential households served by the District. Lines 100 and 101 summarize the most recent fiscal year (FY 2019) operating and debt service costs for the District, based on the District's current pro forma. Lines 103 and 104 show the projected costs for future projects for both the Updated Watershed Plan (UWSP) and on-going renewal and replacement of existing infrastructure. The additional operation and maintenance (O&M) expenses above and beyond FY 2019 levels is based on 0.5% of the total CIP.

Annual debt service is estimated at a 5.0 percent interest rate and 30-year term. A portion of the program is projected to be cash financed, based upon the outcome of the long-term financial plan.

Total current and projected costs total $165,290,481, of which 67.2 percent[1], or $111,075,204 of total District costs is the Residential Share. As shown, cost per household is calculated by dividing the Residential Share by 114,760, which is the estimated total number of households served by the District. The calculated total cost per household, as shown in line 109, is $968. This cost excludes additional storm water costs incurred separately by cities within the District's service area.

Worksheet 1 Total Cost Per Household

Residential Indicator			
Worksheet 1			
Line No.			DISTRICT
	Current WWT Costs		
100	O&M		38,700,435
100a	Cash Financed Capital		1,814,545
101	Debt Service		38,932,089
102	Total Current Costs	$	79,447,069
	Projected WWT and WWC		
103	O&M		7,408,965
103a	Cash financed Capital		59,656,484
104	Debt Service-Bonds		18,777,963
104a	Debt Service-KIA		0
105	Total Projected Costs	$	85,843,412
106	Annual Cost	$	165,290,481
107	Residential Cost	$	111,075,204
107a	Residential Share		67.2%
108	Number of Households		114,760
109	Cost per Household	$	968

A.1.2 Worksheet 2 – Residential Indicator

The second step to determine the Residential Indicator is to determine the adjusted median household income (MHI). The MHI for the District is estimated to be $65,417[2]. Therefore, the District RI is calculated by dividing the Cost per Household (CPH) from Worksheet 1 ($968) by the adjusted MHI ($66,326). The calculated RI of 1.46 percent, which places the RI below the threshold of 2.0 percent but above 1 percent, would indicate "mid-range" based on the EPA Residential Indicator rating scale as follows:

[1] Based upon analysis of billed volume and the District's cost of service/rate setting policies.

[2] 2018 American Community Survey, 5-year average. Weighted average of Boone, Campbell and Kenton Counties, based on population.

- Low – Below 1%
- Mid-Range – 1 – 2%
- High – Above 2%

Worksheet 2 Residential Indicator

Residential Indicator			
Worksheet 2			
201	Census Year MHI	$	65,417
202	MHI Adjustment Factor		101.39%
203	MHI	$	66,326
204	Annual Cost per Household	$	968
205	**Residential Indicator**		1.46%

A.2 FINANCIAL CAPABILITY INDICATORS

The second phase of the EPA FCA is intended to assess the financial capability of the community. There are three general categories of financial capability: debt indicators, socioeconomic indicators, and financial management indicators. The existing EPA guidance for the development of these indicators is found in Worksheets 3 through 8 of the 1997 EPA Guidance.

- **Debt Indicators** – Assess the current debt burden of the community and their ability to issue additional debt to finance the CSO/SSO controls. The indicators used to measure this are:
  - Bond Ratings (Worksheet 3)
  - Overall Net Debt as a Percent of Full Market Property Value (Worksheet 4)
- **Socioeconomic Indicators** – Assess the general well-being of residential users in the community. The indicators selected for this purpose are:
  - Unemployment Rate (Worksheet 5)
  - Median Household Income (Worksheet 6)
- **Financial Management Indicators** – Evaluate the community's overall ability to manage financial operations. The indicators selected for this purpose are:
  - Property Tax Revenue Collection Rate (Worksheet 7)
  - Property Tax Revenues as a Percentage of Full Market Property Value (Worksheet 8)

The source data used in determining these six indicators come from a variety of resources, including: comprehensive annual financial reports and debt rating reports for the District and cities served by the District. A summary of each worksheet follows.

A.2.1 Worksheet 3 – Bond Rating

The debt indicator in Worksheet 3 reflects the revenue bond rating for the District.

Worksheet 3 Bond Rating – District

Revenue Bond (SD1)		
	Moody's	S&P
Date	August 2019	August 2019
Rating agency	Moody's	S&P
Bond insurance (y/n)		
(Revenue bonds only)	n	n
Summary bond rating	Aa2	AA
EPA Rating:	**3**	**3**

The bond rating is scored as weak, mid-range, or strong according to the following scale for Moody's and S&P bond ratings:

- Weak – BB, B, CCC, CC, C, D
- Mid-Range – BBB
- Strong – AAA, AA, A

Based on the Summary Bond Rating, this indicator is scored as a 3 or "Strong".

A.2.2 Worksheet 4 – Overall Net Debt as a Percent of Full Market Property Value (FMPV)

Overall net debt is debt repaid by property taxes in the permittee's service area. It excludes the debt of revenue bonds issued and repaid with user fees. This indicator provides a measure of the debt burden on residents and the ability of the local government to issue additional debt. It includes the debt issued directly by the local government and the debt of overlapping entities, such as school districts. The indicator compares the level of debt owed by the service area population with the full market value of real property used to support the debt.

The District's service area encompasses three counties and multiple cities and towns. As the counties and many cities do not issue Consolidated Annual Financial Reports (CAFRs) with the additional financial and statistical data necessary to complete this worksheet, the District compiled the necessary data from as many cities as possible, and weighted individual scores based on population. As shown in Worksheet 4a, the cities included in the analysis are: Florence (Boone County), Newport (Campbell County), Covington (Kenton County), Crestview Hills (Kenton County), and Erlanger (Kenton County) and reflect each city's fiscal year (FY) 2018 CAFR. The population of these cities is approximately 30% of the total population of the three counties served by the District. The applicable data for each city is shown in Worksheet 4a.

Worksheet 4a Overall Net Debt as a Percentage of FMPV – Representative Cities

Florence, Kentucky (Boone County)		
Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$	15,670,000
Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$	7,956,512
Overall Net Debt	$	23,626,512
Market Value of Property	$	2,903,238,587
Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)		0.81%
EPA Rating:		**3**

Newport, Kentucky (Campbell County)		
Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$	18,905,845
Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$	18,951,313
Overall Net Debt	$	37,857,158
Market Value of Property	$	822,601,000
Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)		4.60%
EPA Rating:		**2**

Covington, Kentucky (Kenton County)		
Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$	54,388,000
Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$	47,402,000
Overall Net Debt	$	101,790,000
Market Value of Property	$	2,113,715,000
Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)		4.82%
EPA Rating:		**2**

Crestview Hills, Kentucky (Kenton County)		
Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$	-
Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$	15,344,156
Overall Net Debt	$	15,344,156
Market Value of Property	$	422,587,900
Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)		3.63%
EPA Rating:		**2**

Erlanger, Kentucky (Kenton County)		
Direct Net Debt (G.O. Bonds Excluding Double-Barreled Bonds)	$	785,000
Debt of Overlapping Entities (Proportionate Share of Multijurisdictional Debt)	$	22,492,000
Overall Net Debt	$	23,277,000
Market Value of Property	$	1,209,354,000
Overall Net Debt as a Percentage of Full Market Property Value (Line 403/Line 404*100)		1.92%
EPA Rating:		**3**

This indicator is scored on the following scale:

- Weak – Above 5%
- Mid-Range – 2% - 5%
- Strong – Below 2%

As shown, each city scores a 2 "Mid-range" or 3 "Strong" for this indicator. As shown on Worksheet 4b, the weighted average score for the District is 2.46, or "Mid-Range" based on the above scale.

Worksheet 4b Overall Net Debt as a Percentage of FMPV – Weighted District Score

	Population	Score
Florence	31,940	3
Newport	15,152	2
Covington	40,552	2
Crestview Hills	3,281	2
Erlanger	18,776	3
EPA Rating:		**2.46**

A.2.3 Worksheet 5 – Unemployment Rate

The estimated unemployment rate for the District's service area was determined based on the weighted average unemployment rate for the three counties served by the District. Worksheet 5 summarizes the resulting calculation of the weighted average unemployment rate, based on the 2018 American Community Survey, 5 year average.

Worksheet 5 Unemployment Rate

	Population	Unempl. Rate
Unemployment Rate (Boone)	128,053	4.3%
Unemployment Rate (Campbell)	88,744	4.5%
Unemployment Rate (Kenton)	162,253	4.8%
Unemployment Rate (Weighted Average)		4.6%
Unemployment Rate (US)		5.9%
EPA Rating:		**3**

This indicator is scored according to the following scale:

- Weak – More than 1% above the national average
- Mid-Range – ± 1% of the national average
- Strong – More than 1% below the national average

This indicator is scored as 3 or "Strong."

A.2.4 Worksheet 6 – Median Household Income

The median household income (MHI) used in this measure of financial capability is the same as that described in Worksheet 2 and reflects the weighted average MHI for the three counties served by the District. For this FCA measure, MHI is compared to the national average MHI, providing an overall indicator of community earning capacity. This comparison is shown in Worksheet 6. Scoring for the MHI indicator is based on the following scale:

- Weak – More than 25% below Adjusted National MHI
- Mid-Range – ± 25% of the Adjusted National MHI
- Strong – More than 25% above the Adjusted National MHI

As shown, the weighted average MHI for the District is 9.0 percent above the national average and is scored as 2 or "Mid-Range".

Worksheet 6 Median Household Income

	Population	Score
Median Household Income (Boone)	128,053	$75,043
Median Household Income (Campbell)	88,744	$59,782
Median Household Income (Kenton)	162,253	$61,606
Median Household Income (Weighted Average)		$65,718
Median Household Income (US)		$60,293
Percent above (below) US		9.0%
EPA Rating:		**2**

A.2.5 Worksheet 7 – Property Tax Revenues as a Percent of Full Market Property Value

This indicator can be viewed as the "property tax burden" as it indicates the funding capacity available to support debt based on the wealth of the community. The full market value of real property is determined in Worksheet 4. As with Worksheet 4, Worksheet 7 is determined based on the data available for the representative cities within the District's service area. Worksheet 7a provides the data for each representative community, based on FY 2018 CAFR data.

Worksheet 7a Property Tax Revenues as a Percent of Full Market Property Value

Florence, Kentucky (Boone County)		
Full Market Property Value (FMPV)	$	2,903,238,587
Property tax revenue	$	7,832,285
Property tax revenue as a percent of FMPV		0.3%
EPA Rating:		**3**
Newport, Kentucky (Campbell County)		
Full Market Property Value (FMPV)	$	822,601,000
Property tax revenue	$	2,214,058
Property tax revenue as a percent of FMPV		0.3%
EPA Rating:		**3**
Covington, Kentucky (Kenton County)		
Full Market Property Value (FMPV)	$	2,113,715,000
Property tax revenue	$	7,016,111
Property tax revenue as a percent of FMPV		0.3%
EPA Rating:		**3**

Crestview Hills, Kentucky (Kenton County)		
Full Market Property Value (FMPV)	$	422,587,900
Property tax revenue	$	681,622
Property tax revenue as a percent of FMPV		0.2%
EPA Rating:		**3**

Erlanger, Kentucky (Kenton County)		
Full Market Property Value (FMPV)	$	1,209,354,000
Property tax revenue	$	3,635,000
Property tax revenue as a percent of FMPV		0.3%
EPA Rating:		**3**

Scoring for Worksheet 7 is as follows:

- Weak – Above 4%
- Mid-Range – 2% - 4%
- Strong – Below 2%

As shown in Worksheet 7b, the weighted average score for the District is 3 or "Strong." While this measure indicates a "Strong" rating, it should be noted that this indicator fails to capture the impact to the community due to other forms of taxation, including earned revenue tax, sales tax, local income taxes or other revenue sources of the community, and therefore under-represents taxing burden on the community.

Worksheet 7b Property Tax Revenues as a Percent of Full Market Property Value – Weighted District Score

	Population	Score
Florence	31,940	3
Newport	15,152	3
Covington	40,552	3
Crestview Hills	3,281	3
Erlanger	18,776	3
EPA Rating:		**3.00**

A.2.6 Worksheet 8 – Property Tax Revenues Collection Rate

The property tax revenue collection rate is an indicator of the efficiency of the tax collection system and the acceptability of tax levels to residents. Worksheet 8a displays the property tax revenues previously used in Worksheet 7 and compares them to the amount of property taxes actually levied. As with Worksheets 4 and 7, Worksheet 8a is completed based on available data from the representative cities, using FY 2018 CAFR data.

Worksheet 8a Property Tax Revenue Collection Rate

Florence, Kentucky (Boone County)		
Property tax revenue collected	$	7,832,285
Property taxes levied	$	7,864,044
Property tax revenue collection rate		100%
EPA Rating:		**3**

Newport, Kentucky (Campbell County)		
Property tax revenue collected	$	2,214,058
Property taxes levied	$	2,191,635
Property tax revenue collection rate		101%
EPA Rating:		**3**

Covington, Kentucky (Kenton County)		
Property tax revenue collected	$	7,016,111
Property taxes levied	$	7,145,767
Property tax revenue collection rate		98%
EPA Rating:		**2**

Crestview Hills, Kentucky (Kenton County)		
Property tax revenue collected	$	681,622
Property taxes levied	$	682,594
Property tax revenue collection rate		100%
EPA Rating:		**3**

Erlanger, Kentucky (Kenton County)		
Property tax revenue collected	$	3,635,000
Property taxes levied	$	3,708,000
Property tax revenue collection rate		98%
EPA Rating:		**2**

Scoring for Worksheet 8 is as follows:

- Weak – Below 94%
- Mid-Range – 94% - 98%
- Strong – Above 98%

As shown in Worksheet 8b, the District's score for Worksheet 8 is 2.46, or "Mid-Range."

Worksheet 8b Property Tax Revenue Collection Rate – Weighted District Score

	Population	Score
Florence	31,940	3
Newport	15,152	3
Covington	40,552	2
Crestview Hills	3,281	3
Erlanger	18,776	2
EPA Rating:		**2.46**

A.2.7 Worksheet 9 – Summary of Permittee Financial Capability Indicators

Worksheet 9 summarizes the six indicators used to develop the overall Financial Capability Indicator. In previous sections, each of the indicators was categorized as "Weak," "Mid-Range," or "Strong" based on the worksheet economic measures. To develop the overall Financial Capability Indicator, an average score is calculated based on the final scores for Worksheets 3 through 8, and assigned an overall rating of "weak," "mid-range," or "strong."

Worksheet 9 Summary of Financial Capability Indicators

Description	Benchmark	Score
Bond Rating (Line 303)	Strong	3
Overall Net Debt as a Percent of Full Market Property Value (Line 405)	Mid-Range	2.46
Unemployment Rate (Local rate minus National rate) (Line 501 – Line 503)	Strong	3
Median Household Income (vs. National MHI) (Line 601 / Line 604)	Mid-Range	2
Property Tax Revenues as a Percent of Full Market Property Value (Line 703)	Strong	3
Property Tax Revenue Collection Rate (Line 803)	Mid-Range	2.46
Permittee Indicator Score (Average of Scores)	**Strong**	**2.65**

As shown, the District's overall Financial Capability Indicator is a 2.65, which is considered "Strong" based on the scoring criteria below:

- Weak – Below 1.5
- Mid-Range – 1.5 – 2.5
- Strong – Above 2.5

A.2.8 Worksheet 10 – Financial Capability Matrix Score

The results of the Residential Indicator and Financial Capability Indicator analyses are combined in the Financial Capability Matrix to evaluate the level of financial burden the CSO/SSO controls may impose on the permittee. As shown in Worksheet 10, the Residential Indicator is 1.46%, which places it within the "mid-range" impact category. The District's Financial Capability Indicator is a

2.65, which places it in the "Strong" category. The combined impact of these two indicators in the matrix places the proposed program in the "Low Burden" range of financial impact to the community. As indicated in EPA's 2014 "Financial Capability Assessment Framework For Municipal Clean Water Act Requirements", the level of burden is a continuum for communities, and as such, this should be taken into consideration in evaluating the community impact.

Worksheet 10 Financial Capability Matrix

FINANCIAL CAPABILITY INDICATOR SCORE	RESIDENTIAL INDICATOR		
	Low (Below 1%)	Medium (1% - 2%)	High (Above 2%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (1.5 – 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

A.4 SUMMARY OF EPA FCA ANALYSIS

While the EPA Analysis results in a "Low Burden" rating as it relates to completion of the District's UWSP, when forecasting the true rate impacts on residential customers in the study period, the average annual bill as a percent of income in each year of the watershed program is a more meaningful measure to evaluate the true impact of the program on customers.

Appendix L: Public Participation Materials

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Project C040-02

SD1
Managing Northern Kentucky's Wastewater and Storm Water

Working in Your Neighborhood

Lakeside Park (Hudson Avenue) Sewer Improvement Project

Why is SD1 working in your neighborhood?

SD1 is working in your community to install a new storm water sewer pipe and replace an existing sanitary sewer line with a larger, higher capacity pipe. The current sanitary sewer pipe is designed only to carry the water flushed and drained from homes and businesses; however, it is aging and allows storm water from rainfall and snow melt to seep in. This sometimes overwhelms the pipe, increasing the risk of sewage backups in basements and sanitary sewer overflows in nearby creeks, streets and yards. The new sewer pipes will reduce the risk of these problems by ensuring storm water in your neighborhood flows properly to nearby streams and that wastewater in your community is safely and effectively conveyed to a treatment plant for cleaning

What kinds of disruptions can you expect during this project?

Construction on this project will take place under and along Hudson Avenue, in the public right of way and where SD1 has previously obtained easements from private property owners. The project site is shown in the attached map.

As a result of this project, you will see and hear construction activity during normal working hours. During construction hours, Hudson Avenue will be closed to through traffic. Construction equipment will be stationed along Hudson Avenue, resulting in limited on-street parking at all times until the project is complete. Local traffic and driveway access will be maintained on Hudson Avenue. As part of this project, SD1 and our contractors will need to connect property owners' private laterals to the new sanitary sewer pipe. This will involve digging into the ground, including in lawns on private property, where SD1 has existing easements. SD1 will restore any areas disturbed by construction activities.

How long will SD1 be in your neighborhood?

SD1's sewer construction work is expected to start June 2017 and continue for about one year, but the project schedule is weather dependent.

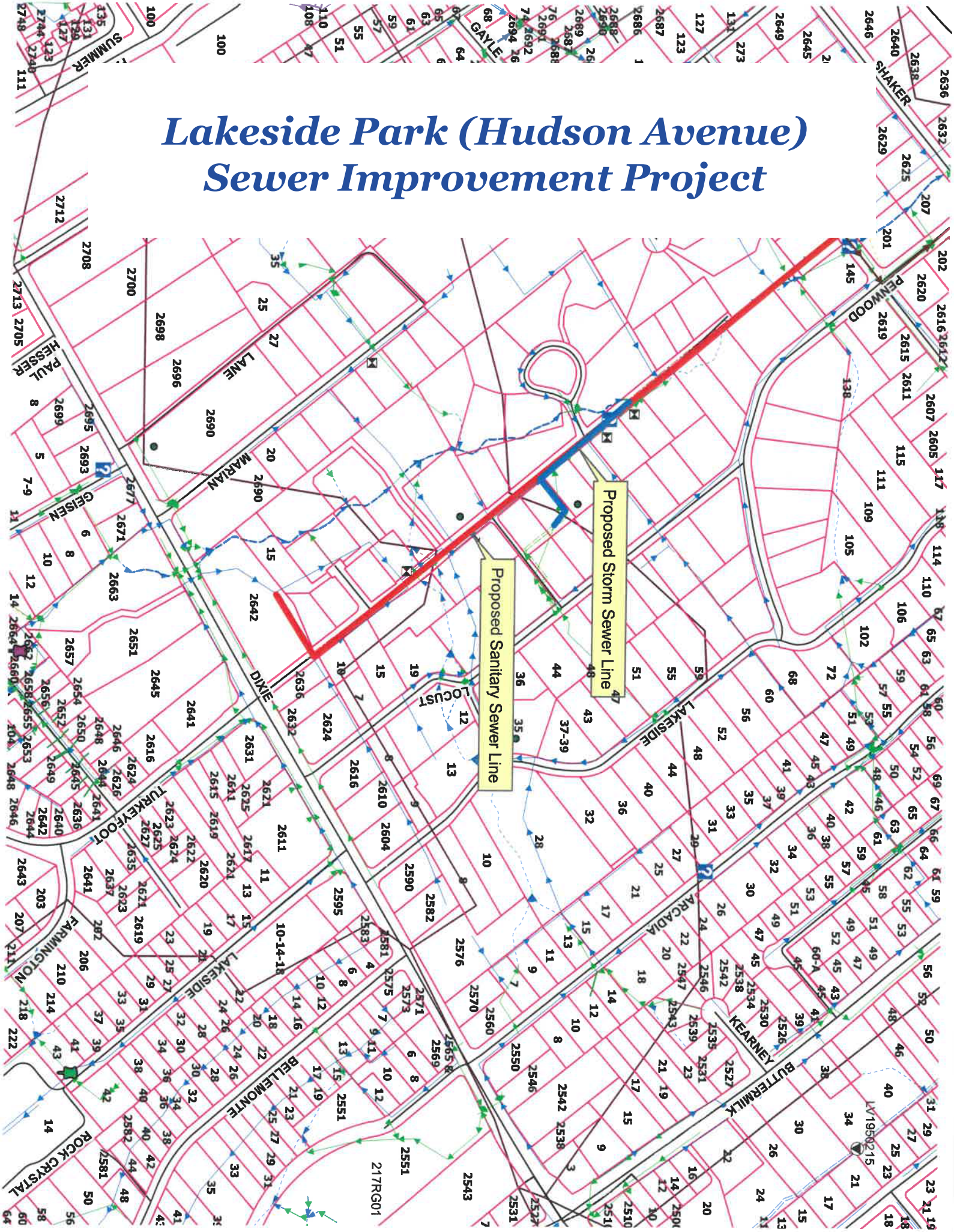
In order to limit future disturbances in your neighborhood, SD1 has notified other utilities of our plans to improve sewers under Hudson Avenue. As a result, prior to SD1 beginning sewer construction, other utilities may improve their infrastructure that is also buried under Hudson Avenue. Please keep in mind that, as a result of other utilities' work, you may experience disturbances prior to the SD1 work detailed above.

If you have questions, whom should you contact?

If you have any questions regarding SD1's work on this project, please feel free to contact Project Engineer Daniel Doss by phone at 859-578-6775 or by email at ddoss@sd1.org during normal business hours, Monday through Friday, 8 a.m. to 4:30 p.m.

Thank you for your cooperation and patience as we work to protect public health, property and the environment by providing safe and reliable wastewater and storm water services.

Lakeside Park (Hudson Avenue) Sewer Improvement Project



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Quick Links

Report a Sewer Emergency
New Customer Information
Open Records Policy & Requests
View SD1 Board Meetings
SD1 Financial Records
GIS Maps
Bids/RFPs/RFQs
Surplus Property Auction

Latest News

WEF National Stormwater Symposium Coming to Cincinnati
EQ Tanks in Highland Heights, Silver Grove will Significantly Reduce SSOs
Changes Coming to SD1 Website

See All News

Subscribe to SD1's E-Newsletter

Upcoming Events

03/17/2020 - SD1 Board of Directors Meeting
04/09/2020 - Storm Water Working Group Meeting
04/21/2020 - SD1 Board of Directors Meeting

See All Events

Education Programs

SD1 offers comprehensive education programs to teach about storm water and wastewater. These programs help us meet regulatory requirements while educating, engaging and inspiring students and other members of the community.

Quick Links
Guided Tours and Field Trips
Mascot Visits and Presentations
Storm Drain Marking Program
Curriculum for Schools
Pre- and Post-tests
VIDEO: Wastewater Treatment
SD1 History and Timeline
Storm Water Runoff (DRIP)

Storm Water Education

SD1 partnered with local school districts to develop and implement an environmental unit. The unit consists of five one-hour lessons that cover topics like point source and non-point source pollution, watershed management, wetlands and best management practices. Through these lessons, students learn the value of our water resources. Geared towards fourth and fifth grades, the unit reaches about 5,000 Northern Kentucky students every year.

SD1 also offers presentations and guided tours and field trips to groups that want to learn more about storm water and how it affects our community.

Wastewater Education

SD1's wastewater curriculum helps students and community members learn what happens to water after it is used. Geared towards middle school students, these lessons teach about SD1's role in the community, daily activities that use water and just how much water a person uses every day.

SD1 also offers presentations and guided tours and field trips to groups that want to learn more about the wastewater treatment process.

Learn More

If you have any questions about SD1's education programs, please call 859-578-7450 and ask to speak to the environmental education program manager.

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Quick Links

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View SD1 Board Meetings
SD1 Financial Records
GIS Maps
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04/21/2020 - SD1 Board of Directors Meeting

See All Events

Disconnection, Redirection, Infiltration Program (DRIP)

What is storm water runoff, and how does it impact the community?

Most rain water that falls from the sky seeps into the ground; but if the ground is saturated, frozen or covered by hard surfaces like a concrete driveway or a paved parking lot, the water is unable to soak into the ground and instead flows over the land, creating what is known as storm water runoff.

Quick Links
Downspout Disconnection step-by-step guide
Rain Barrel step-by-step guide
Rain Garden step-by-step guide
Rain Garden plant selection

Northern Kentucky's creeks, lakes and rivers all depend upon storm water to soak into the ground to replenish water levels. However, unmanaged runoff can cause problems in urbanized areas. When storm water flows over the ground and other hard surfaces, it picks up pollutants like litter, oil, pet waste and chemicals from fertilizers and pesticides and carries those pollutants to SD1's storm sewer system, which, instead of leading to a treatment plant, discharges storm water and any pollutants it picks up directly into the nearest creek or river. Because SD1 doesn't treat storm water runoff like we do wastewater, these pollutants harm water quality in the local creeks and rivers we use for drinking water and recreation, threatening public health and harming aquatic life.

Excess storm water runoff can also cause flooding and erosion in developed communities, resulting in expensive and inconvenient property damage.

What is DRIP?

SD1 strives to develop and implement effective storm water management programs and policies that focus on preventing storm water pollution and managing the quantity and quality of storm water runoff in the region. The Disconnection, Redirection, Infiltration Program, or DRIP, provides homeowners with step-by-step guides to help them implement methods of managing storm water runoff in their own yards and neighborhoods.

How can SD1 help you manage storm water runoff?

A few effective methods homeowners can use to help manage storm water runoff include:

- Downspout Disconnection is the simple procedure of cutting off a segment of your home's downspout and redirecting the flow of storm water runoff from your roof to your lawn, a rain barrel or another vegetated area on your property. By disconnecting your downspout from SD1's sewer system, you can prevent excess storm water from entering the sewer system, as well as potentially redirect the water to an area for personal use. More information on disconnecting your downspout.

- Rain Barrels are containers that collect and store storm water runoff from your roof. The water collected from your roof can be used to irrigate landscaping. By using the water stored in the barrel, you can potentially reduce your water bill and aid SD1 in managing storm water runoff. More information on rain barrels.

- Rain Gardens are shallow, vegetated areas that are designed to capture, store and clean storm water runoff. Installing a rain garden can beautify your property while protecting local waterways by managing runoff. More information on rain gardens.

2020 What's Happening at SD1
Annual Meeting
March 5, 2020
1:30 p.m. – 4:00 p.m.
SD1 Board Room

NAME	COMMUNITY	EMAIL	PHONE NUMBER
Chuck Norris	City of Wilder	cnorris@wilderky.gov	859-581-8884
Chris Zerhusen	City of Elsmere	zerhusen@cityofelsmere.com	859-743-1524
MATT Dowling	Elsmere	Dowling@cityofelsmere.com	859-342-7911
Matt Elberfeld	Campbell County	melberfeld@campbellcountyky.gov	859-547-1601
Kevin Costello	Boone Co. Plng. Com.	kcostello@boonecountyky.org	859-334-2196
Jonathan Brown	"	JBrown@JLBLegal.com	859-620-0480
KEVIN WALL	"	KWALL@BOONECOUNTYKY.GOV	334-2196
BOB JONAS	"	rjonas@boonecountyky.org	334-2196
Matt Krogmer	City of Erlanger	matthew.krogmer@cityoferlanger.com	859-393-4565
DANIEL VONHANDORF	PARK HILLS PWD	DVONHANDORF@PARKHILLSKY.GOV	859-486-9541
Matt Stegman	City of Fort Mitchell P.W.	mstegman@fortmitchell.com	859-547-6149
Amy Kramer	NKWD	akramer@nkywater.org	(859) 426-2734
PAUL MEIER	CITY OF CRESTVIEW HILLS	MAYOR@CRESTVIEWHILLS.COM	859 341-7373
MIKE YEAGER	CITY OF BELLEVUE	MIKEY@INT-ENGINEERING.COM	859 912 1930
Jim Gibson	SD1		
Ralph Johnstone	SD1	RJOHNSTONE@SD1.ORG	8592405385
Brooke Shrieman	SD1	LSims@newportky.gov	859-991-0229
Larisa Sims	Newport		
Wylie Covey			513-325-1171

2020 What's Happening at SD1
Annual Meeting
March 5, 2020
9:00 a.m. – 11:30 a.m.
SD1 Board Room

NAME	COMMUNITY	EMAIL	PHONE NUMBER
Buck	Villa Hills	dyelton@VillaHillsKy.org	859-341-1515
Corey Schalk	Villa Hills	cschalk@villaHillsky.org	859 341-1515
Sara Trapp	Alexandria	strapp@alexandriaky.org	635-4125
John Tucker	Silver Grove	J.Tucker2477TAtyhhe	441-6390
Allen Norwich	Melbourne	MELBOURNECITY.com	781-6664
Trisha Brush	PDS	tbrush@pdskc.org	855-331-8980
Cindy Minter	CC P+Z	cminter@campbellcountyky.org	859-292-3880
Sean Blake	SD1	sblake@SD1.ORG	578-7468
Ralph Johnstone	SD1	RJohnstone@SD1.ORG	859240-5385
Michael Giffen	Dayton	mgiffen@daytonky.com	491-1600
Rick Lucas	Dayton	RLUCAS@DAYTONKY.COM	491-1600
Kenny Birk	VS Engineering	khbirk@vsengineering.com	317-796-3628
Ken Hicks	City of Independence	khicks@cityofindependence.org	363-2949
Jake Eubank	City of Independence	jeubank@cityofindependence.org	8596408757
Hilliard Vance	City of Edgewood	HVance@Edgewoodky.gov	859-743-8102
Emi Randall	PDS	erandall@pdskc.org	331-8980
Jim Gibson	SD1		
Brooke Shireman	SD1		

WHAT'S HAPPENING @ SD1 – Thursday, April 1, 2021
PARTICIPANT LIST

Angela Cook
Brooke Shireman
Chris Cole
Schenkel, Marie
Adam Chaney
Chuck Norris- City of Wilder (Guest)
Matt Stegman
Ken Hicks (Guest)
Robert Schroeder
Frank Warnock (Guest)
shane hamant (Guest)
Larisa Sims
Barry Burke (Guest)
Devon Stansbury
Schabell, Andy
Kyle Ryan
Unknown User
Dan Bell
Laura Tenfelde
Jim Gibson
Jeremy Worley
Jeff Earlywine (Guest)
Jacob Edmonds
Matt Dowling
Pendery, Steve (County Judge-Executive)
Judge Moore
Barry Burke
Michael Giffen (Guest)
Alex Mattingly (Guest)
Andy Aman
sam trapp (Guest)
Brian Painter (Guest)

http://www.rcnky.com/articles/2018/08/10/work-begin-monday-12-million-sewer-project-covington

Work to Begin Monday on $1.2 Million Sewer Project in Covington



FRI, 08/10/2018 - 17:36 RCN NEWSDESK

A $1.2 million sewer project is about to begin in a corner of Covington's Eastside neighborhood.

Workers from Sanitation District No. 1 will begin moving construction equipment and materials on Monday to the eastern end of 10th Street near the flood wall in preparation for work that will take several months.

While residents will notice and hear construction equipment beginning next week, the work won't affect street traffic or parking for several more weeks to a month, said Spencer Stork, project manager for SD1. Eventually, however, crews will begin cutting into the roads, and parking will be limited and traffic flow will be restricted on 9th, 10th and Prospect streets, Stork said.

The project area includes 9th Street from Greenup Street to the levee, 10th Street from just west of Greenup to the levee, Prospect Street between 9th and 10th, parts of Randolph Park, and the floodwall near the 10th Street shelter house.

The goal is to build a new storm water drainage system to separate rainwater from mixing with sanitary sewage, Stork said.

As in much of the City, the existing drainage system is an aging, outdated combined system in which one pipe carries both sanitary sewage from sinks, toilets, showers, and tubs in people's houses and rain from gutters and street-corner catch basins.

During heavy storms, the system can be easily overwhelmed, causing partially diluted sewage to overflow into the Licking River and floor drains in basements to back up.

Combined sewers are common throughout older areas of Northern Kentucky's urban communities.

The project is necessary "to help protect public health, property and the environment," Stork said. "There are several projects (like this) going on right now."

The work will take several months, depending upon the weather and any complications that are discovered, he said.

Covington Public Works Director Rick Davis said the City appreciated SD1's ongoing efforts to update Covington's sewers.

"Covington has miles of this outdated and problematic combined sewer system, and it's going to take many projects like this to continue to separate the storm and sanitary systems for the betterment of the community," Davis said. "This is the next phase in the continuous effort to reduce overflows and backups."

Davis also said he appreciates residents' patience during the work. Notices about traffic and parking restrictions will be posted ahead of time.

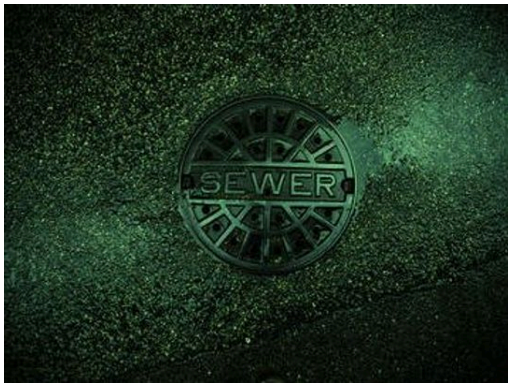
From the City of Covington

https://www.cincinnati.com/story/news/local/kentoncounty/2019/02/19/northern-kentucky-sd-1-epa-extend-1-3-billion-sewer-fix-deadline/2916627002

SD1, EPA extend NKY deadline for $1.3 billion sewer fix

Chris Mayhew, Cincinnati Enquirer
Published 2:54 p.m. ET Feb. 19, 2019 | **Updated 3:01 p.m. ET Feb. 19, 2019**

Northern Kentucky sewer customers just received a 15-year extension to pay the estimated $1.3 billion still needed to comply with the federal Clean Water Act of 1972.



Sanitation District No. 1 of Northern Kentucky's deadline to meet an estimated $1.3 billion to comply with federal Clean Water Act standards will be extended until 2040 under a new agreement with the EPA, Kentucky and SD1. *(Photo11: Enquirer file)*

The year 2025 was the three-county region's previous deadline to meet the EPA's binding 2005 federal consent decree timeline to mitigate sewer overflows into streams and rivers. The consent decree is a legally binding agreement in federal court with the EPA, Sanitation District No. 1 of Northern Kentucky and the Commonwealth of Kentucky.

SD1 has until Jan. 1, 2040 to comply under the amended consent decree, according to an SD1 news release.

SD1 provides sewer service to 300,000 people in Boone, Campbell and Kenton counties.

Ratepayers saw 5 percent increases on their bills to comply with the consent decree in 2016 and 2017, according to previous articles in The Enquirer. The SD1 board promised the increases wouldn't be the last prior to the consent decree extension.



The immediate impact of the consent decree extension on ratepayer bills is unknown at this time.

Back in 2016 SD1 predicted a need to increase average monthly rates by 300 percent by 2025 to adhere to the consent decree. The estimate in 2016 was average bills could climb as high as $180 monthly by 2025.

More than 1 billion gallons of Combined Sewer Overflows (CSO) and 115 million gallons of Sanitary Sewer Overflows still happen every year in Northern Kentucky.

The overflows of untreated sewage mixed with water, CSO's, and raw sewage overflowing (SSO's) must be eliminated or remediated under the consent decree.

“Affordability has been a driving factor in our negotiations with the regulators,” said SD1 Executive Director Adam Chaney. “The extension will allow us to spread infrastructure capital costs over a longer period, reducing the financial impact to our customers while ensuring progress on overflow mitigation.”

The eventual cost of eliminating the overflows may end up being less than the previously estimated $1.3 billion, according to SD1's news release.

The extension gives SD1's board flexibility to take advantage of emerging technologies to lower the eventual cost, according to the news release.

Chaney said he is optimistic the consent decree will be finalized by the U.S. District Court for the Eastern District of Kentucky. The process may take several months, he said.

HTTP://WWW.RCNKY.COM/ARTICLES/2019/02/19/SD1S-AGREEMENT-FEDERAL-GOVERNMENT-EXTENDED-2040

SD1's Agreement with Federal Government Extended to 2040

TUE, 02/19/2019 - 13:48 RCN NEWSDESK

An extension of the consent decree between Sanitation District 1 (SD1) and the United States Environmental Protection Agency (EPA) was extended Tuesday to January 1, 2040.
The consent decree, first adopted in 2005, gives SD1 time to comply with federal law under the Clean Water Act of 1972, mitigating combined system overflows (CSOs) and sanitary system overflows (SS)s) by the year 2025.

Northern Kentucky currently experiences over one billion gallons of CSOs and 115 million gallons of SSOs per year and the amended consent decree, adopted Tuesday by the SD1 board of directors, will provide the utility about 15 additional years to make infrastructure improvements aimed at addressing these overflows under the Clean Water Act.

“Affordability has been a driving factor in our negotiations with the regulators,” said SD1 Executive Director Adam Chaney. “The extension will allow us to spread infrastructure capital costs over a longer period, reducing the financial impact to our customers while ensuring progress on overflow mitigation.”

The cost to clean up Northern Kentucky’s sewer overflows has been estimated at $1.3 billion, but the extension approved by SD1’s board gives the utility the flexibility to take advantage of emerging technologies and innovative approaches to lower that cost, a news release said.

SD1 is currently updating its long-term infrastructure plan to incorporate these new strategies. “The key is to continue to innovate and find efficiencies in our operating and capital plans,” Chaney said.
He said the extension also provides SD1 an opportunity to think about the consent decree in a new way. “This is really a partnership with the EPA and the state of Kentucky,” he said. “It gives us clear objectives and the flexibility we need to meet those objectives.”

Chaney said that while meeting these goals will not be easy, SD1 can now build a plan that is focused on accomplishing them in the most economical way possible. The extension of the consent decree is only part of that, he said. Through the adoption of a continuous improvement business model, the District has been reducing its operating costs and is currently exploring a rate restructure to address consumption decline and more closely align fees with SD1’s cost of providing service.

While the amended consent decree will not become final until it is approved by the United States District Court for the Eastern District of Kentucky – a process that could take several months – Chaney said SD1 is optimistic that process will go smoothly.

“The 2040 extension is a big step forward for our region,” he said. “Now we must work to engage all of Northern Kentucky in support of these important cleanup efforts to protect public health, property and the environment, while continuing to support the economic vitality of our community.”

https://www.nkytribune.com/2019/02/sd1-and-epa-agree-to-extension-of-clean-water-act-consent-decree-until-january1-2040

SD1 and EPA agree to extension of Clean Water Act Consent Decree until January 1, 2040

Feb 20th, 2019 · 0 Comment

The Sanitation District No. 1 Board of Directors Tuesday approved an Amended Consent Decree with the United States Environmental Protection Agency and the Commonwealth of Kentucky.

The amendment extends the deadline for Northern Kentucky's sewer overflow mitigation improvements to January 1, 2040.

In 2005, in order to comply with federal law under the Clean Water Act of 1972, SD1 entered into a legal agreement called a consent decree with the EPA and the Kentucky Energy and Environment Cabinet. The goal of the original consent decree was to mitigate combined system overflows (CSOs) and sanitary system overflows (SSOs) by the year 2025.

SD1 is responsible for the collection and treatment of northern Kentucky's wastewater and also serves as the regional storm water management agency.

Northern Kentucky currently experiences over one billion gallons of CSOs and 115 million gallons of SSOs per year and the amended consent decree will provide SD1 about 15 additional years to make infrastructure improvements aimed at remediating these overflows under the Clean Water Act.

"Affordability has been a driving factor in our negotiations with the regulators," said SD1 Executive Director Adam Chaney. "The extension will allow us to spread infrastructure capital costs over a longer period, reducing the financial impact to our customers while ensuring progress on overflow mitigation."

The cost to clean up Northern Kentucky's sewer overflows has been estimated at $1.3 billion, but the extension approved by SD1's board today gives the District the flexibility to take advantage of emerging technologies and innovative approaches to lower that cost.

The District is currently updating its long-term infrastructure plan to incorporate these new strategies.

"The key is to continue to innovate and find efficiencies in our operating and capital plans," Chaney said.

He said the extension also provides SD1 an opportunity to think about the consent decree in a new way. "This is really a partnership with the EPA and the state of Kentucky," he said. "It gives us clear objectives and the flexibility we need to meet those objectives."

Chaney said that while meeting these goals will not be easy, SD1 can now build a plan that is focused on accomplishing them in the most economical way possible. The extension of the consent decree is only part of that, he said. Through the adoption of a continuous improvement business model, the District has been reducing its operating costs and is currently exploring a rate restructure to address consumption decline and more closely align fees with SD1's cost of providing service.

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SD1 is the second largest public sewer utility in Kentucky, serving more than 290,000 residents throughout Boone, Campbell and Kenton counties.

SD1 maintains approximately 1,600 miles of sanitary-sewer system pipeline, 135 wastewater pumping stations, 15 flood pump stations, six package treatment plants, three major wastewater treatment plants, 416 miles of storm-sewer system and 31,106 storm-sewer structures.

https://www.nkytribune.com/2019/03/sd1-director-chaney-explains-what-extension-of-consent-decree-means-short-term-over-the-long-haul

SD1 director Chaney explains what extension of consent decree means short-term, over the long haul

Mar 6th, 2019 · 0 Comment

By David Holthaus
NKyTribune reporter
|
The operator of Northern Kentucky's wastewater utility system has negotiated an extra 15 years to comply with federal law on sewer overflows.

That extra time, its leaders say, will allow it to spread the huge costs of the project over a longer period and allow it to prioritize parts of the project that will have the most impact.



Northern Kentucky Sanitation District No.1 (SD1) leaders negotiated an extension with the U.S. Environmental Protection Agency that would push back to 2040 its deadline to fix the region's problems with sewer overflows. That agreement still needs to be approved by a federal court. It's unclear if any environmental groups or others will oppose the extension.
SD1 Executive Director Adam Chaney said the extension would help ease the impact on the district's ratepayers, similar to how financing a home mortgage over a longer period reduces the monthly payments.

"SD1 was increasing rates double digits every year," he said. "We knew that was unsustainable. It was unrealistic to continue to raise rates at that level."

The agreement with the EPA and the U.S. government, called a consent decree, took effect in 2007. Between 2007 and 2013, the district's rates grew each year by 15 to 20 percent, according to the district's figures.

Since 2007, the district has spent more than $500 million and eliminated more than 100 million gallons of sewer overflows, Chaney said.

Noncompliance with the consent decree could result in huge fines for SD1, payment of which would be passed on to ratepayers. Inevitably, when the fines are mentioned, some ratepayers suggest that SD1 just pay the fines.

Compliance, however, is mandatory.

If SD1 failed to meet deadlines and fines were assessed, the utility would still be required to come into compliance with the terms of the consent decree.

The district began negotiating with the EPA in 2012, before Chaney was named executive director.

Chaney was appointed in 2017.



“This has been years in the making,” he said. “One of the goals when I came in was to actually get it done.”

He said the extension will allow the district to give priority to projects that have the biggest impact in reducing sewer overflows.

“We’re going to do the projects that create the most benefit first,” he said.

Many of those projects are located in the Licking River watershed, where about 40 percent of the sanitary sewer overflows occur, he said.

Some overflow problems are in remote areas that are expensive to access and to fix and those will be bumped down on the list.

He said the EPA would only agree to the extension if the district ensured progress on the highest priority overflows. The district agreed to eliminate 75 percent of all sanitary sewer overflows, the most harmful because they are wastewater, by 2029.

The new plan also relies more on storing water and then releasing it at appropriate times to prevent overflows. That will reduce the need to replace miles of pipe and save money, Chaney said. The stored water can be released into the system when conditions are dry and overflows aren’t likely to occur.

The downside of the agreement is that the region will continue to experience sewer overflows for an additional 15 years, assuming the deadline is met in 2040. But Chaney said the 2025 deadline could not have been met affordably.

“We were unable to get to where we wanted to be in 2025,” he said. “The plan that we have in place will actually have more benefit because we’re going to be able to affordably solve the problem.”

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Contact the Northern Kentucky Tribune at news@nkytrib.com

https://www.nkytribune.com/2019/05/sanitation-district-no-1-to-consider-implementation-of-base-rate-for-customers-public-hearing-this-week

Sanitation District No.1 to consider implementation of base rate for customers; public hearing this week

May 7th, 2019 · 0 Comment

By David Holthaus
NKyTribune reporter

The more than 100,000 customers of Sanitation District No. 1 (SD1) may see a significant change in their bills soon.

The utility's management wants to change how service is billed by including a base rate on the monthly statements. A base rate is essentially a minimum charge. That minimum charge would start at $21 a month in 2020 and rise to $34 in 2023.


Chaney

District officials will hold a public hearing on the proposed rate restructuring at 5:30 p.m. Thursday, May 9 at the district's headquarters, 1045 Eaton Drive in Fort Wright.

Some customers would see their bills increase under the proposal; others would see a decline, according to district officials' calculations.

The change is meant to align customer bills more closely with the actual cost of providing service, said Executive Director Adam Chaney.
"We have a structure right now that isn't fair, or could be made more fair," he said.

Chaney said most of the district's expenses are fixed costs, such as equipment that needs to be in operation 24 hours a day. Adding to those fixed costs is the millions spent so far on new infrastructure to comply with an agreement with the U.S. Environmental Protection Agency (EPA) to eliminate sewer overflows.
Most expenses are not related to how much water is actually used by customers, he said, although that metric is what customers' bills are based on.

Most other water utilities in the region, including Cincinnati, already include a base rate in their billing.

Complicating the Northern Kentucky utility's finances has been a steady decline in water consumption. Consumption has declined, on average, more than 1 percent for each of the last five years, the utility said. That's largely due to wider use of high-efficiency toilets, dishwashers and washing machines, Chaney said.

Because of the decline in consumption, and with billing based on consumption, rate increases have been necessary to maintain a consistent level of revenue.

Because of the billing structure, customers who use a high volume of water have been subsidizing those who use low volumes, Chaney said.

In general, under the base rate proposal, high volume users will see their bills increase, while low-volume users will see theirs decrease, Chaney said.

In year one of the base rate plan, 54,407 accounts would see an increase in their bills, while 42,270 would see a decrease, district officials have calculated.

Cheney said no customer would see an increase of more than $5 per month in any of the first four years of the proposed plan.

The base rate would include the charge for 200 cubic feet of water. Consumption of more than 200 hundred cubic feet (about 1,500 gallons) would continue to be charged on a variable rate.

The board of Sanitation District 1 unanimously approved the plan in April.

The fiscal courts of Boone, Campbell and Kenton counties will also vote on it, with the district needing two of the three to vote yes in order to move forward with implementation.

Contact the Northern Kentucky Tribune at news@nkytrib.com

https://www.rcnky.com/articles/2019/05/16/sd1-billing-change-after-kenton-campbell-approve-boone-doesnt-vote

Premium Content

SD1 Billing to Change After Kenton, Campbell Approve; Boone Doesn't Vote

THU, 05/16/2019 - 14:27 RCN NEWSDESK

It was a tale of three counties this week as Sanitation District 1 executive director Adam Chaney made the rounds at Northern Kentucky fiscal courts pushing for an allowance to change the base rate structure at the regional utility.

Kenton County Fiscal Court unanimously approved the change with little fanfare.

Campbell County Fiscal Court also unanimously approved the measure, but with a lengthy and showy debate prior to the vote.

Boone County Fiscal Court could not reach a consensus, first on whether to delay the change for at least six months, and then on whether to approve the change at all. The proposed delay was defeated in a 2-2 tie, dying for lack of a majority. The proposal to change the base rate structure at SD1 died on the floor for lack of a second and never received a vote.



Newport city commissioner Ken Rechtin pleads for a delay at the Campbell County Fiscal Court meeting (RCN)

However, with the state law that governs the operation of the sanitation district, two of the three counties need to adopt the change, so with Kenton and Campbell in favor, the change goes into effect across the region, including Boone County.

One of the criticisms surrounding the change was a perceived lack of public input on the matter, but Chaney said that Wednesday evening's Campbell County fiscal court meeting was the seventh such public forum where the change was discussed. Campbell was the last to vote on the issue, with Kenton preceding it the night before and Boone not moving forward on Tuesday morning.

"You're here because you knew about it," Chaney said to Newport city commissioner Ken Rechtin, who took charge of the Campbell County meeting where a near hour-long debate broke out. Rechtin said that there had not been enough information presented to the public. He asked for a 90-day delay. Chaney said that there was a public meeting last week for the sole purpose of discussing the issue and was broadcast live via Facebook where it received one thousand views.

"We had two meetings in every county, a Facebook live video," Chaney said. "You're trying to make an argument to delay because the process is flawed or whatever but on what grounds are you disagreeing on the logic of the purpose?"

"Because we are public entities and we should inform our public," Rechtin said.
"We had seven public meetings," Chaney said again. "What is in the next ninety days that we can present?"

"I disagree with the way this was rolled out," Rechtin said.



SD1 executive director, seated rear-left, listens at the Campbell County Fiscal Court meeting (RCN)

Chaney explained at the meetings across the region that SD1 was adversely impacted primarily by lower water consumption due to higher-efficiency appliances, and also by the constraints of the federal consent decree the utility entered into with the United States Environmental Protection Agency (EPA) which mandated a pricey clean-up of the sanitary water systems in Northern Kentucky related to the adoption of the Clean Water Act of 1972.

That consent decree had long been a drag on the utility and customers' sanitation bills with near-annual rate increases needed to cover the associated costs of fulfilling the federal obligations and the normal operations and projects. Chaney said that with the change in the base rate structure, which was already approved by the SD1 board of directors, whose members are appointed by the judges/executive of the three counties in numbers based on population, annual rate increases would not be as severe or could even be less than usual.

According to the presentation shown by Chaney, net revenue generated by the base rate will be offset by reducing the variable rate. Over the next four years, the presentation said, higher-volume users will see their bills decrease while lower-volume users will see their bill go up. Average-volume user rates will remain constant, Chaney said.

The plan is to adjust the base rate structure over the next four years with the average cost for rate-payers being about $21 each month in 2020, $25 in 2021, $30 in 2022, and $34 in 2023. Those fees include both an operational and environmental charge.

Concern was expressed about people who less water being penalized and also for lower-income residents likely seeing their bills increase.

"Even once all this work is done and the rate structure is adjusted, our people are going to be paying less than in competing utilities," Campbell County Judge/Executive Steve Pendery said. "All you can do with your utilities is do a better job than everyone else, and if they are, I don't see how you can complain."

"I am not disagreeing with a change in the base rate," Rechin, the Newport city commissioner, said. "I'm disagreeing with how it was rolled out and protections for people who can't afford it." Chaney explained that SD1 is working with the Brighton Center in Newport to have a fund available to assist rate-payers who are unable to afford a significant increase in their bills. Campbell County Geoff Besecker was also reassured following a conversation with the Brighton Center on the matter, he said. Currently, SD1 and the Brighton Center have a memorandum of agreement to address the situation.

Besecker said the proposal with Brighton Center raised the baseline poverty rate percentage from 150 to 200 percent of the poverty rate for residents who would be eligible to participate in the forthcoming program.
In Boone County, Commissioner Jesse Brewer moved that the issue be tabled for six months to open up more discussion with the public. He also said that turnout at public meetings would likely have been greater had SD1 scheduled more and advertised them on the bills.

His motion was supported by Commissioner Cathy Flaig, but voted against by Commissioner Charlie Kenner and Judge/Executive Gary Moore.

Kenner's motion to approve the change to the base rate structure ultimately failed to gain a second and so the matter never received a vote.

At Kenton County, following Chaney's presentation, the full court voted in favor with very little feedback.

With the change in the base rate structure and a pending agreement with the EPA, which still needs approval from a federal judge, the timeline for SD1 to fully fulfill its federal obligations would be adjusted from 2025 to 2040, giving even more relief to the agency.

To see the SD1 base rate presentation, click here.

Editor's note: *The author of this article attended the Campbell County Fiscal Court meeting but watched the Kenton County Fiscal Court meeting via the Telecommunications Board of Northern Kentucky, and the Boone County Fiscal Court meeting through its website.*

Written by Michael Monks, editor & publisher

https://www.wvxu.org/post/new-sanitation-rate-coming-nky#stream/0

New Sanitation Rate Coming To NKY

By MICHAEL MONKS · 18 HOURS AGO

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MICHAEL MONKS / WVXU

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https://www.nkytribune.com/2019/05/sd1-moving-to-base-rate-billing-in-july-change-designed-to-share-cost-equally-across-customer-base

SD1 moving to base-rate billing in July; change designed to share cost equally across customer base

May 30th, 2019

Northern Kentucky Sanitation District No. 1 (SD1) will change its residential sanitary billing to include a base rate beginning in July. The effect on customer bills will be dependent on individual water usage.

Historically, SD1's residential sanitary sewer rates have been based entirely on water consumption. However, much of the cost associated with operating the utility are fixed, meaning that certain costs have to be met before any customer uses a drop of water.



"We have more than 1,600 miles of sanitary sewer pipe in Northern Kentucky, 120 pump stations and three major treatment plants," said SD1 Executive Director Adam Chaney. "All of this infrastructure has to be maintained and operational whether you flush your toilet once or one hundred times a day. These fixed costs need to be shared equally across our customer base with a reduced reliance on the variable nature of water usage."

Starting in July, every residential customer will be charged a fixed operating fee of $16 per month, which will include 2 hundred cubic feet (HCF) of water treatment, and a fixed sanitary sewer overflow mitigation fee of $5 per month. These fees are based on SD1's fixed operating expenses, and will comprise the base rate of $21 per month. The changes will appear on customers' August bills.

To offset the impact of the base rate, the variable rate for water consumption beyond the minimum 2 HCF will be reduced from $8.11 to $7.25. SD1 will gradually increase its base rate and continue to decrease its variable rate over the next four years.

SD1 is also partnering with the Brighton Center to develop a Customer Assistance Program to help cover the incremental increase that will result from the shift to a base-rate structure for qualifying low-income and fixed-income customers.

"We understand that even a small increase can have a dramatic impact on some of our customers," Chaney said, "so we are working with the Brighton Center to ease the impact."

The $5 sanitary sewer overflow mitigation fee will fund SD1's federal requirements under an amended Clean Water Act Consent Decree to mitigate Northern Kentucky's sanitary sewer overflows and combined sewer overflows by the year 2040.

"We're committed to keeping rates affordable for all," Chaney said. "We've spent the last two years renegotiating the end date for our consent decree and reducing costs in all aspects of our work. Adjusting our rates to more closely align with the the actual cost of providing service is another important part of that commitment."

The SD1 Board of Directors unanimously approved the base-rate structure in April and on May 21 unanimously approved the SD1 rates and budget. The base-rate structure was approved by the fiscal courts earlier this month, and Wednesday the Boone, Campbell and Kenton county judges executive gave the final approval on the Fiscal Year 2020 SD1 budget and rate schedule.

SD1 is responsible for the collection and treatment of Northern Kentucky's wastewater and also serves as the regional storm water management agency. SD1 is the second largest public sewer utility in Kentucky, serving more than 290,000 residents throughout Boone, Campbell and Kenton counties.

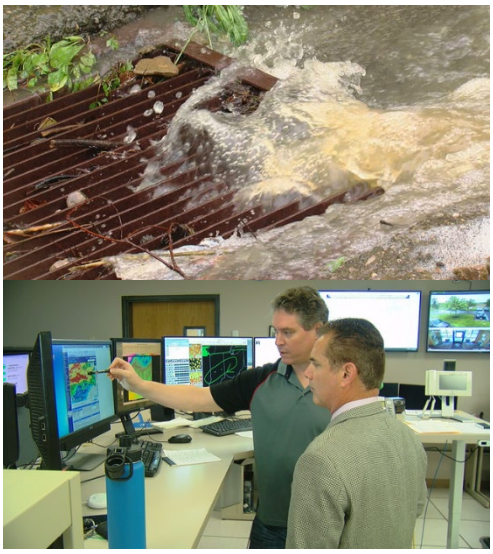
SD1 maintains approximately 1,600 miles of sanitary-sewer system pipeline, 135 wastewater pumping stations, 15 flood pump stations, six package treatment plants, three major wastewater treatment plants, 416 miles of storm-sewer system and 31,106 storm-sewer structures. For more information on SD1, click here.

SD1

https://local12.com/news/local/100-year-rainfalls-happening-more-often

100-year rainfalls happening more often

by David Winter, WKRC
Wednesday, June 19th 2019



COVINGTON, Ky. (WKRC) - Many people in our area are bracing for more flooding and sewage backups.

In Covington, rain-weary neighbors are still bailing out from the last storm. With every passing rain cloud, they're looking up to the sky and down to their basements.

Two feet of water and sewage poured in and backed up into basements of many of the homes on the west side of Covington. Many people are frustrated, asking why their local government isn't helping due to the fact that there are so many of these "100-year rainfall events" happening so often.

So, Local 12 looked into both those things. First of all, why isn't the government doing more?

"Your attitude towards the people that are in here is very disrespectful," one woman yelled at the Covington City Councilpeople at a Monday night meeting. Tempers overflowed there when the mayor tried to explain that the management of stormwater and sewage is handled by Sanitation District 1.

"The city government is just as frustrated with the course of events as our residents are," said Mayor Joe Meyer.

At SD1, previously, they said it would be economically irresponsible to upgrade the entire system to handle a 100-year rain event.

"Resources beyond what anyone would imagine," said SD1's Chris Cole. "We're talking likely tens of billions of dollars."

Currently, SD1 is under an EPA mandate to upgrade over the next 20 years to handle a two-year rain event, which is a $1-billion project itself. A meteorologist at the National Weather

Service in Wilmington describes what a two-year rain event -- or a 100-year rain event -- really means:

"We're trying to take what we have known for rainfall events, statistically analyze things and

then determine what is the chance of that event occurring on any given year," said meteorologist John Franks.

So, in Covington, a 100-year rain event is 5.85 inches falling in a 24-hour period. Statistics show the likelihood of that happening is once every 100 years.
But, just like a coin flip, having a 50-percent probability doesn't mean you won't get heads eight times in a row. The frequency of a 100-year rain could be 10 times in the next 10 years. The reality is, Covington has only recorded more than five inches once in the last 120 years, and that was back in 1964. But it did have two 50-year rain events in 2018 and three other 10-year rain events in the '50s, '60s and '80s. And Sunday's rain very well may have qualified as a 100-year event.

"In Covington, you are most certainly radar-estimated over four inches of rain -- five inches is not unreasonable," said Franks.

Bottom line, Covington homes have flooded a lot in the last 50 years. So, clearly, it doesn't take a 50-year rain event for that to happen.

SD1 just approved a new detention pond that might very well help the people in parts of Covington, but that's not going to be done anytime soon, and more rain is coming.

https://www.wvxu.org/post/nky-sanitation-bill-reboot-residents-have-questions#stream/0

With NKY Sanitation Bill Reboot, Residents Have Questions

By AMBRIEHL CRUTCHFIELD · JUL 1, 2019

Sanitation District No. 1 is implementing a new billing structure for Northern Kentucky customers today.

Every SD1 residential customer will be charged a base rate of $16, which covers 200-cubic feet of water treatment and a $5 sanitary sewer overflow. A variable rate of $7.25 will be charged for each additional hundred cubic feet of wastewater above the minimum.

The $5 sanitary fee will fund sewer overflows and reduce Northern Kentucky's sanitary sewer overflow by 2040. The fee will allow SD1 to fulfill a federal requirement under an amended Clean Water Act Consent Decree.

Christopher Vaught-Hall is a Boone County resident and SD1 customer. He says he is concerned money isn't supporting infrastructure changes. "All over their website they talk about how they are supposed to be mitigating risk of flooding and preventing your storm water from backing up into your home," he says. "You also hear about Covington that flooded and their sewer systems were not taken care of properly. Where was SD1 during that?"

"SD1 is charged with providing safe and reliable storm water services to our customers," says SD1's Chris Cole. "We are planning several improvement projects in strategic areas that will help address flooding and sewer backups, but none of those projects will completely eliminate the risk of flooding during extreme weather. That is why our Backup Assistance Program is so important - it is the most effective tool to help protect public health and property during major rain events."

In the past, sewer rates were based on water consumption.

Cole says when they compared their billing to utility companies throughout the region, they didn’t match up. "Our low-volume users were paying significantly less than theirs and our high-volume users were paying significantly more than theirs," he says. Cole adds the new structure will balance everything out.

Vaught-Hall says he has taken his concerns to SD1 and was told to check for leaky toilets or water lines dripping under his home.

SD1 is partnering with a local organization to cover the incremental increase for low- and fixed-income people.

"The restructure is not about bringing in more revenue," Cole says. "The low-volume users are going to see their bills go up but the high-volume users will see their rates go down. Those two will actually level out."

The fixed rate will continue to increase and the variable rate will decrease over the next four years. Cole says no one's bill will go up more than $5 each month because of this change. Customers will see a change on their August bill.

http://www.fortthomasmatters.com/2019/12/sd1-project-in-highland-heights-silver.html?m=1

SD1: project in Highland Heights, Silver Grove to eliminate rainfall overflows



In an effort to eliminate about 21 million gallons of annual sanitary sewer overflows (SSOs), Sanitation District No. 1 (SD1) hopes to begin constructing equalization (EQ) tanks in Highland Heights and Silver Grove next spring.

The EQ tanks will store excess flow during significant rain events and gradually release the flow back into the SD1 sewer system once the wet weather has stopped. This will minimize the risk of increased volume overwhelming the system and causing overflows.

“This marks a shift in strategy for SD1,” Executive Director Adam Chaney said. “We are moving toward a controlled storage approach, meaning that we will be strategically storing flow in EQ tanks, pipes and other structures and controlling how and when that flow is reintroduced into our system. This approach, combined with targeted upsizing of pipes, is the most cost-effective strategy to address overflows and meet the requirements of our amended consent decree.”

Under the terms of that agreement, SD1 must completely eliminate all SSOs during a typical year rainfall by the year 2040. Currently, the system experiences about 115 million gallons of SSOs in a typical year. The agreement also requires SD1 to recapture at least 85 percent of combined sewer overflows by 2040.



The Highland Heights/Silver Grove project also includes the construction of new pump stations at both sites. The new pump stations and EQ tanks will reduce about 18 percent of the baseline sanitary sewer overflows established by the amended consent decree.

The two tanks will be located at the intersections of Rt. 8 and Blangey Road in Highland Heights and Rt. 8 and Industrial Road in Silver Grove. The Highland Heights tank will stand about 39.5 feet above ground and hold about 1.4 million gallons when full. The Silver Grove tank will stand about 35 feet above ground and hold about 1.6 million gallons when full.

SD1 officials said the tanks will accept flow only during rain events. The EQ tanks will have flow in them 3-4 days per month, but should only completely fill once during a typical year.

SD1 expects to break ground on the EQ tanks and pump stations next spring pending final approval from the Environmental Protection Agency, and construction is expected to be completed by spring 2022 for an estimated cost of about $10 million.

“We’re excited to begin work on this project,” Chaney said. “This work allows us to improve the quality of our local waterways and make significant progress toward the requirements of our amended consent decree at about half the cost of what was originally anticipated. That’s good news for our ratepayers and our community.”

https://www.nkytribune.com/2019/12/sanitation-district-equalization-tanks-in-highland-heights-silver-grove-to-eliminate-rainfall-overflows

Sanitation District equalization tanks in Highland Heights, Silver Grove to eliminate rainfall overflows

Dec 17th, 2019

In an effort to eliminate about 21 million gallons of annual sanitary sewer overflows (SSOs), Sanitation District No. 1 (SD1) hopes to begin constructing equalization (EQ) tanks in Highland Heights and Silver Grove next spring.

The EQ tanks will store excess flow during significant rain events and gradually release the flow back into the SD1 sewer system once the wet weather has stopped. This will minimize the risk of increased volume overwhelming the system and causing overflows.



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https://www.rcnky.com/articles/2019/12/17/highland-heights-silver-grove-target-new-sd1-tanks-address-overflows

Highland Heights, Silver Grove Target of New SD1 Tanks to Address Overflows

TUE, 12/17/2019 - 17:40 RCN NEWSDESK

In an effort to eliminate about 21 million gallons of annual sanitary sewer overflows (SSOs), Sanitation District 1 (SD1) hopes to begin constructing equalization (EQ) tanks in Highland Heights and Silver Grove next spring.

The EQ tanks will store excess flow during significant rain events and gradually release the flow back into the SD1 sewer system once the wet weather has stopped. This will minimize the risk of increased volume overwhelming the system and causing overflows, SD1 said in a news release.

“This marks a shift in strategy for SD1,” Executive Director Adam Chaney said. “We are moving toward a controlled storage approach, meaning that we will be strategically storing flow in EQ tanks, pipes and other structures and controlling how and when that flow is reintroduced into our system. This approach, combined with targeted upsizing of pipes, is the most cost-effective strategy to address overflows and meet the requirements of our amended consent decree.”

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https://www.nkytribune.com/2020/04/sanitation-district-getting-started-on-first-phase-of-stormwater-wastewater-project-in-ft-thomas

Sanitation District getting started on first phase of stormwater/wastewater project in Ft. Thomas

Apr 22nd, 2020

Sanitation District No. 1 starting to break ground this week on the first phase of a stormwater and wastewater project along Waterworks Road in Ft. Thomas to alleviate flooding and eliminate sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs).



During heavy rainfall, the storm sewer system in the area can become overwhelmed by excess stormwater, resulting in flooding between Taylor Avenue and Memorial Parkway.

At a cost of just over $3 million, Phase I of the project includes increasing the size of stormwater and wastewater pipes starting near the intersection of Waterworks Road and Memorial Parkway, proceeding down Waterworks Road to the Ft. Thomas/Newport city line near London Acres Drive. The work will be completed by Smith & Brown Contractors, Inc., of Harrison, Ohio, and is expected to continue through fall 2021.

Later phases of the project will include installation of a Taylor Creek Equalization (EQ) Tank to eliminate sewer overflows in the city as part of SD1's Clean H2O40 program to meet sewer overflow mitigation requirements under an amended federal consent decree.

The Waterworks Road project is SD1's highest priority sanitary sewer project because it eliminates SSOs near the Northern Kentucky Water District's reservoir, allows for cost savings through coordination with a necessary stormwater project in the area, and addresses failing infrastructure needs.

Under the terms of its amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency, SD1 must completely eliminate all typical-year SSOs by the year 2040. The system experiences about 115 million gallons of SSOs in a typical year. The agreement also requires SD1 to recapture at least 85 percent of CSOs by 2040.

During construction, vehicle and foot traffic on Waterworks Road may be restricted. Detour signs will be posted. By combining a sanitary sewer project and stormwater project, SD1 is also making every effort to minimize disturbances to surrounding homes, businesses and motorists.

https://www.nkytribune.com/2020/04/sd1-turning-to-smart-sewer-management-to-fight-sewer-overflows-in-highland-heights-silver-grove

SD1 turning to smart-sewer management to fight sewer overflows in Highland Heights, Silver Grove

Apr 28th, 2020

By Chris Cole
Sanitation District No. 1

Sanitation District No. 1 is about to break ground on new equalization (EQ) tanks and pump stations in Highland Heights and Silver Grove that begin a new era of smart-sewer management in Northern Kentucky that will significantly reduce the cost of complying with federal Clean Water Act regulations.



The two tanks, which will be used to hold mostly storm water, will eliminate about 20 million gallons of typical-year sanitary sewer overflows (SSOs), and will do so at a price tag well below what traditional overflow mitigation would cost.

"We're going to make our sewer system smarter," said SD1 Executive Director Adam Chaney. "We can no longer afford to simply build bigger and bigger pipes and wait for them to become overwhelmed by larger and larger storms."
The first step toward smart sewers happens long before any work begins in the field. Working with its Updated Watershed Plan partner, Hazen and Sawyer, SD1 ran thousands of scenarios using artificial intelligence software to accurately predict what will happen throughout Northern Kentucky's sewer system under various storm simulations.

The results of that work provided a blueprint – which SD1 is calling Clean H2O40 – for the most effective and affordable approach to mitigating sewer overflows. The new EQ tanks in Highland Heights and Silver Grove will be the first projects constructed under the new Clean H2O40 plan.



The new tanks will ultimately use flow meter technology to signal the sewer system to store excess flow during storm events until downstream capacity is available. Once a storm has passed, the system will gradually release flow back into the pipes for transport to a treatment plant. This will minimize the risk of increased volume overwhelming the system and causing sewer overflows.

Chaney compares the technology to smart traffic lights during rush hour. As more and more cars begin to congest the road, traffic lights can be used strategically to keep things moving. SD1 will apply the same logic to Northern Kentucky's sewer system, and the Highland Heights/Silver Grove EQ tanks are a step toward system-wide coordination – storing flow in tanks, pipes and other structures across the region.

"This new strategy is anticipated to significantly lower project costs and associated revenue needs by hundreds of millions of dollars over the next 20 years. In addition to maintaining sewer rate affordability, the reduced overflow mitigation costs will allow SD1 to address system expansion required to support the local economy," Chaney said.
Under the terms of an amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency, SD1 must completely eliminate all typical-year sanitary sewer overflows by the year 2040. The system experiences about 115 million gallons of SSOs in a typical year. The agreement also requires SD1 to recapture at least 85 percent of combined sewer overflows by 2040.

Chaney said the Highland Heights and Silver Grove tanks – which will be located about a mile apart on Rt. 8 – will combine to hold about 3 million gallons when full and will help reduce about 17 percent of the region's typical-year SSOs. While the tanks will have flow of mostly storm water in them 3-4 days per month, they should only fill completely once during a typical year.

The tanks are expected to be completed by December 2021 for an estimated cost of about $10 million.

“We’re going to use storm water storage in combination with smart sewer management to improve our system today and into the future,” Chaney said. “This new approach, along with the recent nearly 15-year extension on our consent decree deadline, will make it possible for SD1 to mitigate system overflows, improve water quality and public health, and continue supporting the economic vitality of our region without over-burdening ratepayers.”



https://www.rcnky.com/articles/2020/04/30/new-tanks-pump-stations-coming-silver-grove-highland-heights

New Tanks, Pump Stations Coming to Silver Grove, Highland Heights

THU, 04/30/2020 - 14:09 RCN NEWSDESK

Sanitation District 1 is set to break ground on new equalization (EQ) tanks and pump stations in Highland Heights and Silver Grove.

The utility said in a news release that the move begins a "new era of smart-sewer management in Northern Kentucky that will significantly reduce the cost of complying with federal Clean Water Act regulations."

The two tanks, which will be used to hold mostly storm water, will eliminate about 20 million gallons of typical-year sanitary sewer overflows (SSOs), and will do so at a price tag well below what traditional overflow mitigation would cost.



“We’re going to make our sewer system smarter,”
said SD1 Executive Director Adam Chaney. “We can no longer afford to simply build bigger and bigger pipes and wait for them to become overwhelmed by larger and larger storms.”

The first step toward smart sewers happens long before any work begins in the field. Working with its Updated Watershed Plan partner, Hazen and Sawyer, SD1 ran thousands of scenarios using artificial intelligence software to accurately predict what will happen throughout Northern Kentucky’s sewer system under various storm simulations, a news release said.

SD1 is calling the results of that process "Clean H2O40. The Silver Grove and Highland Heights projects are the first under that plan.

The new tanks will ultimately use flow meter technology to signal the sewer system to store excess flow during storm events until downstream capacity is available. Once a storm has passed, the system will gradually release flow back into the pipes for transport to a treatment plant. This will minimize the risk of increased volume overwhelming the system and causing sewer overflows, the utility said.

Chaney compares the technology to smart traffic lights during rush hour. As more and more cars begin to congest the road, traffic lights can be used strategically to keep things moving. SD1 will apply the same logic to Northern Kentucky's sewer system, and the Highland Heights/Silver Grove EQ tanks are a step toward system-wide coordination – storing flow in tanks, pipes and other structures across the region.

"This new strategy is anticipated to significantly lower project costs and associated revenue needs by hundreds of millions of dollars over the next 20 years. In addition to maintaining sewer rate affordability, the reduced overflow mitigation costs will allow SD1 to address system expansion required to support the local economy," Chaney said.

Under the terms of an amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency, SD1 must completely eliminate all typical-year sanitary sewer overflows by the year 2040. The system experiences about 115 million gallons of SSOs in a typical year. The agreement also requires SD1 to recapture at least 85 percent of combined sewer overflows by 2040.

Chaney said the Highland Heights and Silver Grove tanks – which will be located about a mile apart on Rt. 8 – will combine to hold about 3 million gallons when full and will help reduce about 17 percent of the region's typical-year SSOs. While the tanks will have flow of mostly storm water in them 3-4 days per month, they should only fill completely once during a typical year. The tanks are expected to be completed by December 2021 for an estimated cost of about $10 million.

"We're going to use storm water storage in combination with smart sewer management to improve our system today and into the future," Chaney said. "This new approach, along with the recent nearly 15-year extension on our consent decree deadline, will make it possible for SD1 to mitigate system overflows, improve water quality and public health, and continue supporting the economic vitality of our region without over-burdening ratepayers."

-Staff report

https://www.cincinnati.com/story/news/local/campbellcounty/2020/05/01/nky-sanitary-sewer-overflow-reduction-project-cost-10-million/3063389001

NKY sanitary sewer overflow reduction project will cost $10 million

Chris Mayhew, Cincinnati Enquirer
Published 12:19 p.m. ET May 1, 2020
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Sanitation District No. 1 of Northern Kentucky will spend $10 million to eliminate about 20 million gallons of sanitary sewer overflow each year, according to a release from the utility.

The utility, which serves 290,000 residents of Boone, Campbell and Kenton Counties, is about to break ground on constructing new equalization tanks and pump stations in Highland Heights and Silver Grove, according to the release.

The Campbell County projects are the start of a new era of smart-sewer management in Northern Kentucky that will reduce the cost of complying with the Clean Water Act, according to the release.



SD1 provides service to 300,000 people in Northern Kentucky. *(Photo: File Photo)*

The two tanks will mostly hold stormwater but will eliminate about 20 million gallons of sanitary sewer overflows. The tanks will be triggered to start storing stormwater during heavy rains. Once a storm has passed, water will be released from the tanks gradually into sewer pipes to go to treatment plants, according to the release.

The tanks will each hold up to three million gallons, according to the release. They will be about a mile between each other along Ky. 8. The tanks will sometimes fill partially, but probably will only fill to maximum capacity once each year, according to the release.

The project is expected to be complete in December 2021 with the cost spread across SD1's 2019, 2020 and 2021 budgets, said Chris Cole, director of enterprise communications for SD1.

“We’re going to make our sewer system smarter,” said SD1 Executive Director Adam Chaney in the release. “We can no longer afford to simply build bigger and bigger pipes and wait for them to become overwhelmed by larger and larger storms.”

Clean H2O40, as in complying with the Clean Water Act fully by 2040, is what SD1 calls the new blueprint to comply with the Clean Water Act.

Hazen and Sawyer, a firm providing technical water quality services, helped SD1 run thousands of scenarios using artificial intelligence software to predict what will happen throughout Northern Kentucky's sewer system during different scenarios to come up with the new plan.



SD1 Executive Director Adam Chaney *(Photo: File photo)*

The new Silver Grove and Highland Heights pump stations and equalization tanks are the first projects in the Clean H2O40 plan.

“This new strategy is anticipated to significantly lower project costs and associated revenue needs by hundreds of millions of dollars over the next 20 years," Chaney said in the release. "In addition to maintaining sewer rate affordability, the reduced overflow mitigation costs will allow SD1 to address system expansion required to support the local economy."

SD1's consent decree, a legally binding agreement with Kentucky and the U.S. Environmental Protection Agency, requires that all sanitary sewer overflows be eliminated by 2040. SD1's system has about 115 million gallons of sanitary sewer overflows each year, according to the release.

The consent decree requires that 85 percent of SD1's combined sewer overflows, which are stormwater and sanitary sewage mixed together, be eliminated by 2040.

http://www.fortthomasmatters.com/2020/05/smart-sewer-management-announced-for.html?m=1

Smart-Sewer Management Announced for Silver Grove and Highland Heights

SD1 Turning to Smart-Sewer Management in Fight Against Sewer Overflows

FORT WRIGHT, Ky. – Sanitation District No. 1 is about to break ground on new equalization (EQ) tanks and pump stations in Highland Heights and Silver Grove that begin a new era of smart-sewer management in Northern Kentucky that will significantly reduce the cost of complying with federal Clean Water Act regulations.



New EQ tanks in Highland Heights, Silver Grove begin shift to save hundreds of millions of dollars.
(Img: SD1 Executive Director Adam Chaney, provided)

The two tanks, which will be used to hold mostly storm water, will eliminate about 20 million gallons of typical-year sanitary sewer overflows (SSOs), and will do so at a price tag well below what traditional overflow mitigation would cost.

“We’re going to make our sewer system smarter,” said SD1 Executive Director Adam Chaney. “We can no longer afford to simply build bigger and bigger pipes and wait for them to become overwhelmed by larger and larger storms.”

The first step toward smart sewers happens long before any work begins in the field. Working with its Updated Watershed Plan partner, Hazen and Sawyer, SD1 ran thousands of scenarios using artificial intelligence software to accurately predict what will happen throughout Northern Kentucky’s sewer system under various storm simulations.

The results of that work provided a blueprint – which SD1 is calling Clean H2O40 – for the most effective and affordable approach to mitigating sewer overflows. The new EQ tanks in Highland Heights and Silver Grove will be the first projects constructed under the new Clean H2O40 plan.

The new tanks will ultimately use flow meter technology to signal the sewer system to store excess flow during storm events until downstream capacity is available. Once a storm has passed, the system will gradually release flow back into the pipes for transport to a treatment plant. This will minimize the risk of increased volume overwhelming the system and causing sewer overflows.



Chaney compares the technology to smart traffic lights during rush hour. As more and more cars begin to congest the road, traffic lights can be used strategically to keep things moving. SD1 will apply the same logic to Northern Kentucky's sewer system, and the Highland Heights/Silver Grove EQ tanks are a step toward system-wide coordination – storing flow in tanks, pipes and other structures across the region.

"This new strategy is anticipated to significantly lower project costs and associated revenue needs by hundreds of millions of dollars over the next 20 years. In addition to maintaining sewer rate affordability, the reduced overflow mitigation costs will allow SD1 to address system expansion required to support the local economy," Chaney said.

Under the terms of an amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency, SD1 must completely eliminate all typical-year sanitary sewer overflows by the year 2040. The system experiences about 115 million gallons of SSOs in a typical year. The agreement also requires SD1 to recapture at least 85 percent of combined sewer overflows by 2040.

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The tanks are expected to be completed by December 2021 for an estimated cost of about $10 million.

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https://www.rcnky.com/articles/2020/05/05/sewer-project-begin-ft-wright

Sewer Project to Begin in Ft. Wright

TUE, 05/05/2020 - 13:04 RCN NEWSDESK

Sanitation District 1 is set to begin work on the replacement of a sanitary sewer bypass line along General Drive in Fort Wright, the utility announced on Tuesday.



The line was a temporary solution to a collapsed sewer near Devou Park that had caused an upstream manhole to release sewage into an unnamed creek in the area.

The project aims to eliminate the surface-level bypass and replace it with the installation of about 1,300-linear feet of 8-inch gravity sewer through horizontal directional drilling (HDD) and open-cut installation.

The replacement will include the entire section where the pipe collapsed and the HDD will run 3 feet into stable bedrock, eliminating the risk of future hillside movement impacting the condition of the pipe, the utility said.

Residents in the area may hear and see construction activities during normal working hours, but local traffic will have road access. A small portion of Fort Henry Drive will be closed to traffic for a 24-hour period, with detours posted. Some driveway access on Pickett Drive may be temporarily limited during the project. Notice will be given to homeowners before restricting driveway access.

The project is expected to be finished by the end of the year.

https://www.nkytribune.com/2020/05/sd1-to-begin-work-on-ft-wright-general-drive-sanitary-sewer-replacement-some-detours-expected

SD1 to begin work on General Drive sanitary sewer replacement in Ft. Wright, some detours expected

May 6th, 2020



Sanitation District No. 1 will soon begin work on the replacement of a sanitary sewer bypass line along General Drive in Ft. Wright.

The bypass line was a temporary solution to a collapsed sewer near Devou Park which had caused an upstream manhole to release sewage into an unnamed creek in the area. This project will eliminate the surface-level bypass by installing about 1,300 linear feet of 8-inch gravity sewer by means of horizontal directional drilling (HDD) and open-cut installation.

The replacement will include the entire section where the pipe collapsed and the HDD will run 3 feet into stable bedrock, eliminating the risk of future hillside movement impacting the condition of the pipe.
Residents in the area may hear and see construction activities during normal working hours, but local traffic will have road access. A small portion of Fort Henry Drive will be closed to traffic for a 24-hour period, with detours posted. Some driveway access on Pickett Drive may be temporarily limited during the project. Notice will be given to homeowners before restricting driveway access.

SD1 and its contractors will make every effort to minimize disturbances to surrounding residents, businesses and motorists. SD1 inspectors are present at every construction project to ensure our contractors are working safely and effectively with minimal disturbances to the community.

The General Drive project is expected to continue, weather permitting, through the end of 2020.

Article Score: 10 ***Clean H2O40? Yes***

https://www.cincinnati.com/story/news/local/kentoncounty/2020/07/02/sewer-construction-starting-fort-wright-last-until-december/5367007002/

SD1 starts $3 million Highland Pike sewer project to replaced failed pipe in Fort Wright

Chris Mayhew
Cincinnati Enquirer



An estimated $3 million new sewer project in Fort Wright will close the vehicle entrance to a nature park and trails along Highland Pike.

Work will start the week of July 6-10 and last through December, according to a Sanitation District No. 1 of Northern Kentucky release.

The construction is part of SD1's Clean H2O40 program. The larger pipe will increase sewer capacity in the area by 50 percent, and help eliminate sanitary sewer overflows (SSOs), according to the release.

The construction will replace a failed sanitary sewer pipe and an above-ground bypass in the area, according to the release. Approximately 2,400 linear feet of 15-inch gravity sewer will be installed along Highland Pike on private property, according to the release. The pipe is in an active landslide area, so the new pipe will be installed higher on the hill in stable bedrock.

SD1 pledged in the release not to disturb the hillside during the work, and to protect infrastructure from future landslides.

The Fort Wright Nature Center's vehicle entrance at Highland Pike entrance will be closed during the sewer pipe construction.

Trails and access to the lake is still open via Augusta Avenue, according to the Fort Wright city website.

There will be temporary trail closures in the Fort Wright Nature Center because of the work. A connected pathway will give pedestrians a safe route up Highland Pike, according to the SD1 release.

A sidewalk along Highland Pike, disconnected and damaged due to landslide activity, will be repaired by SD1's contractor during the work. A blocked-off parking lot along Highland Pike will be removed, according to the release.

Article Score: 9 *Clean H2O40? Yes*

https://www.nkytribune.com/2020/07/sd1-to-begin-sanitary-sewer-relocation-project-along-highland-pike-in-fort-wright-next-week

SD1 to begin sanitary sewer relocation project along Highland Pike in Fort Wright next week

Jul 2nd, 2020 ·



SD1 will replace a failed sanitary sewer pipe and above-ground bypass line along Highland Pike. (SD1 photo)

Sanitation District No. 1 will begin work next week to replace a failed sanitary sewer pipe and above-ground bypass line by installing approximately 2,400 linear feet of 15-inch gravity sewer along Highland Pike in Fort Wright.

Construction will take place on private property through December, but will result in temporary trail closures in the Fort Wright Nature Center.

Because the pipe is located near an active landslide area, the new sewer line will be installed higher on the hill using horizontal directional drilling. By placing the sewer in stable bedrock, SD1 will not disturb the hillside and will protect its infrastructure from future landslides.

As part of SD1's Clean H2O40 program, the upsized pipe will increase sewer capacity in the area by 50 percent, helping to eliminate sanitary sewer overflows (SSOs) while also allowing SD1 to meet future increases in demand.

In conjunction with this project, SD1's contractor will repair the sidewalk along Highland Pike that was disconnected due to landslide activity. The blocked-off parking lot along Highland Pike will also be removed.

The Fort Wright Nature Center's Highland Pike entrance will remain closed, but trails are still accessible from Augusta Avenue. The connected pathway will give pedestrians a safe route up Highland Pike.

Due to a favorable bid environment, the relocation project is estimated to cost $3 million, saving SD1 approximately $1.3 million from its original budget estimates.

From Sanitation District No. 1

Article Score: 9 *Clean H2O40? Yes*

https://www.rcnky.com/articles/2020/07/02/highland-pike-sewer-project-begin-next-week

Highland Pike Sewer Project to Begin Next Week

THU, 07/02/2020 - 19:03 RCN NEWSDESK

Sanitation District 1 will begin its sewer relocation project along Highland Pike in Fort Wright next week.



According to the utility, the sanitary sewer pipe has failed, and will be relocated along with an above-ground bypass line, and replaced with 2,400 linear feet of 15-inch gravity sewer.

Construction is expected to take place through December and will result in temporary trail closures in the Fort Wright Nature Center

Because the pipe is located near an active landslide area, the new sewer line will be installed higher on the hill using horizontal directional drilling. By placing the sewer in stable bedrock, SD1 will not disturb the hillside and will protect its infrastructure from future landslides.

As part of SD1's Clean H2O40 program, the upsized pipe will increase sewer capacity in the area by 50 percent, helping to eliminate sanitary sewer overflows (SSOs) while also allowing SD1 to meet future increases in demand, a news release said. In conjunction with this project, SD1's contractor will repair the sidewalk along Highland Pike that was disconnected due to landslide activity. The blocked-off parking lot along Highland Pike will also be removed.

The Fort Wright Nature Center's Highland Pike entrance will remain closed, but trails are still accessible from Augusta Avenue. The connected pathway will give pedestrians a safe route up Highland Pike.

The relocation project is estimated to cost $3 million, saving SD1 approximately $1.3 million from its original budget estimates, a news release said.

Article Score: 10 Clean H2O40? Yes

https://www.cincinnati.com/story/news/local/kentoncounty/2020/08/12/sd-1-spend-24-2-million-upgrade-river-city-sewer-pump-station/3354447001

NKY's largest sewer pump station in need of critical maintenance: SD1 announces $24M project

Chris Mayhew

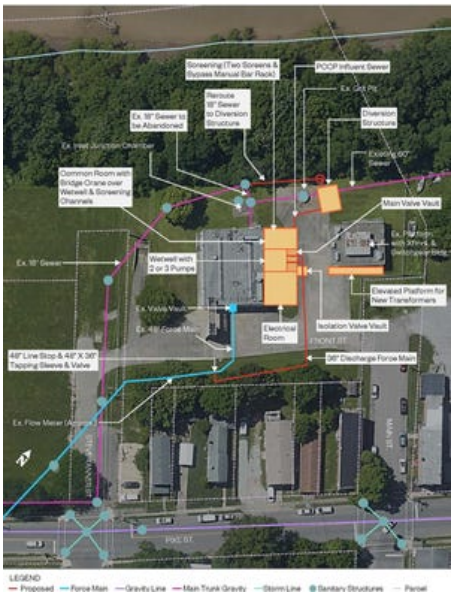
August 12th, 2020

SD1 provided an overview of Northern Kentucky's largest sewage pumping station in Bromley along the Ohio River. The 45-year-old pumping station will be upgraded as part of a $24.2 million project.

Northern Kentucky's largest wastewater pump station that handles 40 million gallons of sewage a day from river cities will be repaired in a $24.2 million project, according to a Sanitation District No. 1 of Northern Kentucky release.

The 45-year-old Bromley pump station at Front and Main streets in Bromley is in need of critical maintenance, according to the release.

The project will eliminate about 114 million gallons of combined sewer overflows (CSOs) in a typical year, according to the release. Construction is scheduled to start in summer of 2021 with a late 2023 completion date, according to the release.



SD1 provided an overview of Northern Kentucky's largest sewage pumping station in Bromley along the Ohio River. The 45-year old pumping station will be upgraded as part of a $24.2 million project. *Sanitation District No. 1 Of Northern Kentucky/ Provided*

The Bromley pump station operates near capacity. The facility conveys 40 million gallons of sewage per day to SD1's Dry Creek Wastewater Treatment Plant. The treatment plant is west of Villa Hills within about a mile of the Ohio River and Anderson Ferry.

"A lot of the equipment at the Bromley Pump Station is original and in dire need of maintenance or repair," said Lydia Watkins, SD1 project manager in the release.

The project will increase the pumping capacity at the Bromley station, which is a key component in SD1's Clean H2O40 commitment to improving water quality by reducing sewer overflows, Watkins said in the release.

Upgrading the Bromley pump station will greatly reduce the risk of environmental damage, due to a potential station failure, according to the release. The project will reduce future maintenance costs as well by eliminating the need for a costly bypass to continue pumping, according to the release.

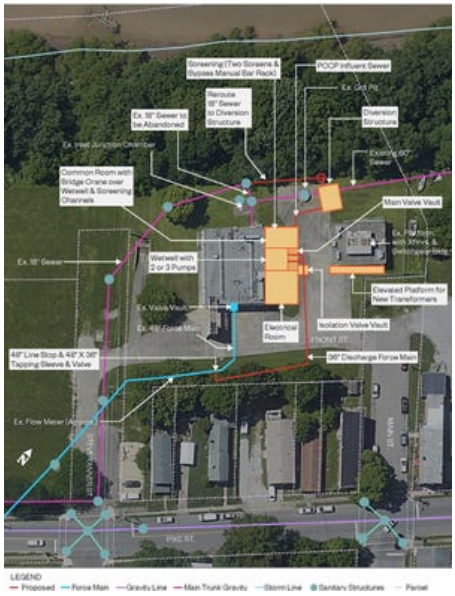
Article Score: 9 Clean H2O40? Yes

https://www.rcnky.com/articles/2020/08/12/242-million-improvement-project-planned-bromley-pump-station

$24.2 Million Improvement Project Planned at Bromley Pump Station

August 12th, 2020

Sanitation District 1 announced Wednesday that it plans to upgrade the wastewater pump station at Bromley, and to build a parallel pump station and nearby diversion structure. The utility said that the plans address critical maintenance needs by increasing system capacity and cutting sewer overflow mitigation costs.



The Bromley facility, along the Ohio River, has operated for 45 years.

SD1 said that failure of the station would threaten public health and the cleanliness of local waterways. The expected cost of the project is $24.2 million and is designed to eliminate about 114 million gallons of combined sewer overflows (CSOs) in a typical year, a news release said.

“A lot of the equipment at the Bromley Pump Station is original and in dire need of maintenance or repair,” said Lydia Watkins, SD1 project manager. Watkins said increasing Bromley’s pumping capacity is also a key component of Clean H2O40 - SD1’s commitment to improving water quality by reducing sewer overflows in Northern Kentucky.

As SD1’s largest pump station, the Bromley facility already operates near capacity, conveying 40 million gallons of sewage per day (MGD) to the SD1 Dry Creek Wastewater Treatment Plant from Northern Kentucky’s river cities.

SD1’s solution is to upsize the pumping capacity at Bromley to 45 million gallons per day and improve the facility’s mechanical, control and electrical systems. SD1 will also build a new diversion structure and a second nearby pump station with a capacity of 30 million gallons per day. Both pump stations will use the same force main, for a combined pumping capacity of 50 million gallons per day.

SD1’s new smart-sewer strategy calls for a holistic view of the entire system when making decisions about where and when to make enhancements to the public sewer system. The Bromley project is a prime example, including analysis of not only SD1’s Clean H2O40 consent decree requirements, but also its asset management needs.

SD1’s Updated Watershed Plan – the District’s blueprint to accomplish its Clean H2O40 amended consent decree goals – originally called for an increase in Bromley’s capacity to just 45 MGD and four additional projects to eliminate a total of 119 million gallons of typical-year

CSOs. Instead, a second pump station at Bromley allows SD1 to eliminate the four previously planned projects.

“We can achieve about the same level of CSO elimination in one project versus five separate projects, for an overall cost savings of approximately $3.5 million,” said Watkins.

The project also reduces future maintenance costs at Bromley by eliminating the need for costly bypass pumping, a news release said. With two pump stations, SD1 will no longer have to shut down the system for maintenance work.

Construction is expected to begin summer of 2021 and conclude in late 2023.

-Staff report

Article Score: 9 Clean H2O40? Yes

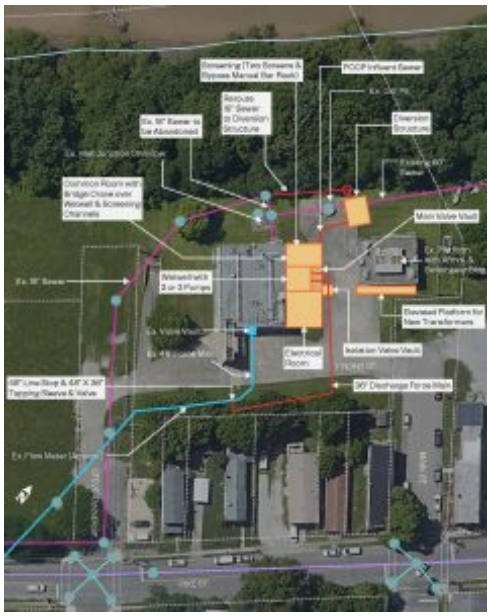
https://www.nkytribune.com/2020/08/upgrades-to-sanitation-district-no-1-bromley-pump-station-to-save-money-increase-capacity/

Upgrades to Sanitation District No. 1 Bromley Pump Station to save money, increase capacity

August 13th, 2020

Sanitation District No. 1 plans to upgrade its Bromley wastewater pump station and build a parallel pump station and nearby diversion structure, addressing critical maintenance needs, increasing system capacity and cutting sewer overflow mitigation costs.

The Bromley facility, located along the Ohio River, has operated for 45 years and is in need of critical maintenance, as failure of the station would threaten public health and the cleanliness of local waterways.



The Bromley Pump Station project map

The $24.2 million project will eliminate about 114 million gallons of typical-year combined sewer overflows (CSOs). “A lot of the equipment at the Bromley Pump Station is original and in dire need of maintenance or repair,” said Lydia Watkins, SD1 project manager. Watkins said increasing Bromley’s pumping capacity is also a key component of Clean H2O40 — SD1’s commitment to improving water quality by reducing sewer overflows in Northern Kentucky.

As SD1’s largest pump station, the Bromley facility already operates near capacity, conveying 40 million gallons of sewage per day (MGD) to the SD1 Dry Creek Wastewater Treatment Plant from Northern Kentucky’s river cities.

SD1’s solution is to upsize the pumping capacity at Bromley to 45 million gallons per day and improve the facility’s mechanical, control and electrical systems. SD1 will also build a new diversion structure and a second nearby pump station with a capacity of 30 million gallons per day. Both pump stations will use the same force main, for a combined pumping capacity of 50 million gallons per day.

SD1’s new smart-sewer strategy calls for a holistic view of the entire system when making decisions about where and when to make enhancements to the public sewer system. The Bromley project is a prime example, including analysis of not only SD1’s Clean H2O40 consent decree requirements, but also its asset management needs.

SD1’s Updated Watershed Plan – the District’s blueprint to accomplish its Clean H2O40 amended consent decree goals – originally called for an increase in Bromley’s capacity to just 45 MGD and four additional projects to eliminate a total of 119 million gallons of typical-year CSOs. Instead, a second pump station at Bromley allows SD1 to eliminate the four previously planned projects.

“We can achieve about the same level of CSO elimination in one project versus five separate projects, for an overall cost savings of approximately $3.5 million,” said Watkins.

The project also reduces future maintenance costs at Bromley by eliminating the need for costly bypass pumping. With two pump stations, SD1 will no longer have to shut down the system for maintenance work.

The Bromley Pump Station project will greatly reduce the risk of environmental damage due to station failure, lower future maintenance expense by eliminating the need for costly bypass pumping, and achieve a reduction of 114 million gallons CSOs per year.
Construction is expected to begin summer of 2021 and conclude in late 2023.

From Sanitation District No. 1

Article Score: 9 Clean H2O40? Yes

https://www.nkytribune.com/2020/08/sd1-completes-critical-sanitary-sewer-project-in-elsmere-to-eliminate-overflows-increase-capacity

SD1 completes critical sanitary sewer project in Elsmere to eliminate overflows, increase capacity

Aug 21st, 2020

Sanitation District No. 1 recently completed a sanitary sewer replacement project in Kenton County, eliminating sanitary sewer overflows and increasing sewer capacity for future growth and development in the region.

SD1 installed approximately 1.5 miles of sewer pipe ranging from 18 inches to 24 inches along Bullock Pen Creek and an unnamed tributary in the wooded area south of Oxford Court to Eastern Avenue and East Covered Bridge Drive.

The $4.89 million project provides vital capacity needs to the area's sanitary sewer system, conveying sewage from Elsmere, Florence and other areas to SD1's Dry Creek Wastewater Treatment Plant.



SD1 has completed a sanitary sewer replacement project in Kenton County, eliminating sanitary sewer overflows and increasing sewer capacity for future growth and development in the region.

"The Elsmere Corridor Sewer Project is one of the most important infrastructure projects to be completed in Elsmere," said Matthew Dowling, Elsmere city administrator. "This sewer project creates an opportunity for industrial growth that can produce a massive positive economic impact on not only Elsmere but the entire Northern Kentucky region."

The work is part of SD1's Clean H2O40 program, which includes a commitment to completely eliminating typical-year sanitary sewer overflows (SSO) in the region by 2040.

Prior to the Elsmere Corridor Sewer Project, heavy rain permeated the area's aging pipes, overwhelming the sewer system and causing raw sewage to spill into the surrounding environment. SD1 estimates the system upgrades will eliminate at least 2 million gallons of typical-year SSOs, improving water quality and reducing the risk to public health.

"Generations will benefit from not only the great economic potential of this project but also the positive environmental impact," Dowling said. "This future growth would not be possible without the investment and commitment from SD1."

Article Score: 9 Clean H2O40? Yes

https://www.rcnky.com/articles/2020/08/23/sd1-completes-489-million-elsmere-corridor-sewer-project

SD1 Completes $4.89 Million Elsmere Corridor Sewer Project



A sanitary sewer replacement project was recently completed in Kenton County and Sanitation District 1 said that the effort eliminates sanitary sewer overflows and increases sewer capacity for future growth and development in the region.

The utility installed roughly 1.5 miles of sewer pipe ranging from 18 to 24 inches along Bullock Pen Creek and unnamed tributary in the wooded area south of Oxford Court to Eastern Avenue and East Covered Bridge Drive in Elsmere.

The $4.89 million project, SD1 said, provides vital capacity needs to the area's sanitary sewer system, conveying sewage from Elsmere, Florence, and others areas to SD1's Dry Creek Wastewater Treatment Plant.

“The Elsmere Corridor Sewer Project is one of the most important infrastructure projects to be completed in Elsmere,” said Matthew Dowling, Elsmere city administrator. “This sewer project creates an opportunity for industrial growth that can produce a massive positive economic impact on not only Elsmere but the entire Northern Kentucky region.”

The work is part of SD1’s Clean H2O40 program, which includes a commitment to completely eliminating typical-year sanitary sewer overflows (SSO) in the region by 2040.

Prior to the Elsmere Corridor Sewer Project, heavy rain permeated the area’s aging pipes, overwhelming the sewer system and causing raw sewage to spill into the surrounding environment. SD1 estimates the system upgrades will eliminate at least 2 million gallons of typical-year SSOs, improving water quality and reducing the risk to public health.

“Generations will benefit from not only the great economic potential of this project but also the positive environmental impact,” Dowling said. “This future growth would not be possible without the investment and commitment from SD1.”

Article Score: 9 Clean H2O40? Yes

https://www.rcnky.com/articles/2020/09/22/drainage-improvements-coming-ky-route-9-area-newport

Drainage Improvements Coming to KY Route 9 Area in Newport

TUE, 09/22/2020 - 18:03 RCN NEWSDESK

A plan to improve drainage in Newport along the Route 9 realignment project is coming together through a partnership between Sanitation District 1 and the Kentucky Transportation Cabinet.



The project includes the construction of 388 linear feet of separate storm sewer along Route 9 and extending through the earthen levee to discharge directly to the Licking River, SD1 said in a news release. The utility will construct various access structures and gates to keep the Licking River from backing up into the storm pipe when the river level is elevated.

The partnership allows SD1 to upsize the separate storm sewers within the footprint of the State Route 9 realignment project, a news release said. The upgrades will accommodate the separation of 197 acres of drainage from the surrounding areas.

By installing long-term sewer upgrades in connection with the road improvement project, KYTC and SD1 will minimize road disruptions while reducing overland flooding and improving water quality, the announcement said.

“This gives SD1 and the City of Newport flexibility to solve future drainage needs, in addition to seeing a combined sewer overflow (CSO) reduction,” said Ralph Johnstone, SD1 chief engineer.

Separating the sewer system will eliminate approximately 10 million gallons of typical-year CSOs, moving SD1 closer to its Clean H2O40 amended consent decree goal of recapturing 85 percent of all typical-year CSO volume by the year 2040.

KYTC will reimburse SD1 for bidding and managing the construction of the storm sewer, estimated to cost $1.77 million. After completion, SD1 will own and maintain the storm sewer. “Projects like this benefit everyone,” said Bob Yeager, chief engineer of the Covington Division of KYTC. “There’s no reason to tear up the road a second time, and SD1 can increase sewer capacity for growth in the Commonwealth.”

SD1 estimates construction will begin in spring 2021 and continue through fall 2021, pending

board approval. The sewer improvements will complete the overall Route 9 road improvement project.

While the earthen levee is excavated, walkers will not be able to use the walkway located on top of the levee to access the Fourth Street Bridge. Signs will be posted.

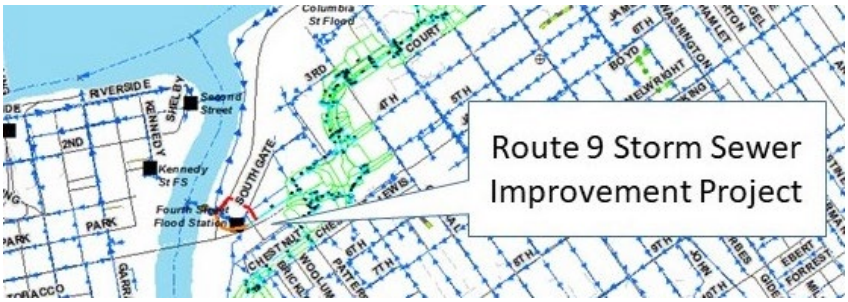
-Staff report

Article Score: 9 *Clean H2O40? Yes*

https://www.nkytribune.com/2020/09/sd1-partners-with-ky-transportation-cabinet-to-bring-drainage-improvements-along-route-9-in-newport

SD1 partners with Kentucky Transportation Cabinet to improve drainage along Route 9 in Newport

Sep 23, 2020



Sanitation District No. 1 and the Kentucky Transportation Cabinet (KYTC) are working together to improve drainage in Newport as part of KYTC's State Route 9 realignment project.

The project includes the construction of 388 linear feet of separate storm sewer along Route 9 and extending through the earthen levee to discharge directly to the Licking River. SD1 will construct various access structures and gates to keep the Licking River from backing up into the storm pipe when the river level is elevated.

The partnership allows SD1 to upsize the separate storm sewers within the footprint of the State Route 9 realignment project. The upgrades will accommodate the separation of 197 acres of drainage from the surrounding areas.

By installing long-term sewer upgrades in connection with the road improvement project, KYTC and SD1 will minimize road disruptions while reducing overland flooding and improving water quality.

"This gives SD1 and the City of Newport flexibility to solve future drainage needs, in addition to seeing a combined sewer overflow (CSO) reduction," said Ralph Johnstone, SD1 chief engineer.

Separating the sewer system will eliminate approximately 10 million gallons of typical-year CSOs, moving SD1 closer to its Clean H2O40 amended consent decree goal of recapturing 85 percent of all typical-year CSO volume by the year 2040.

KYTC will reimburse SD1 for bidding and managing the construction of the storm sewer, estimated to cost $1.77 million. After completion, SD1 will own and maintain the storm sewer.

"Projects like this benefit everyone," said Bob Yeager, chief engineer of the Covington Division of KYTC. "There's no reason to tear up the road a second time, and SD1 can increase sewer capacity for growth in the Commonwealth."

SD1 estimates construction will begin in spring 2021 and continue through fall 2021, pending board approval. The sewer improvements will complete the overall Route 9 road improvement project.

While the earthen levee is excavated, walkers will not be able to use the walkway located on top of the levee to access the Fourth Street Bridge. Signs will be posted.

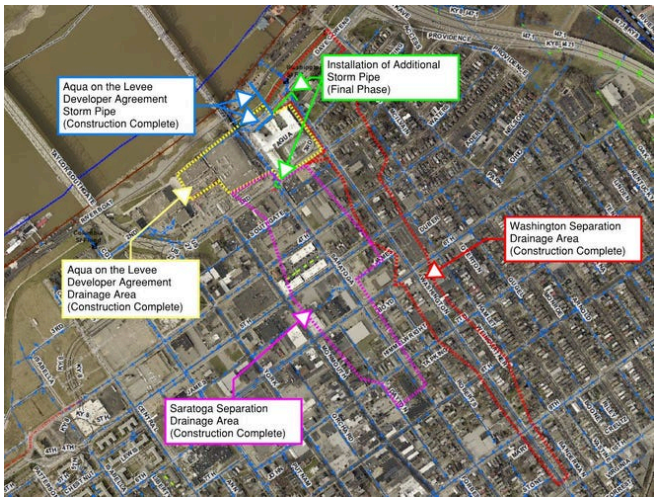
From Sanitation District #1

Article Score: 10 Clean H2O40? Yes

https://www.cincinnati.com/story/news/local/newport/2020/09/24/newport-project-eliminate-15-million-gallons-sewer-overflow/3515268001

Newport project will eliminate 15 million gallons of sewer overflow

Chris Mayhew
Cincinnati Enquirer



About 15 million gallons of annual combined sewer overflow in Northern Kentucky will be eliminated when installation of a new pipe around Newport on the Levee is finished, according to a Sanitation District No. 1 of Northern Kentucky release.

Construction to install a separate storm sewer pipe through a portion of the earthen levee at the Ohio River is scheduled to finish by April 2021, according to the SD1 release.
The project will reduce flooding during rains and increase sewer capacity in the area, according to the release. The creation of a separate system is expected to help foster development in the area by lessening the stormwater management requirements, according to the release.

This is the final phase of a project that started in 2018.

The new storm sewer pipe will be installed along Dave Cowens Drive and Washington Avenue. The cost of the new storm sewer pipe will be $957,054, according to the release.

When work is complete, sanitary and storm sewer pipes will be separated along Washington Avenue to Ninth Street and on Saratoga Street to East Seventh Street.

The combined sewer overflow is typically about 15 million gallons a year in the overall project area.

SD1 is working towards its program Clean H2O40 goal of recapturing 85 percent the typical year's combined sewer overflow volume across Northern Kentucky by 2040.

“This separation project is another example of SD1’s commitment to maximizing the impact of our work in Northern Kentucky,” said SD1 Executive Director Adam Chaney in the release.

“While accomplishing our Clean H2O40 goals is important, we also regularly look for opportunities to reduce flooding and backups and promote growth and development. This project checks all of those boxes.”

Article Score: 9 *Clean H2O40? Yes*

http://www.fortthomasmatters.com/2020/09/newport-drainage-projects-planned-along.html?fbclid=IwAR0pac8WLA9uUBBFWML2PVNIKwFVf66imFRzdsXzc94XtCGgbGA0iriShQs&m=1

Newport Drainage Projects Planned Along Route 9 in Newport and Newport on the Levee

Two local projects by Sanitation District 1 are about to launch in Newport. These projects will help to improve the flow of storm water in the area.

The first project will take place along Route 9 and last from approximately Spring 2021 to Fall 2021. This project will impact pedestrian traffic on the Fourth Street bridge.

The second project will take place on Saratoga Street near Newport on the Levee and last until April 2021.



SD1 Partners with Kentucky Transportation Cabinet to Bring Drainage Improvements along Route 9

State Route 9 Realignment Project

Sanitation District No. 1 and the Kentucky Transportation Cabinet (KYTC) are working together to improve drainage in Newport as part of KYTC's State Route 9 realignment project.

The project includes the construction of **388 linear feet of separate storm sewer along Route 9** and extending through the earthen levee to discharge directly to the Licking River. SD1 will construct various access structures and gates to keep the Licking River from backing up into the storm pipe when the river level is elevated.

The partnership allows SD1 to upsize the separate storm sewers within the footprint of the State Route 9 realignment project. The upgrades will accommodate **the separation of 197 acres of drainage from the surrounding areas.**

By installing long-term sewer upgrades in connection with the road improvement project, KYTC and SD1 **will minimize road disruptions while reducing overland flooding and improving water quality.**

"This gives SD1 and the City of Newport flexibility to solve future drainage needs, in addition to seeing a combined sewer overflow (CSO) reduction," said Ralph Johnstone, SD1 chief engineer.

Separating the sewer system will **eliminate approximately 10 million gallons** of typical-year CSOs, moving SD1 closer to its Clean H2O40 amended consent decree goal of recapturing 85 percent of all typical-year CSO volume by the year 2040.

KYTC will reimburse SD1 for bidding and managing the construction of the storm sewer, estimated to cost $1.77 million. After completion, SD1 will own and maintain the storm sewer.

“Projects like this benefit everyone,” said Bob Yeager, chief engineer of the Covington Division of KYTC. “There’s no reason to tear up the road a second time, and SD1 can increase sewer capacity for growth in the Commonwealth.”

SD1 estimates construction **will begin in spring 2021 and continue through fall 2021**, pending board approval. The sewer improvements will complete the overall Route 9 road improvement project.

While the earthen levee is excavated, **walkers will not be able to use the walkway located on top of the levee to access the Fourth Street Bridge**. Signs will be posted.

Separate Storm Water Pipe from Sanitary Sewer Pipe near Newport on the Levee

Sanitation District No. 1 will soon begin work on the final phase of a project to separate storm water pipe from sanitary sewer pipe near Newport on the Levee.



During this final phase of a project that started in 2018 with the installation of a separate storm water pipe through the earthen levee to the Ohio River, additional storm sewer will be installed along Dave Cowens Drive and Washington Street. This will complete the separation of storm and sanitary sewer pipe along Washington Avenue south to East 9th Street and Saratoga Street south to just past East 7th Street.

Once this final phase is completed, the sewer separation will eliminate 15 million gallons of typical-year combined sewer overflow (CSO) in the area, moving SD1 closer to its Clean H2O40 goal of recapturing 85 percent of typical-year Northern Kentucky CSO volume by the year 2040.

The project, at a total cost of $957,054, will also increase capacity in this area of Newport, improving drainage conditions and reducing the potential for flooding and building backups. The project will also promote redevelopment in the urban corridor by softening storm water management requirements due to the creation of a separate system.

“This separation project is another example of SD1’s commitment to maximizing the impact of our work in Northern Kentucky,” said SD1 Executive Director Adam Chaney. “While accomplishing our Clean H2O40 goals is important, we also regularly look for opportunities to reduce flooding and backups and promote growth and development. This project checks all of those boxes.”

The project is expected to be **completed by April 2021.**

Article Score: 9 Clean H2O40? Yes

https://www.nkytribune.com/2020/09/sd1-sewer-separation-project-in-newport-to-reduce-overflows-promote-redevelopment-in-city

SD1 sewer separation project in Newport to reduce overflows, promote redevelopment in city

Sep 25th, 2020

Sanitation District No. 1 will soon begin work on the final phase of a project to separate storm water pipe from sanitary sewer pipe near Newport on the Levee.



During this final phase of a project that started in 2018 with the installation of a separate storm water pipe through the earthen levee to the Ohio River, additional storm sewer will be installed along Dave Cowens Drive and Washington Street. This will complete the separation of storm and sanitary sewer pipe along Washington Avenue south to East 9th Street and Saratoga Street south to just past East 7th Street.

Once this final phase is completed, the sewer separation will eliminate 15 million gallons of typical-year combined sewer overflow (CSO) in the area, moving SD1 closer to its Clean H2O40 goal of recapturing 85 percent of typical-year Northern Kentucky CSO volume by the year 2040.

The project, at a total cost of $957,054, will also increase capacity in this area of Newport, improving drainage conditions and reducing the potential for flooding and building backups. The project will also promote redevelopment in the urban corridor by softening storm water management requirements due to the creation of a separate system.

“This separation project is another example of SD1’s commitment to maximizing the impact of our work in Northern Kentucky,” said SD1 Executive Director Adam Chaney. “While accomplishing our Clean H2O40 goals is important, we also regularly look for opportunities to reduce flooding and backups and promote growth and development. This project checks all of those boxes.”

The project is expected to be completed by April 2021.

From Sanitation District No. 1

Article Score: 9 Clean H2O40? Yes

https://www.rcnky.com/articles/2020/09/27/levee-pipe-project-enters-final-phase?fbclid=IwAR1_azalpaNbCjCu8hj_gzk_Dd7Pc_vm1rqtFCTC0wHpn8n3crGLZN1svRw

Levee Pipe Project Enters Final Phase

SUN, 09/27/2020 - 20:50 RCN NEWSDESK



Sanitation District 1 will soon begin work on the final phase of a project to separate storm water pipe from sanitary sewer pipe near Newport on the Levee.

The project started in 2018 with the installation of a separate storm water pipe through the earthen levee to the Ohio River, and now additional storm sewer will be installed along Dave Cowens Drive and Washington Street.

This will complete the separation of storm and sanitary sewer pipe along Washington Avenue south to East 9th Street and Saratoga Street south to just past East 7th Street.

Once this final phase is completed, the sewer separation will eliminate 15 million gallons of typical-year combined sewer overflow (CSO) in the area, moving SD1 closer to its Clean H2O40 goal of recapturing 85 percent of typical-year Northern Kentucky CSO volume by the year 2040, the utility said in a news release.

The project, at a total cost of $957,054, will also increase capacity in this area of Newport, improving drainage conditions and reducing the potential for flooding and building backups. The project will also promote redevelopment in the urban corridor by softening storm water management requirements due to the creation of a separate system.

“This separation project is another example of SD1’s commitment to maximizing the impact of our work in Northern Kentucky,” said SD1 Executive Director Adam Chaney. “While accomplishing our Clean H2O40 goals is important, we also regularly look for opportunities to reduce flooding and backups and promote growth and development. This project checks all of those boxes.”

The project is expected to be completed by April.

-Staff report

Article Score: 9 *Clean H2O40? Yes*

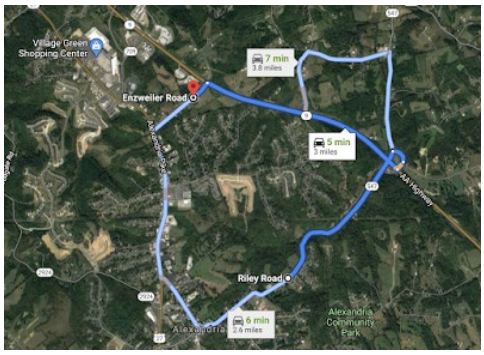
http://www.fortthomasmatters.com/2020/10/sanitation-district-to-begin-sewer.html?fbclid=IwAR1dNSVLFAHCwK3qOs98HhLe8hBSuA7tnm8Zddmjh1md0UVz_5sDkmSgow8&m=1

Sanitation District to Begin Sewer Improvements along US 27 and AA Highway

Sanitation District No. 1 will begin the first phase of a sanitary sewer improvement project along US 27 and the AA Highway this month.

During this first phase of the project, SD1 will upgrade about 7,000 linear feet of gravity sewer from the high point of the AA Highway near Enzweiler Road, running east to the Riley Road Pump Station. This phase of the project will cost approximately $2 million.

By replacing the 8-inch diameter pipe with a new 18-inch pipe, SD1 will increase system capacity, allowing the sewer to convey wastewater from new developments in the area and accept buildout flows from the next phase of the project, which includes critical pump station upgrades.



New sewer improvements are coming to Alexandria from Enzweiler Rd to Riley Rd.

“The Centerplex Pump Station is in urgent need of full rehabilitation,” said Phil Sebastian, SD1 pump station manager. “The pumps are in poor condition and, due to their design, it would be difficult to find support to maintain or replace them if they were to fail.”

Additionally, SD1 will redirect the flow of wastewater from Wolpert and other nearby pump stations to SD1’s Eastern Regional Water Reclamation Facility for treatment rather than sending it to SD1’s Dry Creek Wastewater Treatment Plant.

By redirecting pump station flows, SD1 will address sanitary sewer overflows (SSOs) along Industrial Road near the Silver Grove Pump Station, which account for approximately 1.6 million gallons of typical-year SSOs.

This project will move SD1 closer to its Clean H2O40 amended consent decree goal of completely eliminating typical-year sanitary sewer overflows by the year 2040.

“This project is a top priority for the District,” said SD1 Executive Director Adam Chaney. “It addresses asset management plans, system capacity needs and our Clean H2O40 goals, maximizing our efforts in the region.”

During the first phase of construction, motorists can expect single lane or shoulder closures along this portion of the AA Highway between 9 a.m. and 3 p.m. Poplar Ridge may also require a road closure at the intersection of the AA Highway. Detour signs will be posted.

SD1 expects all phases of the project to be complete by the summer of 2022.

Article Score: 9 *Clean H2O40? Yes*

https://www.nkytribune.com/2020/10/sd1-to-begin-phase-i-of-us-27-aa-highway-sanitary-sewer-improvements-later-this-month

SD1 to begin Phase I of US 27/AA Highway sanitary sewer improvements later this month

Oct 22nd, 2020



Sanitation District No. 1 will begin the first phase of a sanitary sewer improvement project along US 27 and the AA Highway this month. (Click to enlarge image)

Sanitation District No. 1 will begin the first phase of a sanitary sewer improvement project along US 27 and the AA Highway this month.

During this first phase of the project, SD1 will upgrade about 7,000 linear feet of gravity sewer from the high point of the AA Highway near Enzweiler Road, running east to the Riley Road Pump Station. This phase of the project will cost approximately $2 million.

By replacing the 8-inch diameter pipe with a new 18-inch pipe, SD1 will increase system capacity, allowing the sewer to convey wastewater from new developments in the area and accept buildout flows from the next phase of the project, which includes critical pump station upgrades.

“The Centerplex Pump Station is in urgent need of full rehabilitation,” said Phil Sebastian, SD1 pump station manager. “The pumps are in poor condition and, due to their design, it would be difficult to find support to maintain or replace them if they were to fail.”

Additionally, SD1 will redirect the flow of wastewater from the Wolpert Pump Station and other nearby pump stations to SD1’s Eastern Regional Water Reclamation Facility for treatment rather than sending it to SD1’s Dry Creek Wastewater Treatment Plant.

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This project will move SD1 closer to its Clean H2O40 amended consent decree goal of completely eliminating typical-year sanitary sewer overflows by the year 2040.

“This project is a top priority for the District,” said SD1 Executive Director Adam Chaney. “It addresses asset management plans, system capacity needs and our Clean H2O40 goals, maximizing our efforts in the region.”

During the first phase of construction, motorists can expect single lane or shoulder closures along this portion of the AA Highway between 9 a.m. and 3 p.m. Poplar Ridge may also require a road closure at the intersection of the AA Highway. Detour signs will be posted.

SD1 expects all phases of the project to be complete by the summer of 2022.

Article Score: 9 *Clean H2O40? Yes*

https://www.rcnky.com/articles/2020/10/22/sanitary-sewer-improvement-project-begin-along-aa-highwayus-27

Sanitary Sewer Improvement Project to Begin Along AA Highway/U.S. 27

THU, 10/22/2020 - 17:12 RCN NEWSDESK

A sanitary sewer improvement project along U.S. 27 and AA Highway is set to begin soon.

Sanitation District 1 plans to upgrade around 7,000 linear feet of gravity sewer from the high point of AA Highway near Enzweiler Road, running east to the Riley Road Pump Station.

This first phase of the project will cost approximately $2 million.



By replacing the 8-inch diameter pipe with a new 18-inch pipe, SD1 will increase system capacity, allowing the sewer to convey wastewater from new developments in the area and accept buildout flows from the next phase of the project, which includes critical pump station upgrades, a news release said.

“The Centerplex Pump Station is in urgent need of full rehabilitation,” said Phil Sebastian, SD1 pump station manager. “The pumps are in poor condition and, due to their design, it would be difficult to find support to maintain or replace them if they were to fail.”

Additionally, SD1 will redirect the flow of wastewater from the Wolpert Pump Station and other nearby pump stations to SD1’s Eastern Regional Water Reclamation Facility for treatment rather than sending it to SD1’s Dry Creek Wastewater Treatment Plant.

By redirecting pump station flows, SD1 will address sanitary sewer overflows (SSOs) along Industrial Road near the Silver Grove Pump Station, which account for approximately 1.6 million gallons of typical-year SSOs, a news release said.

This project will move SD1 closer to its Clean H2O40 amended consent decree goal of completely eliminating typical-year sanitary sewer overflows by the year 2040.

“This project is a top priority for the District,” said SD1 Executive Director Adam Chaney. “It addresses asset management plans, system capacity needs and our Clean H2O40 goals, maximizing our efforts in the region.”

During the first phase of construction, motorists can expect single lane or shoulder closures along this portion of the AA Highway between 9 a.m. and 3 p.m. Poplar Ridge may also require a road closure at the intersection of the AA Highway. Detour signs will be posted.

SD1 expects all phases of the project to be complete by the summer of 2022.

Article Score: 10 Clean H2O40? Yes

A new road, a K-9 unit cemetery idea, broadband and water line extensions – By the Way, NKY

Julia Fair
Cincinnati Enquirer

This is an installment of reporter Julia Fair's series "By the way, NKY." Here, you'll find what's going on in Northern Kentucky.

Don't worry, we won't remind you how many days there are until Election Day in this article. Instead, we'll tell you about road construction, how some good dogs will have a place to be remembered forever, and how broadband and waterlines will be expanded in Boone County. In this series, By the way, NKY – we focus on some of the good news happening in the region and to fill you in on what's going on in your neighborhoods.

If there's something you think should be included, email reporter Julia Fair at jfair@enquirer.com By the way, here's what's going on in Northern Kentucky:

A place for K-9 units to be buried
Next year, the dogs that serve Northern Kentucky police departments could have a special burial site at the Highland Pet Cemetery in Fort Mitchell.

Heather Jansen, president of the Highland Cemetery, has a trust with her brother and sister that is used to fund various projects for local organizations. Jansen plans to use part of the trust to create a memorial for police canines that would be available to local police departments, according to a letter she sent to Villa Hills Police Chief Bryan Allen that was shared with The Enquirer.

"It has been brought to my attention that there is a niche that has been overlooked when honoring those who have passed: the canines who have died either during service on the police force or after their service has been completed," Jansen wrote in her letter. "The expansion of the pet cemetery at Highland Cemetery provides the perfect space and opportunity to recognize this overlooked service to the community."

The monument will include a place for plaques to recognize the dogs' names and years of service. Jansen will also set aside funds for the officers to bury their dog with a marker. Her goal is to have the monument ready by Spring 2021.

Amsterdam Road Corridor unveiled
On October 6, the redesigned and rebuilt Amsterdam Road Corridor was unveiled. Residents in Covington and Park Hills will mostly benefit from the $60 million project. Construction began in 2019.

The aim is to reduce landslides and flooding problems in the area, according to a press release. Residents will see a new road, sidewalks, sewers, stormwater improvements and landscaping.

The new Amsterdam Road Regional Detention Basin is part of the Clean H2040plan spearheaded by Sanitation District No. 1, the Environmental Protection Agency, and the state. Clean H2O40 is SD1's **effort** to increase the "capacity to better manage the flow of wastewater and stormwater in Northern Kentucky."

More water lines and broadband in Boone County
In 2019, the Boone County Fiscal Court commissioners set a goal of expanding waterlines and broadband services into the rural western and southern areas of the county.

In September, it approved a funding plan to extend those services. The new utility development fund will be funded by new revenue from personal property taxes and real estate tax rates. That's estimated at $620,000, according to Chris Courtney, Communications & Community Affairs Manager for the Office of the Boone County Judge-Executive.

County officials will use those funds to pay for the broadband and water line extensions. The Fiscal Court will determine the cost of the expansion after it receives final bids and details for the project.

About 1,700 households will benefit from the water line expansion. The county will partner with the Boone County Water District.
When county officials choose a company for the broadband expansion, it will know how many households it will serve, according to a press release.

Boone County didn't raise taxes to pay for the expansions. That's because its tax base and property values have increased, which gives it more funds to work with.

The Fiscal Court lowered the personal property tax rate from 12.5 cents to 11 cents and the real property tax rate from 10.2 cents to 10.1 cents, according to meeting minutes.

Total assessments of county property grew by almost $1 billion over the last 12 months, said Judge-Executive Gary Moore in the meeting minutes.

COVID-19 resources for NKY residents
Need a COVID-19 test? Here are some helpful links to resources in Northern Kentucky.

- Find a free COVID-19 test on the state's COVID-19 website.
- Find Northern Kentucky COVID-19 data on the health department website.

That's it for this installment of By the way, NKY. Let us know if there's something you think we should include in the next. In the meantime, here are some other ways to keep up with your community:

- Keep an eye on your local government with us and subscribe to the free daily newsletter that gets sent directly to your inbox every morning.
- Download the NKY news app and sign up for alerts to be the first to know about news in your neighborhood

Julia is the Northern Kentucky government reporter through the Report For America program. Anonymous donors pledged to cover the local donor portion of her grant-funded position with The Enquirer. If you want to support Julia's work, you can donate to her Report For America position ***at this website*** *or email her editor Carl Weiser at cweiser@cincinna.gannett.com to find out how you can help fund her work. Do you know something she should know? Send her a note at jfair@enquirer.com and follow her on twitter at @JFair_Reports.*

Article Score: 9 Clean H2O40? Yes

https://www.nkytribune.com/2021/01/sd1-begins-lakeview-force-main-partial-replacement-project-to-address-asset-renewal-increase-capacity

SD1 begins Lakeview Force Main partial replacement project to address asset renewal, increase capacity

Jan 1st, 2021

Sanitation District No. 1 plans to replace and upgrade a deteriorating force main in Lakeside Park, addressing critical asset renewal needs, increasing sewer capacity and cutting future sewer overflow mitigation costs. The $1,507,588 project will begin construction in January and continue through September 2021.



Lakeview Force Main serves the Lakeview Pump Station, the largest pump station in SD1's separate sewer system, conveying approximately 18 million gallons of wastewater every day.

Lakeview Force Main serves the Lakeview Pump Station, the largest pump station in SD1's separate sewer system, conveying approximately 18 million gallons of wastewater every day. A portion of the pipe along Dixie Highway and Buttermilk Pike is in critical need of replacement, and a failure would threaten public health and the environment.

"This force main is the only example of Pre-stressed Concrete Cylinder Pipe (PCCP) in SD1's separate collection system," said SD1 Project Manager Lydia Watkins. She said the material was common in the 1970s when the force main was built, but is vulnerable when exposed to naturally corrosive sewer gases in wastewater applications.

The upcoming project will replace approximately 2,000 linear feet of 30-inch PCCP with 36-inch PVC pipe, a material that is more resistant to corrosion.

To further reduce the risk of system failure, SD1 will replace the force main in a new alignment. This will allow for the elimination of two of three existing air release valves (ARV).

Wastewater ARVs are designed to release any air that may become trapped in a pipe, such as hydrogen sulfide that is naturally corrosive and odorous. However, due to odor concerns, SD1 shut these valves over 10-years ago, compounding the risk to an already vulnerable pipe.

“By shutting these air release valves, we ensure unpleasant odors don’t escape,” Watkins said. “But as this air builds up, it reduces the amount of wastewater that can flow through the pipe and traps corrosive air inside. Over time this weakens the pipe and makes it more susceptible to rupture.”

Watkins said the new design includes an odor control vault and places the remaining ARV further away from homes to minimize future odors issues.

This project begins the process of increasing Lakeview’s overall system capacity as part of SD1’s Clean H2O40 program – SD1’s commitment to increasing system capacity to mitigate sewer overflows in Northern Kentucky.

“SD1 is continuously looking for ways to provide multiple benefits with the same rate payer dollar,” said SD1 Executive Director Adam Chaney. “This section of force main was identified as high risk in our business case analysis due to its condition and the financial risk of replacement under emergency conditions. The combination of environmental benefits, asset maintenance needs and risk mitigation makes good business sense.”

SD1’s contractor will work to minimize traffic disruptions, but travelers should expect periodic lane closures along Dixie Highway and Buttermilk Pike between 9 a.m. and 4 p.m. Signs will be posted.

From Sanitation District No. 1

Article Score: 9 *Clean H2O40? Yes*

https://www.rcnky.com/articles/2021/01/03/sd1-replace-pipe-along-dixie-highway-and-buttermilk-pike

SD1 to Replace Pipe Along Dixie Highway and Buttermilk Pike

SUN, 01/03/2021 - 17:27 RCN NEWSDESK



Sanitation District 1 (SD1) plans this month to replace and upgrade what it calls a deteriorating force main in Lakeside Park.
The project is designed to address critical asset renewal needs, the utility said, while also increasing sewer capacity and cutting future sewer overflow mitigation costs.
The more than $1.5 million project begins this month and is expected to continue through September.

Lakeview Force Main serves the Lakeview Pump Station, the largest pump station in SD1's separate sewer system, conveying approximately 18 million gallons of wastewater every day, a news release said.

A portion of the pipe along Dixie Highway and Buttermilk Pike is in critical need of replacement, and a failure would threaten public health and the environment.

"This force main is the only example of Pre-stressed Concrete Cylinder Pipe (PCCP) in SD1's separate collection system," said SD1 Project Manager Lydia Watkins. She said the material was common in the 1970s when the force main was built, but is vulnerable when exposed to naturally corrosive sewer gases in wastewater applications.

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Wastewater ARVs are designed to release any air that may become trapped in a pipe, such as hydrogen sulfide that is naturally corrosive and odorous. However, due to odor concerns, SD1 shut these valves over ten years ago, compounding the risk to an already vulnerable pipe, a news release said.

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and traps corrosive air inside. Over time this weakens the pipe and makes it more susceptible to rupture."

Watkins said the new design includes an odor control vault and places the remaining ARV further away from homes to minimize future odors issues.

This project begins the process of increasing Lakeview's overall system capacity as part of SD1's Clean H2O40 program – SD1's effort at increasing system capacity to mitigate sewer overflows in Northern Kentucky.

"SD1 is continuously looking for ways to provide multiple benefits with the same rate payer dollar," said SD1 Executive Director Adam Chaney. "This section of force main was identified as high risk in our business case analysis due to its condition and the financial risk of replacement under emergency conditions. The combination of environmental benefits, asset maintenance needs and risk mitigation makes good business sense."

Though contractors will work to minimize traffic disruption, some lane closures along Dixie and Buttermilk should be expected between the hours of 9 a.m. and 4 p.m.

-Staff report

Article Score: 9 *Clean H2O40? Yes*

https://www.rcnky.com/articles/2021/02/28/sd1-project-address-flooding-erlanger-intersection

SD1 Project to Address Flooding at Erlanger Intersection

SUN, 02/28/2021 - 18:31 RCN NEWSDESK



Sanitation District 1 (SD1) is planning to address flooding and sanitary sewer overflow issues at the intersection of Fitzgerald Court and Forest Avenue in Erlanger.

Construction on a new project will begin later this year and continue through early 2022.

During heavy rainfall, the storm sewer system in this area becomes overwhelmed, causing storm water to flood nearby streets and properties, the utility said in a news release.

SD1 will upsize the storm sewer pipes from Fitzgerald Court and Forest Avenue to a nearby creek, using an approximately 540-foot open channel as a storm water management control to mitigate the impact downstream. A new berm will redirect storm water runoff from residential yards into the sewer system.

Additionally, SD1 will upgrade the sanitary sewer system within the storm water project's footprint, increasing sewer capacity and helping to eliminate nearby SSOs.

"We initially scheduled these sanitary sewer improvements for 2030," said SD1 Project Manager Sean Blake. "However, combining the two projects will eliminate disturbing the neighborhood twice and reduce costs."

The estimated $1.48 million project will reduce flooding and move SD1 closer to its Clean H2O40 amended consent decree goal of eliminating all typical-year sanitary sewer overflows by 2040.

SD1 and its contractors will make every effort to minimize construction disturbances, but residents in the area can expect to see and hear construction activity during regular working hours, a news release said.

SD1 will notify homeowners before restricting driveways access.

-Staff report

Article Score: 9 *Clean H2O40? Yes*

http://www.fortthomasmatters.com/2021/03/sd1-begins-multi-phase-project-in.html

Thursday, March 11, 2021

SD1 Begins Multi-Phase Project in Wilder to Eliminate 47 Million Gallons of Sanitary Sewer Overflows

Sanitation District No. 1 is building an equalization (EQ) tank and wet weather pump station along the Licking River in Wilder to begin a three-phase project to eliminate more than 47 million gallons of sanitary sewer overflows (SSO).



The Licking River Siphon is the largest SSO location in Northern Kentucky, representing about 41 percent of all reoccurring SSOs that SD1 must eliminate by the year 2040 to meet the terms of its Clean H2O40 amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency.

Controlling such a significant source of pollution requires a multi-phase approach. This first project will eliminate about 5 million gallons of SSOs by installing a 7.3-million-gallon tank and a wet-weather pump station while also upsizing approximately 1,800 feet of sanitary sewer from Route 9 to the tank location.

Later, SD1 plans to install a second siphon underneath the river and upsize the conveyance system downstream to eliminate the remaining typical-year SSO volume.

"The sanitary sewers in this area experience excessive inflow and infiltration during heavy rainfall, resulting in sewer overflows," said SD1 Project Manager Lydia Watkins.

She said the tank, which is the third planned tank in Northern Kentucky, joining tanks currently under construction in Highland Heights and Silver Grove, will operate during rain events, allowing SD1 to store wastewater that would otherwise overflow into the creek and river.

The tank's size and location also allow SD1 to control how and when wastewater flows are reintroduced into the sewer system, reducing the need for a larger siphon now and in the future.

"The Licking River Siphon project is part of SD1's controlled storage approach to managing sewer overflows," said SD1 Executive Director Adam Chaney. "This strategy, paired with targeted upsizing of pipes, is the most cost-effective strategy to accomplish our Clean H2O40 goals. These projects will help improve our community's quality of life by eliminating a significant source of water pollution."

This first phase of the project, expected to cost about $13 million, will be under construction through July 2022.

Article Score: 9 Clean H2O40? Yes

https://www.rcnky.com/articles/2021/03/11/sd1-project-wilder-aims-eliminate-millions-gallons-sewer-overflow

SD1 Project in Wilder Aims to Eliminate Millions of Gallons of Sewer Overflow

THU, 03/11/2021 - 17:09 RCN NEWSDESK

Sanitation District 1 announced that it is set to begin building an equalization (EQ) tank and wet weather pump station along the Licking River in Wilder as part of a three-phase project to eliminate 47 million gallons of sanitary sewer overflows (SSO).

The Licking River Siphon is the largest SSO location in Northern Kentucky, representing about 41 percent of all reoccurring SSOs that SD1 must eliminate by the year 2040 to meet the terms of its Clean H2O40 amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency, the utility said in a news release.



A multi-phase approach was necessary in order to control such a significant source of pollution, SD1 said.

This first project will eliminate about 5 million gallons of SSOs by installing a 7.3-million-gallon tank and a wet-weather pump station while also upsizing approximately 1,800 feet of sanitary sewer from Route 9 to the tank location.

Later, SD1 plans to install a second siphon underneath the river and upsize the conveyance system downstream to eliminate the remaining typical-year SSO volume.

"The sanitary sewers in this area experience excessive inflow and infiltration during heavy rainfall, resulting in sewer overflows," said SD1 Project Manager Lydia Watkins.

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This first phase of the project, expected to cost about $13 million, will be under construction through July 2022.

Article Score: 9 *Clean H2O40? Yes*

https://www.nkytribune.com/2021/03/sd1-begins-multi-phase-project-in-wilder-to-eliminate-47m-gallons-of-sanitary-sewer-overflows

SD1 begins multi-phase project in Wilder to eliminate 47m gallons of sanitary sewer overflows

Mar 13th, 2021

Sanitation District No. 1 is building an equalization (EQ) tank and wet weather pump station along the Licking River in Wilder to begin a three-phase project to eliminate more than 47 million gallons of sanitary sewer overflows (SSO).



Work in progress on Licking River Siphon Project.

The Licking River Siphon is the largest SSO location in Northern Kentucky, representing about 41 percent of all reoccurring SSOs that SD1 must eliminate by the year 2040 to meet the terms of its Clean H2O40 amended consent decree with the Commonwealth of Kentucky and the US Environmental Protection Agency.

Controlling such a significant source of pollution requires a multi-phase approach. This first project will eliminate about 5 million gallons of SSOs by installing a 7.3-million-gallon tank and a wet-weather pump station while also upsizing approximately 1,800 feet of sanitary sewer from Route 9 to the tank location.

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The tank's size and location also allow SD1 to control how and when wastewater flows are reintroduced into the sewer system, reducing the need for a larger siphon now and in the future.

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This first phase of the project, expected to cost about $13 million, will be under construction through July 2022.

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Appendix M: Examples of SD1's Green Infrastructure Program

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12TH STREET GREEN IMPROVEMENT PROJECT

PROJECT DESCRIPTION

SD1 worked closely with the City of Covington and the Kentucky Transportation Cabinet (KYTC) during the 12th Street corridor expansion project to incorporate storm water best management practices (BMPs) into the plans with the goal of reducing the volume of storm water runoff entering Covington's combined sewer system. Four bioretention planter boxes (cells of vegetation, mulch and soil set intermittently in the sidewalk) collect and retain storm water runoff from the 0.5 acres of impervious roadway, thereby reducing the volume of storm water entering the sewer system and adding aesthetic appeal to a historic neighborhood. Additionally, a biofiltration swale (a gently sloping channel planted with vegetation) was constructed in the open space behind the planter boxes to receive excess rainwater from the planter boxes and up to one acre of surrounding hillside and residential area.

An interpretive park on the 500 block incorporates signage about historical 12th Street elements as well as information about SD1's integrated storm water initiatives in the area. The biofiltration swale, containing a variety of native flowers and shrubs, compliment the park's aesthetics.

PROJECT TIMELINE

Construction on SD1's portion of this project began in July of 2011 and was completed early in September of 2011.





PROJECT FUNDING

SD1's contribution to the project totalled $80,700, including the design and construction of the storm water BMPs.

PROJECT BENEFITS

>> Based on modeling of a typical year of rainfall, the bioretention planter boxes and biofiltration swale together reduce combined sewer overflow (CSO) volume by 300,000 gallons annually.

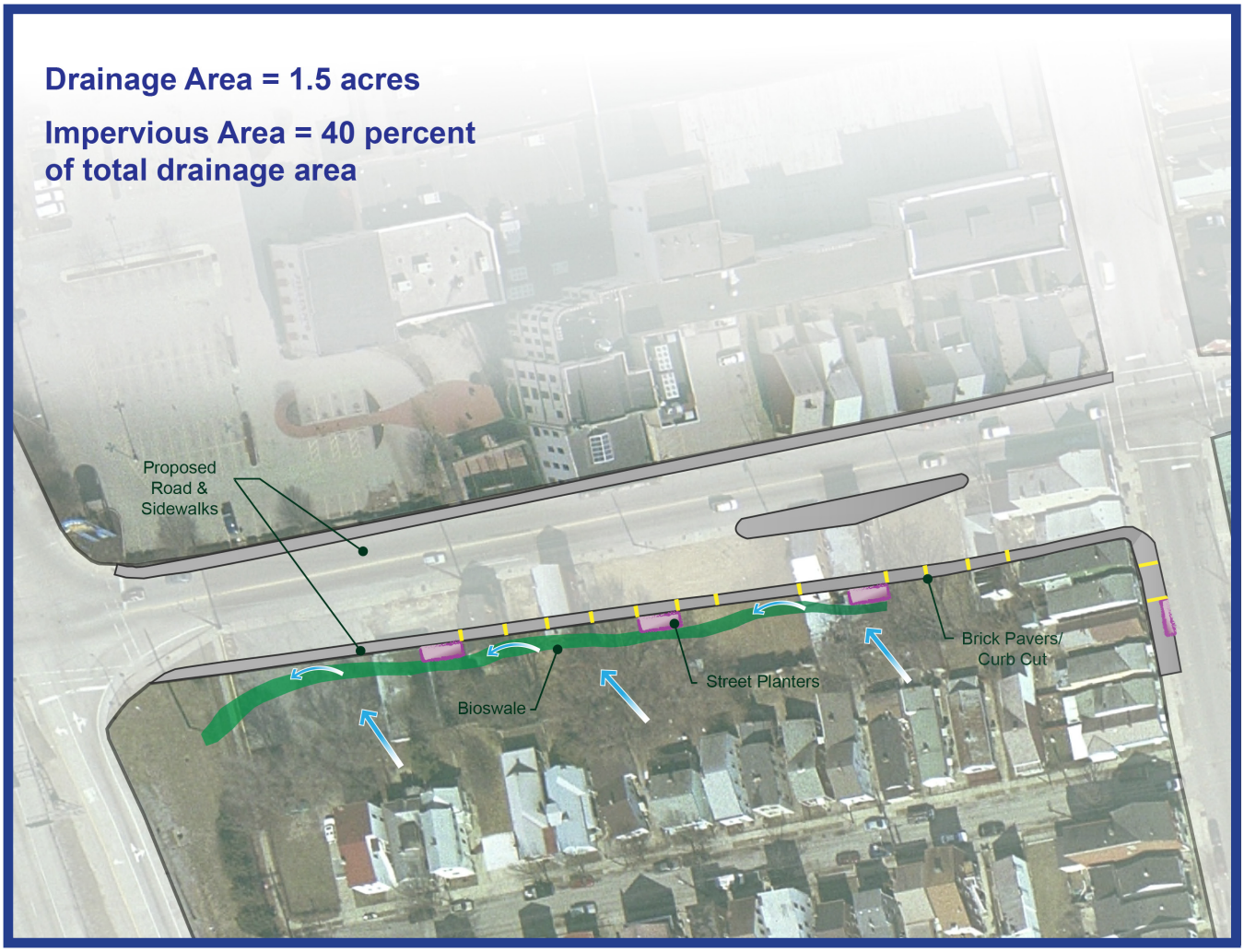
>> The 12th Street storm water BMPs show a considerable cost savings compared to traditional sewer projects for reducing CSO volume. Using the project cost assumed by SD1, the unit cost of this project is $0.27 per gallon of CSO volume reduction, which compares favorably with typical gray infrastructure costs of $0.50 per gallon of CSO volume reduction.

>> The addition of storm water BMPs to this historic area provides visual and educational benefits with landscaping and informational signage on storm water management.

For more information, please visit **www.sd1.org**, or email **info@sd1.org**.

PROJECT MAP on back

PROJECT MAP


Drainage Area = 1.5 acres
Impervious Area = 40 percent of total drainage area
Proposed Road & Sidewalks
Bioswale
Street Planters
Brick Pavers/ Curb Cut

BANKLICK CREEK REGIONAL WETLANDS PROJECT

PROJECT DESCRIPTION

The Banklick Creek Regional Wetlands project involved the construction of six acres of wetland to help improve the water quality of Banklick Creek, as it has been identified by the Kentucky Division of Water (KDOW) as a polluted waterway for bacteria, sediment, nutrients and other contaminants. Wetlands provide natural water treatment by allowing bacteria in the water to naturally decay and by capturing the excess sediment, nutrients and other pollutants often found in storm water runoff and waterways. The water released from a wetland is, as a result, much cleaner and free of many of the contaminants that pollute our waterways.

A small pump station has been constructed near Banklick Creek to remove a portion of the polluted creek water and divert it into the wetlands for natural decontamination. The naturally treated water released from the wetland is then allowed to flow back into the creek downstream. Because wetlands provide natural cleansing processes, the objective for the project is to reduce bacteria in the creek and provide other water quality improvements during the recreation season, May through October, as well as early spring and late fall, as conditions allow.



PROJECT TIMELINE

Construction of the Banklick Creek Regional Wetlands project began in April of 2010 and was completed in September of 2011. Final system adjustments and modifications were completed in the following spring, and the facility began normal operations on May 1, 2012.

PROJECT FUNDING

The total cost of this project, including design, construction, land acquisition and financing, was just under $2.5 million. SD1 received a $1.37 million loan through the American Recovery and Reinvestment Act of 2009, 52 percent of which does not have to be repaid by the Northern Kentucky community. This saved ratepayers $714,600. The final project cost assumed by SD1 was $1,777,300.

PROJECT BENEFITS

- >> Modeling results indicate that the wetland will result in a 54 percent reduction in average bacteria quantities in Banklick Creek immediately downstream of the wetland during the recreation season. This reduction is estimated to achieve compliance with KDOW's water quality standards in regards to bacteria levels for approximately 31 more days out of the year than it does currently.
- >> The primary purpose of the project is to reduce bacteria; however, the use of the regional wetland also allows for water quality benefits not provided by traditional infrastructure like pipes and tunnels. These benefits include reduction of other pollutants, improved wetland habitat and educational opportunities.
- >> More traditional infrastructure to contain or treat sanitary sewer overflows in the area, like pipes and tunnels, are more expensive. A more traditional approach to controlling water quality in Banklick Creek was estimated to cost approximately $20 million and would not provide additional days of compliance to water quality standards set by KDOW.

For more information, please visit **www.sd1.org**, or email us at **info@sd1.org**.

PROJECT MAP on back

PROJECT MAP





Google Earth V 7.0.3.8542. (August 29, 2012). Ft. Wright, Ky. DigitalGlobe 2012. http://www.earth.google.com [July 23, 2013].

FT. WRIGHT DETENTION BASIN AND NATURE PARK PROJECT

PROJECT DESCRIPTION

SD1 has completed an innovative project in Ft. Wright to reduce combined sewer overflows (CSOs) in and around the area. An existing detention basin located on Kentucky Transportation Cabinet (KYTC) and the City of Ft. Wright's property has been reconstructed and improved to include a nature park that will help to control storm water runoff with natural features and processes.

Combined sewer systems carry both wastewater from homes and businesses and storm water from rainfall or snow melt through the same pipes. Excess storm water can overload the pipes and cause the system to overflow into nearby streams, resulting in a major pollution concern. As a part of this project, the existing detention basin was modified and reinforced to hold additional storm water runoff and significantly reduce the rate at which the runoff enters the combined sewer system. The detention basin is fenced off from the park area for the safety of visitors and nearby residents.

The park was designed for passive recreational use and provides a natural setting for visitors to take a walk on the trail and observe the wildlife that is attracted to the park in addition to the storm water control benefits. Among the park features are two small, shallow vernal pools that collect excess storm water; a prairie area planted with native plants and grasses to help slow and filter the storm water flowing out of the vernal pools; and several reforested areas to restore some of the trees that were removed during the construction of this project and to provide habitat for wildlife. Bat boxes positioned in the trees around the vernal pools attract bats that help control mosquitoes and other unwanted pests. Because the primary purposes of the passive park are to slow storm water runoff and provide natural wildlife habitat, SD1 conducts minimal maintenance on the park, allowing nature to do what nature does best.

PROJECT TIMELINE

This project began in April of 2010 and was completed in August of 2011.

PROJECT FUNDING

The total cost of this project, including design, construction and financing, was approximately $1.78 million. SD1 received a $1.47 million loan through the American Recovery and Reinvestment Act of 2009, 52 percent of which does not have to be repaid by the Northern Kentucky community. This saved ratepayers $768,400. The final project cost assumed by SD1 was $1,013,900.

PROJECT BENEFITS

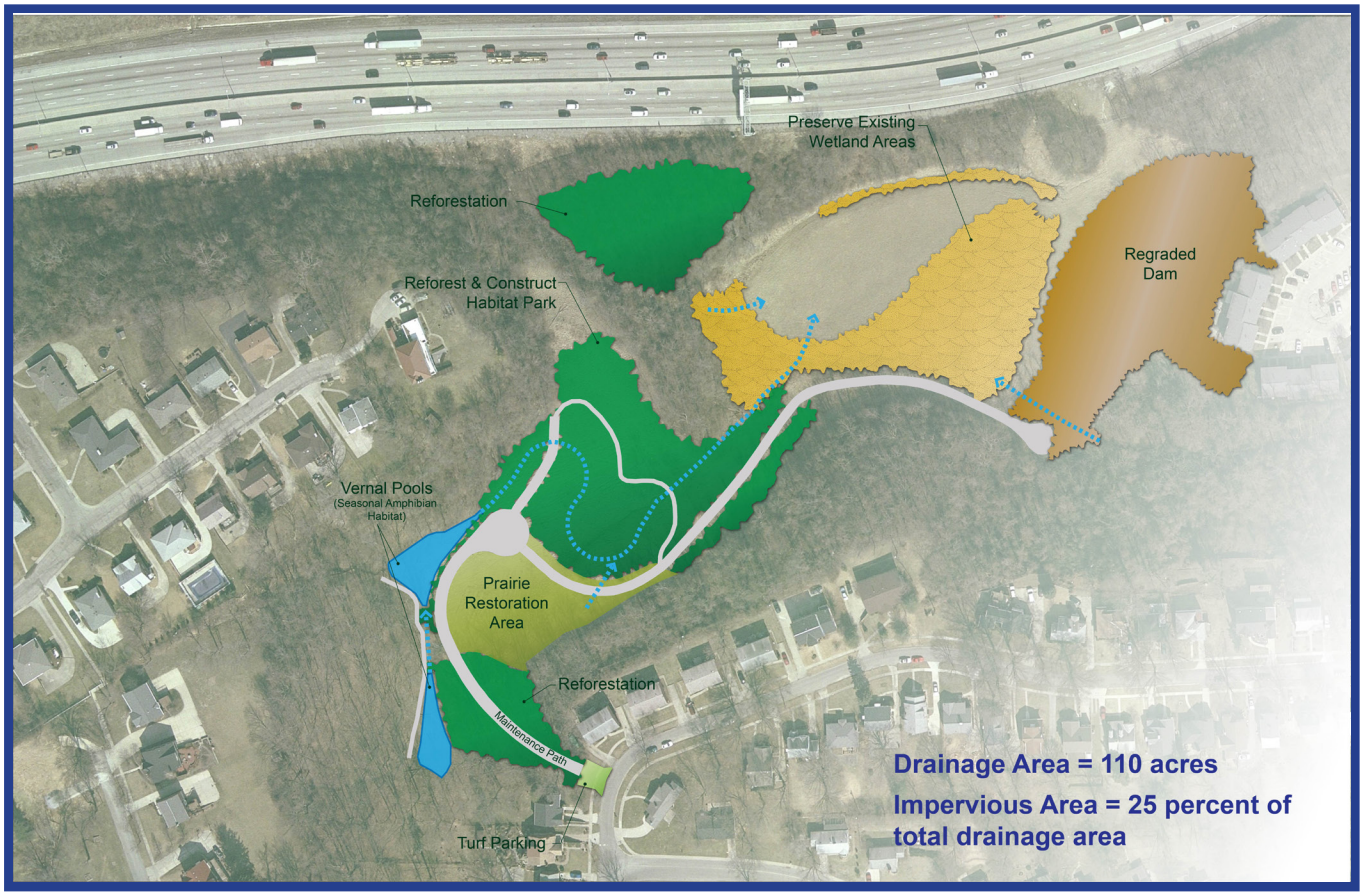
- >> Based on monitoring, this project reduces the annual CSO volume from Willow Run, SD1's largest CSO, by over 20 million gallons during a typical year of rainfall.
- >> Using the project cost assumed by SD1, the unit cost of this project is approximately $0.05 per gallon of CSO volume reduction, which compares favorably with typical gray infrastructure costs of $0.50 per gallon of CSO volume reduction.
- >> This project reintroduces natural features and processes to effectively manage storm water runoff and water pollution, and is a cost-effective alternative to traditional solutions like sewer systems, tanks and tunnels.
- >> The implementation of the nature park and its natural features provides an improvement in wildlife habitat.
- >> The passive recreational park also provides a natural area for visitors to enjoy.



For more information, please visit **www.sd1.org**, or email us at **info@sd1.org**.

PROJECT MAP on back

PROJECT MAP


Preserve Existing Wetland Areas
Reforestation
Regraded Dam
Reforest & Construct Habitat Park
Vernal Pools
(Seasonal Amphibian Habitat)
Prairie Restoration Area
Reforestation
Maintenance Path
Turf Parking
Drainage Area = 110 acres
Impervious Area = 25 percent of total drainage area

TERRACED REFORESTATION PROJECT

PROJECT DESCRIPTION

SD1's Terraced Reforestation project involved the construction of a series of vegetated, terraced berms within the I-71/75 right-of-way in the City of Covington. This project helps SD1 meet the requirements of its Consent Decree, an agreement entered into with the U.S. Environmental Protection Agency and the Kentucky Division of Water, to reduce combined sewer overflows (CSOs) while providing an aesthetic amenity to the community.

Combined sewer systems carry both wastewater from homes and businesses and storm water from rainfall or snowmelt through the same pipes. Excess storm water can overload the pipes and cause the system to overflow into nearby streams, resulting in a major pollution concern. The Terraced Reforestation project was designed to catch storm water runoff and detain it, slowing the runoff and allowing for a more gradual flow of water into the combined sewer system. Twelve linear, earthen terraces were constructed, featuring compacted embankments that prevent runoff from flowing downhill and a permeable soil mix to promote better infiltration of rainwater. In addition, over 40 shrubs and 280 trees, as well as eight acres of native plant seeding, were planted to absorb rainwater. The overall project included approximately 5,000 feet in total terrace length.



PROJECT TIMELINE

Construction on this project began in May 2010 and was substantially complete in the spring of 2012.

PROJECT FUNDING

The total cost of this project, including design, construction and financing, was approximately $1.39 million. SD1 received a loan of $834,200 through the American Recovery and Reinvestment Act of 2009, 52 percent of which does not have to be repaid by the Northern Kentucky community. This saved ratepayers $434,600. The final project cost assumed by SD1 was $951,800.

PROJECT BENEFITS

>> Based on a typical year model, CSO volume is reduced by approximately 3.1 million gallons annually. *(This estimate is based on a combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects.)*

>> Using the project cost assumed by SD1, the unit cost of this project is approximately $0.39 per gallon of CSO volume reduction, which compares favorably with typical gray infrastructure costs of $0.50 per gallon of CSO volume reduction. *(This benefit is based upon the combination of the Terraced Reforestation and St. Elizabeth Detention Basin Retrofit projects.)*

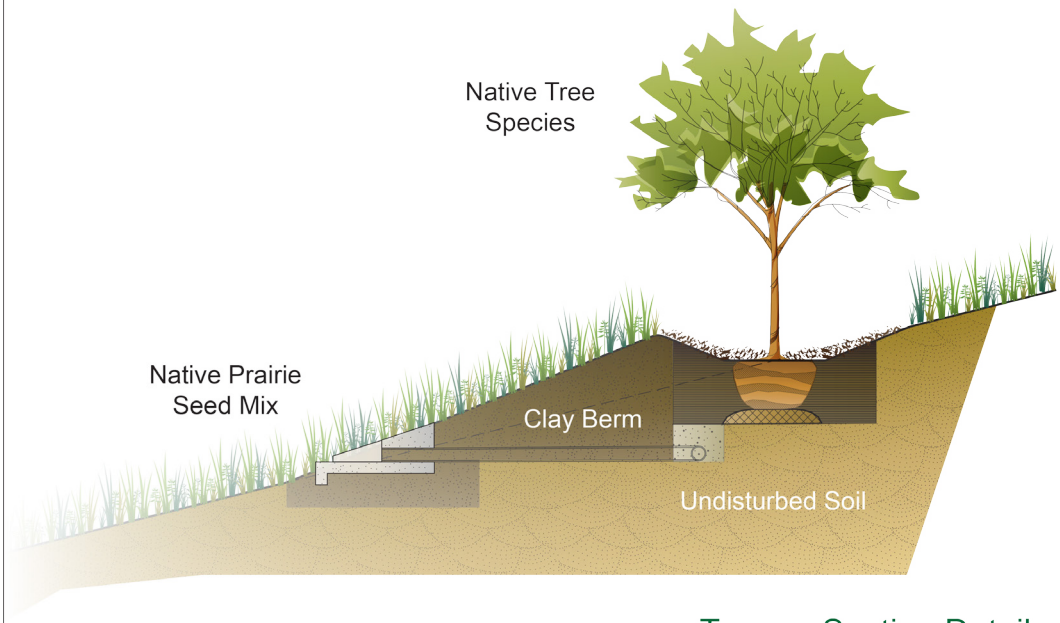
>> The project site is located in a highly visible area of the I-71/75 right-of-way, which has a current traffic volume of approximately 150,000 vehicles daily. This project significantly improves the aesthetic value of this open space area through the planting of trees, shrubs and native prairie grasses.

For more information, please visit **www.sd1.org**, or email **info@sd1.org**.

PROJECT MAP on back

PROJECT MAP





Terrace Section Detail

Appendix N: Project Summary Graphics

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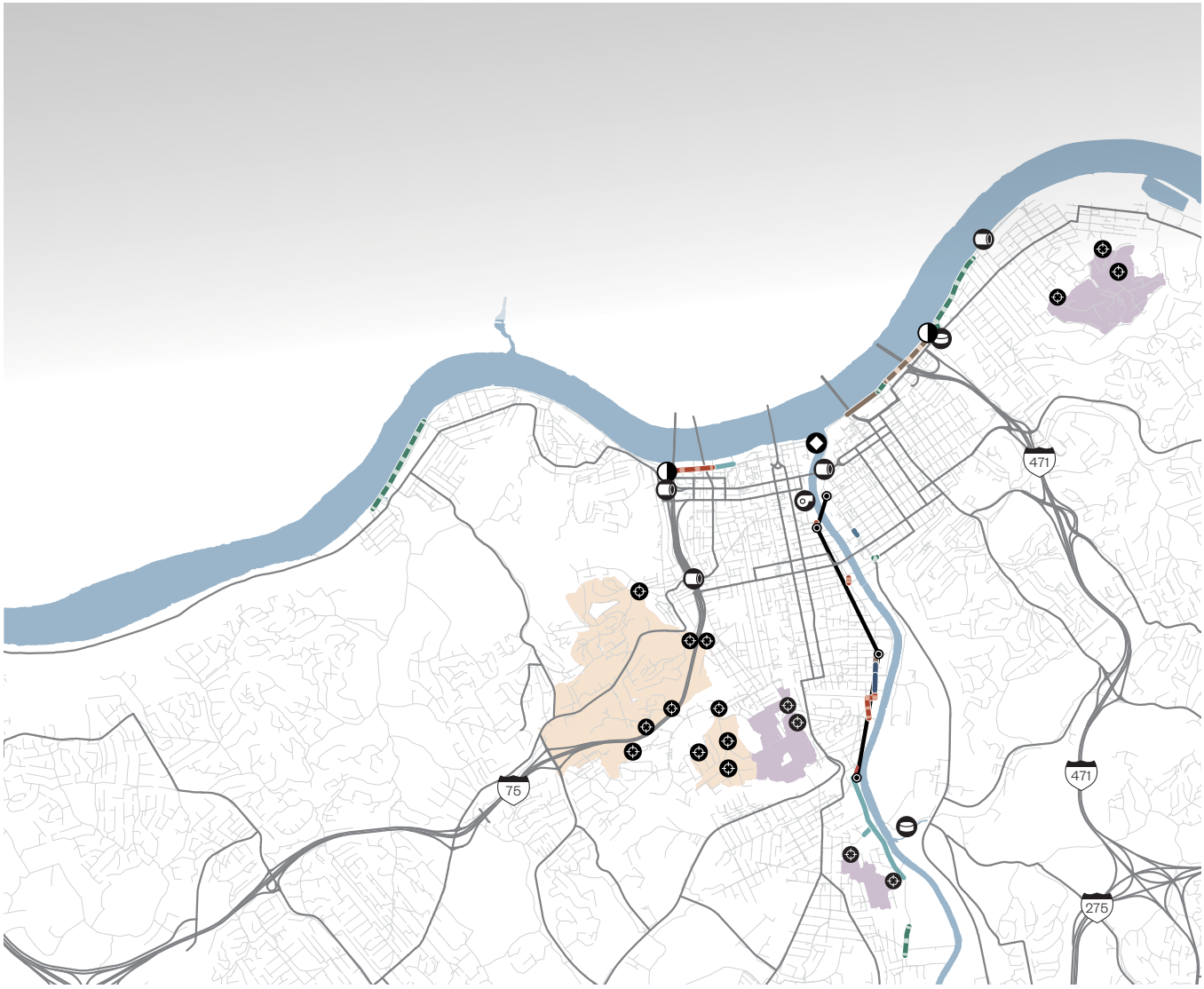
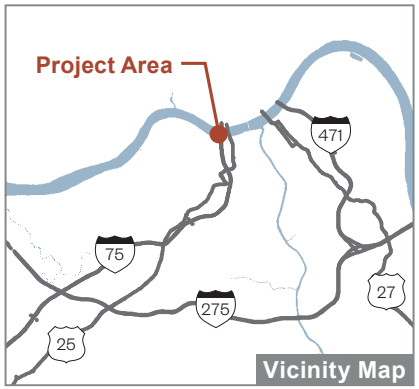








2023 Improvements



Project Summary Sheet

2023 CSO Solution — RWI Phase I & II Improvements

Project Status: Conceptual Planning

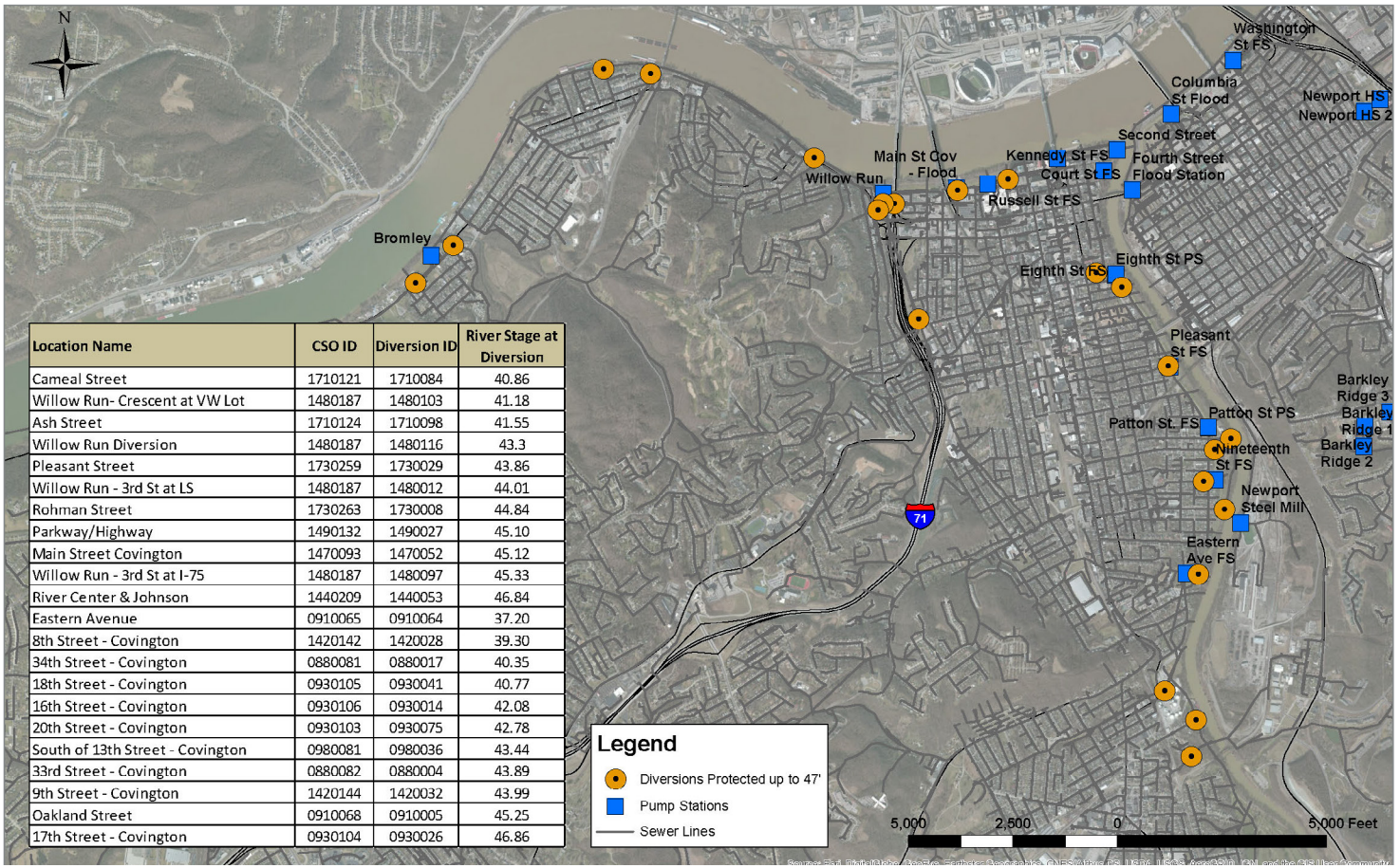
Estimated Capital Cost: $7,880,000

Project Metrics

Estimated Overflow Reduction (Typical Year):	116 MG
Cost Per Gallon Removed (Typical Year):	$0.07

NOTE:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***RWI Program shortened to three phases instead of four to more efficiently construct the improvements.***



Location Name	CSO ID	Diversion ID	River Stage at Diversion
Cameal Street	1710121	1710084	40.86
Willow Run- Crescent at VW Lot	1480187	1480103	41.18
Ash Street	1710124	1710098	41.55
Willow Run Diversion	1480187	1480116	43.3
Pleasant Street	1730259	1730029	43.86
Willow Run - 3rd St at LS	1480187	1480012	44.01
Rohman Street	1730263	1730008	44.84
Parkway/Highway	1490132	1490027	45.10
Main Street Covington	1470093	1470052	45.12
Willow Run - 3rd St at I-75	1480187	1480097	45.33
River Center & Johnson	1440209	1440053	46.84
Eastern Avenue	0910065	0910064	37.20
8th Street - Covington	1420142	1420028	39.30
34th Street - Covington	0880081	0880017	40.35
18th Street - Covington	0930105	0930041	40.77
16th Street - Covington	0930106	0930014	42.08
20th Street - Covington	0930103	0930075	42.78
South of 13th Street - Covington	0980081	0980036	43.44
33rd Street - Covington	0880082	0880004	43.89
9th Street - Covington	1420144	1420032	43.99
Oakland Street	0910068	0910005	45.25
17th Street - Covington	0930104	0930026	46.86

Project Summary Sheet

2023 CSO Solution

Targeted Sewer Separation

Project Status: In Construction - Washington/ Saratoga; Complete - RiverCenter, Jacob Price PH2,Church St PH2, Water's Edge, Aqua on the Levee

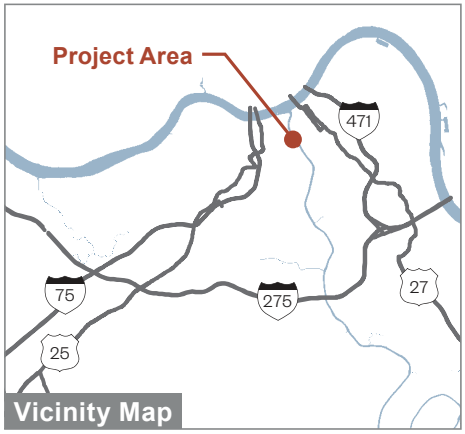
Estimated Capital Cost: $1,130,000 (In Construction)

Primary Improvement

Conveyance ☐ Sewer Separation ■ PS & Force Main ☐

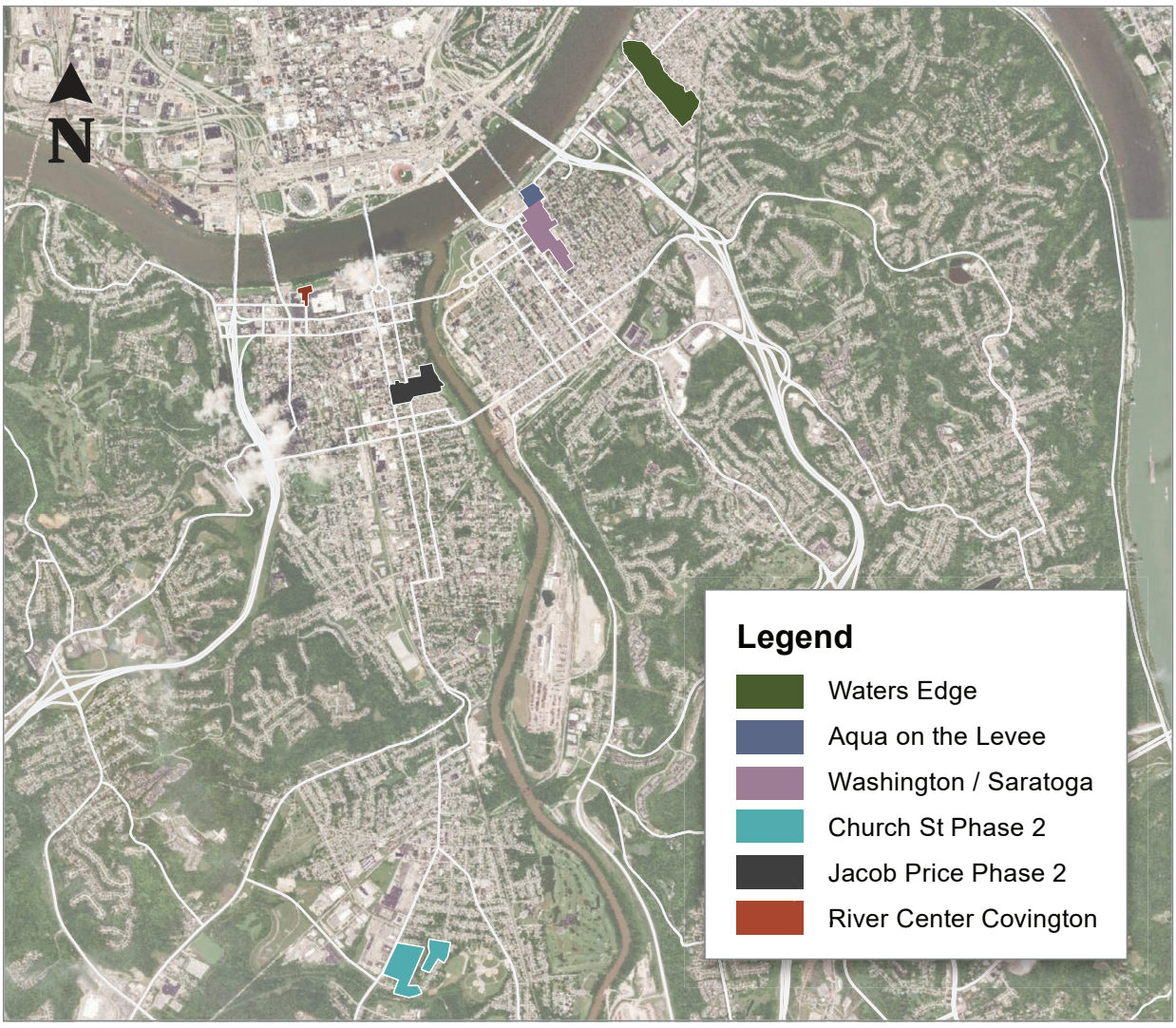
Project Metrics

Est. Overflow Reduction (Typ. Year): 7.0 MG (In Construction)
Cost Per Gallon Removed (Typ. Year): $0.16



NOTES:

1. ***CSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2023 CSO Solution

Ash Street EQ Tank

Project Status: Conceptual Planning

Estimated Capital Cost: $2,190,000

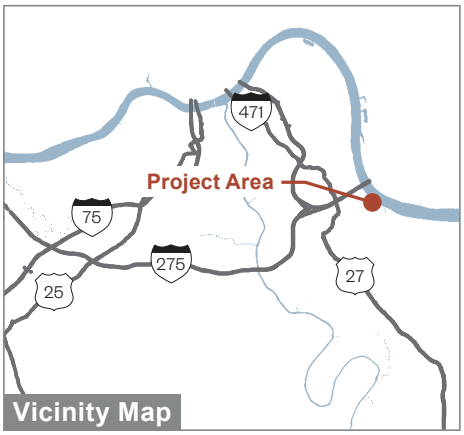
Primary Improvement

Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Ash St Storage Volume: 0.41 MG

Project Metrics

Estimated Overflow Reduction (Typical Year): 1.5 MG
Cost Per Gallon Removed (Typical Year): $1.46



NOTES:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***Pursuant to the Ash Street Pump Station Replacement Project approval letter dated February 10, 2020, the completion date for this project is December 1, 2021.***



Project Summary Sheet

2023 SSO Solution

Vernon Lane RDII Removal

Project Status: Complete

Primary Improvement

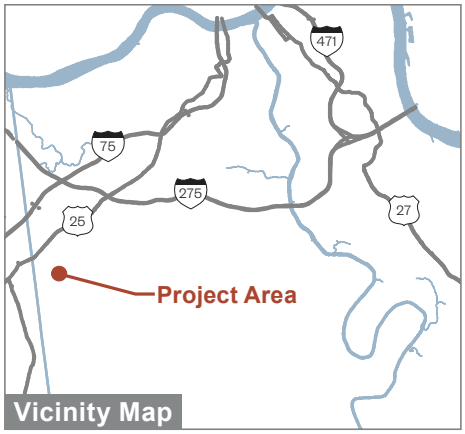
RDII Removal ☒ EQ Storage ☐ PS and Force Main ☐

8-inch to 16-inch:	0 LF	27-inch to 42-inch:	0 LF
18-inch to 24-inch:	0 LF	48-inch and Greater:	0 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 4.4 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





Project Summary Sheet

2023 SSO Solution

Elsmere Corridor Capacity Upgrade

Project Status: Complete

Primary Improvement

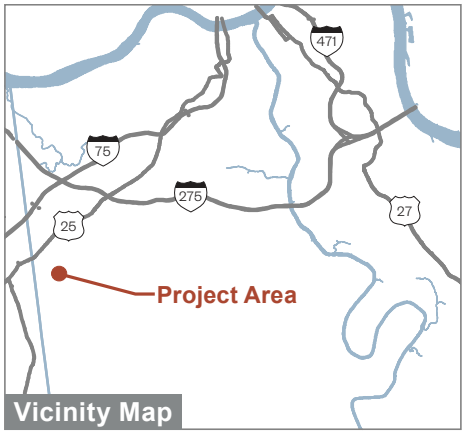
Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

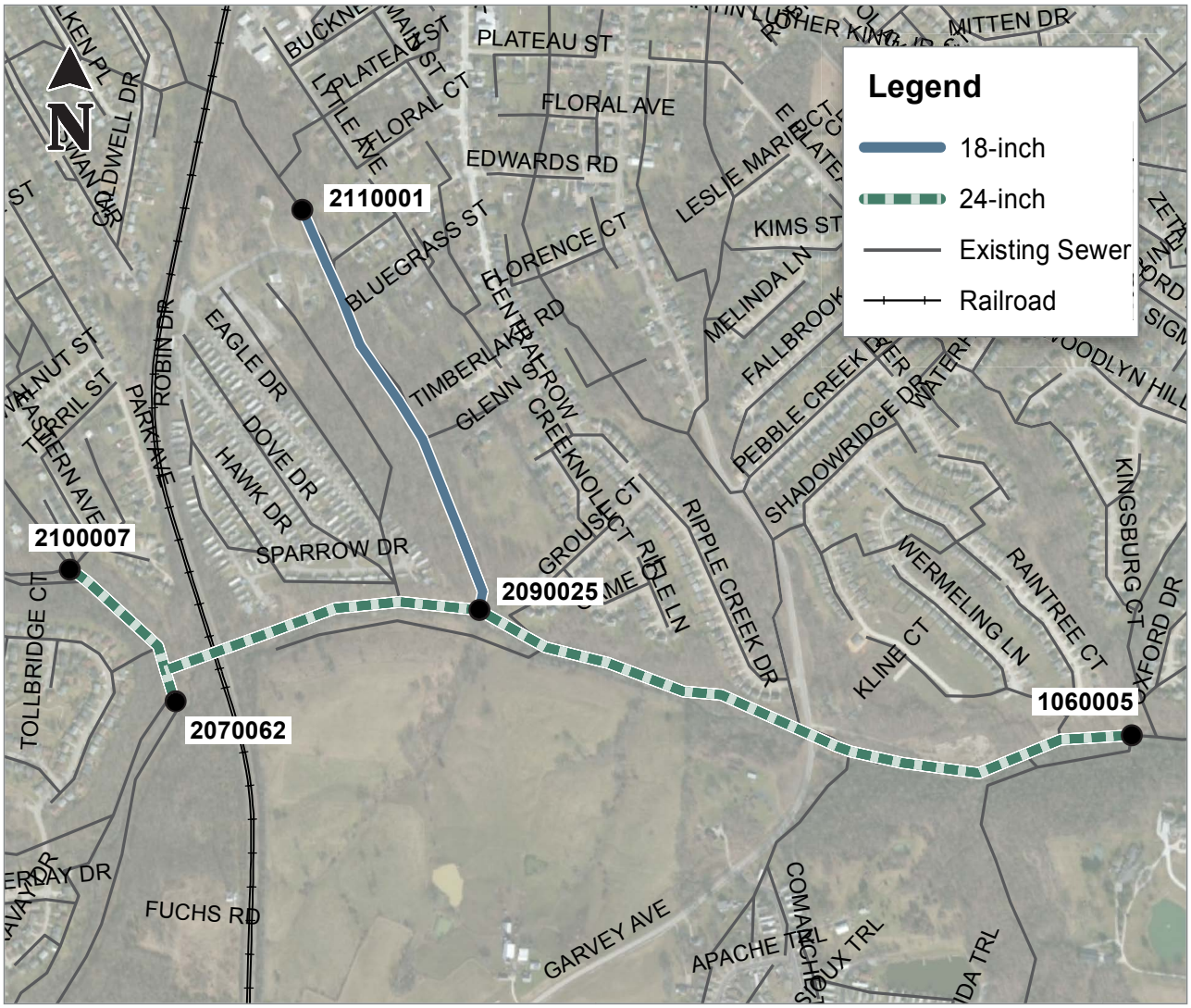
8-inch to 16-inch:	0 LF	27-inch to 42-inch:	0 LF
18-inch to 24-inch:	8,040 LF	48-inch and Greater:	0 LF

Project Metrics

Estimated Overflow Reduction (Typical Year): 3.5 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





Project Summary Sheet

2023 SSO Solution

Richwood Pump Station and Force Main Improvements

Project Status: Complete

Primary Improvement

Conveyance ☐ EQ Storage ☐ PS and Force Main ☒

8-inch to 16-inch: 0 LF 27-inch to 42-inch: 0 LF

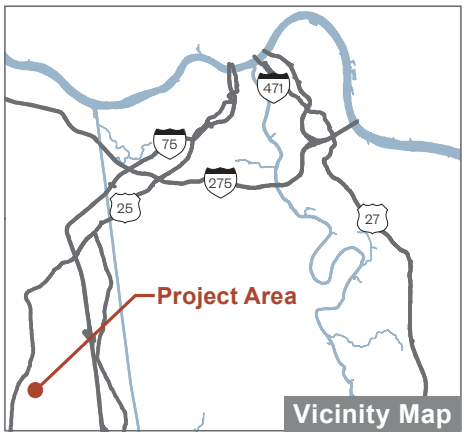
18-inch to 24-inch: 18,600 LF 48-inch and Greater: 0 LF

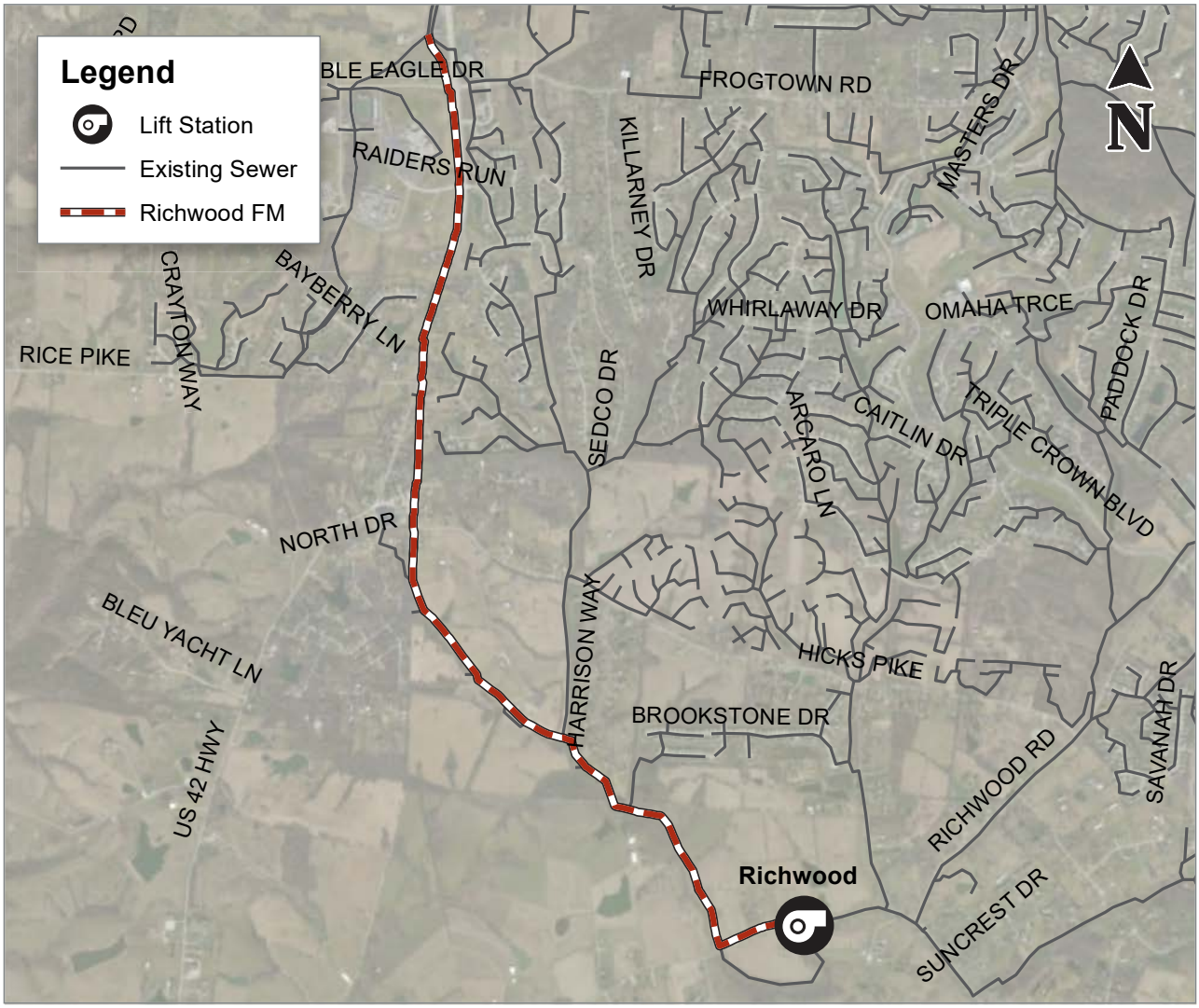
New Lift Station Capacity: 7.5 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 3.6 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





Project Summary Sheet

2023 SSO Solution

Allen Fork Pump Station Capacity Upgrade

Project Status: Complete

Primary Improvement

Conveyance ☐ EQ Storage ☐ PS and Force Main ■

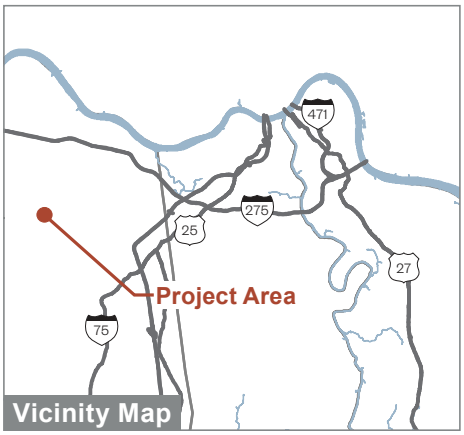
8-inch to 16-inch:	0 LF	27-inch to 42-inch:	0 LF
18-inch to 24-inch:	0 LF	48-inch and Greater:	0 LF

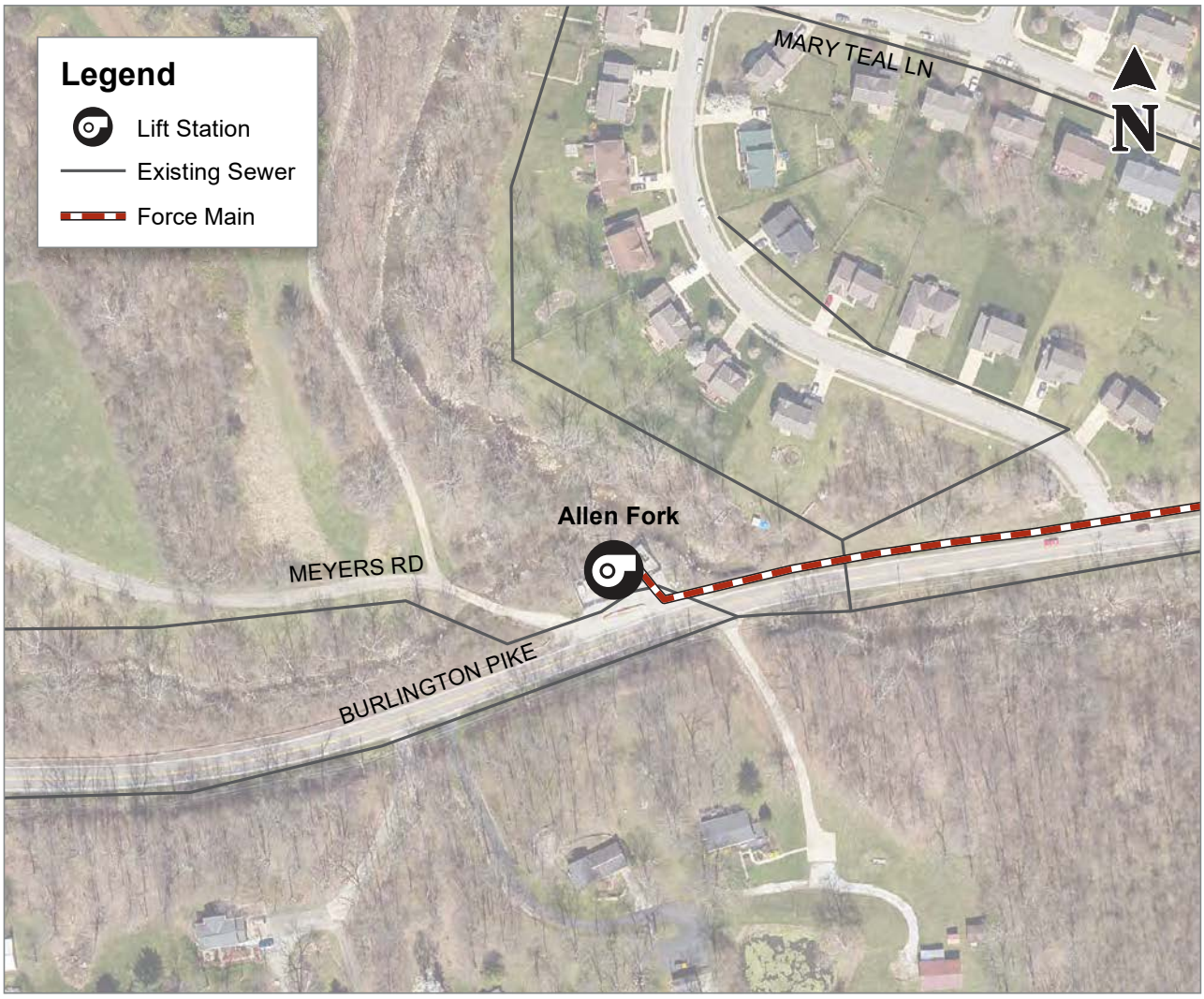
New Lift Station Capacity: 3.4 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 0.01 MG

NOTES: ***1. SSO benefit is as of the October 2017 baseline model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***





Project Summary Sheet

2023 SSO Solution

Highland Heights/Silver Grove EQ Tanks

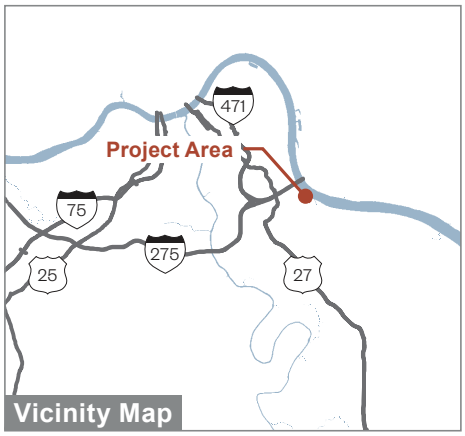
Project Status: In Construction

Estimated Capital Cost: $15,020,000

Primary Improvement

Conveyance ☐ EQ Storage ☒ PS and Force Main ☐

Highland Heights Storage Volume:	1.4 MG
Highland Heights EQ Pumping Rate:	7.9 MGD
Silver Grove Storage Volume:	1.6 MG
Silver Grove EQ Pumping Rate:	7.5 MGD



Project Metrics

Estimated Overflow Reduction (Typical Year): 22.0 MG

Cost Per Gallon Removed (Typical Year): $0.68

NOTES:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***EQ tank volumes shown are less than the sizes provided in the February 10, 2020 Ash Street Pump Station Replacement Project approval letter. Additional flow monitoring was performed in the Highland Heights/Silver Grove project area. The information gained from this flow monitoring exercise was utilized in sizing the EQ facilities currently under construction.***
4. ***Pursuant to the Ash Street Pump Station Replacement Project approval letter dated February 10, 2020, the completion date for this project is December 1, 2021.***



Project Summary Sheet

2023 SSO Solution

Licking River Double Siphon

Project Status: Conceptual Planning

Estimated Capital Cost: $1,150,000

Primary Improvement

Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

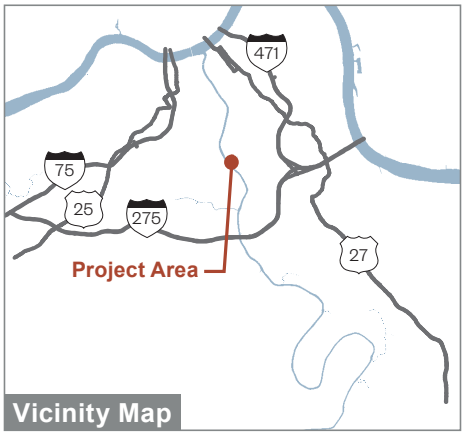
8-inch to 16-inch: 1,345 LF 30-inch to 42-inch: 0 LF

18-inch to 27-inch: 0 LF 48-inch and Greater: 0 LF

Project Metrics

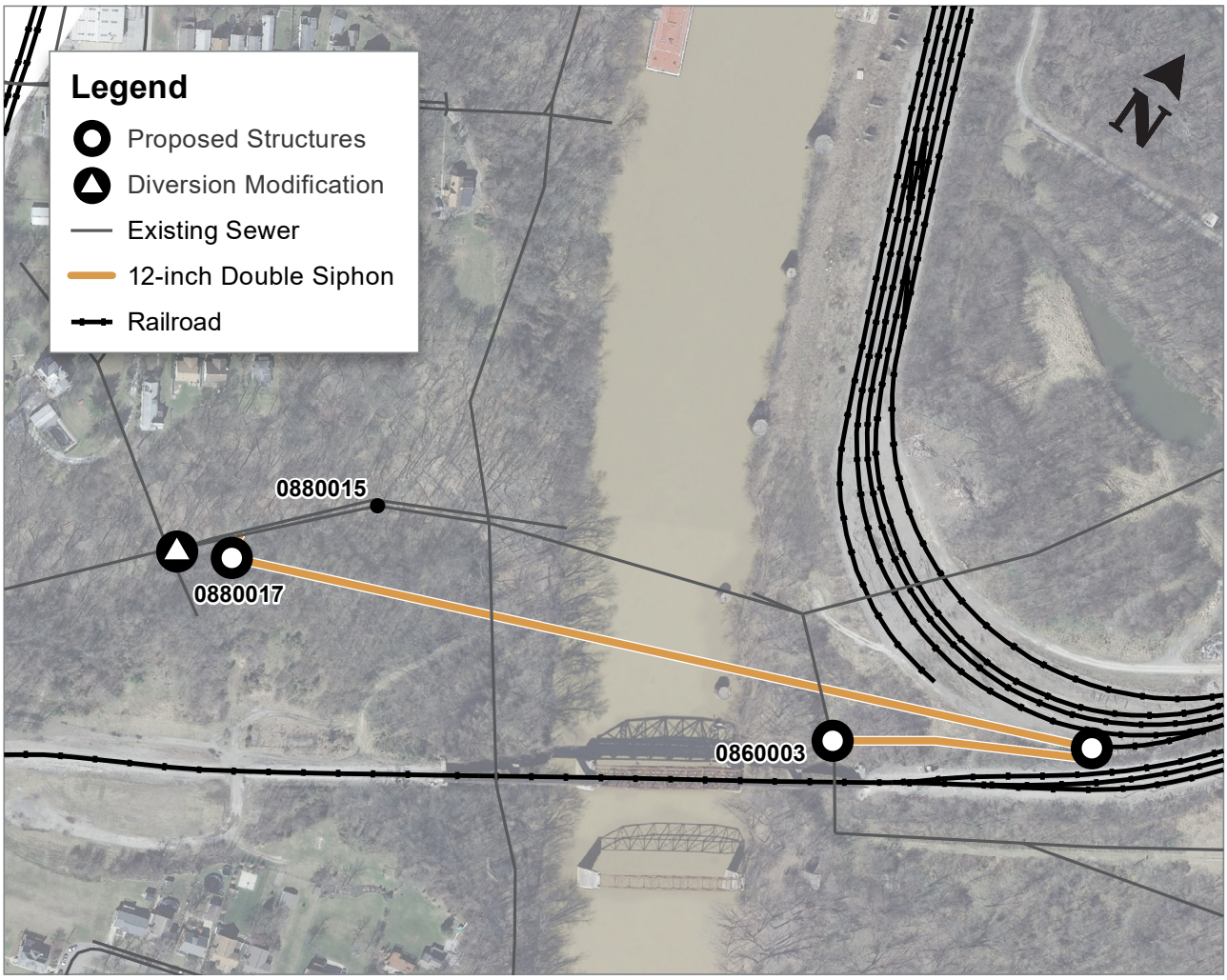
Estimated Overflow Reduction (Typical Year): 42.0 MG

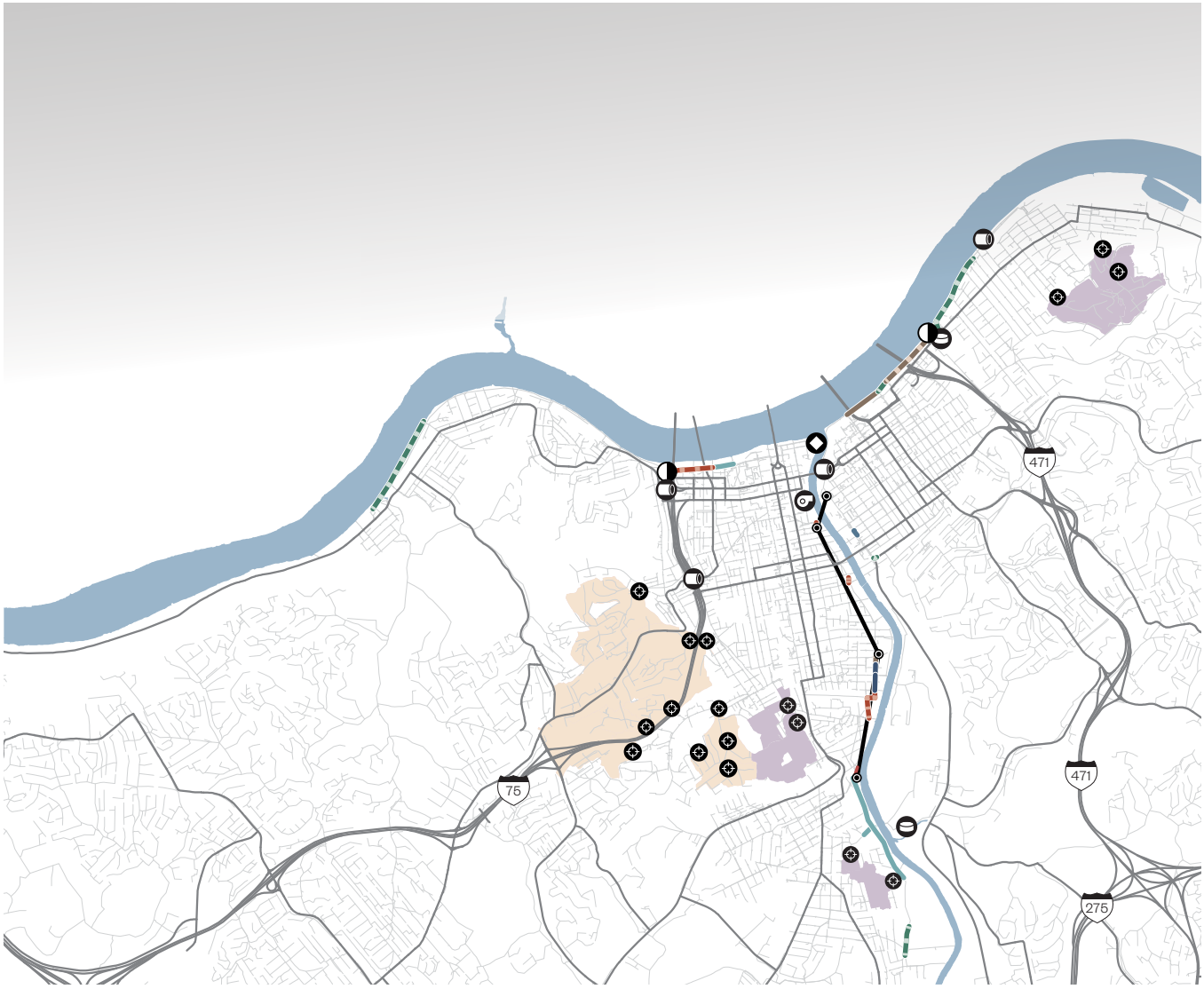
Cost Per Gallon Removed (Typical Year): $0.03



NOTES:

1. ***SSO benefit is as of the current 2023 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***











2029 Improvements

Project Summary Sheet

2029 CSO Solution

Willow Run Pilot Detention Basins

Project Status: Conceptual Planning

Estimated Capital Cost: $1,780,000

Primary Improvement

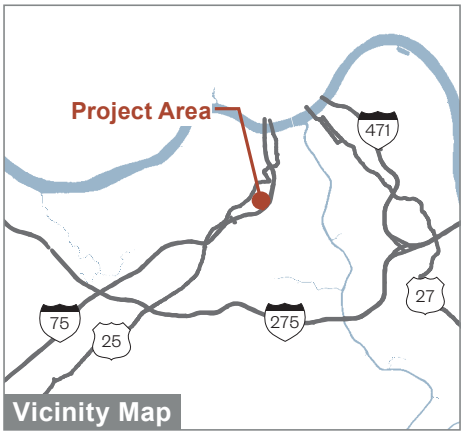
Conveyance ☐ Detention Basins ☒ PS & Force Main ☐

Storage Surface Area: 13.3 Acres

Storage Volume: 43.4 MG

Project Metrics

Estimated Overflow Reduction (Typical Year): 154.0 MG
Cost Per Gallon Removed (Typical Year): $0.01



NOTES:

1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***Controls on all the basins will be implemented as one project.***



Project Summary Sheet

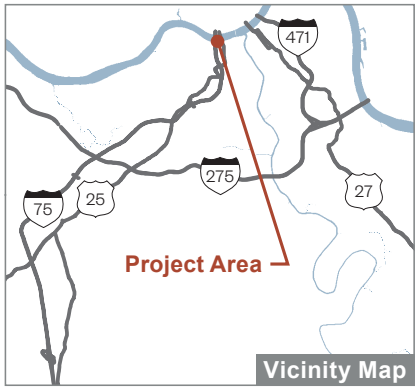
2029 CSO Solution — RWI Phase III Improvements

Project Status: Conceptual Planning

Estimated Capital Cost: $6,250,000

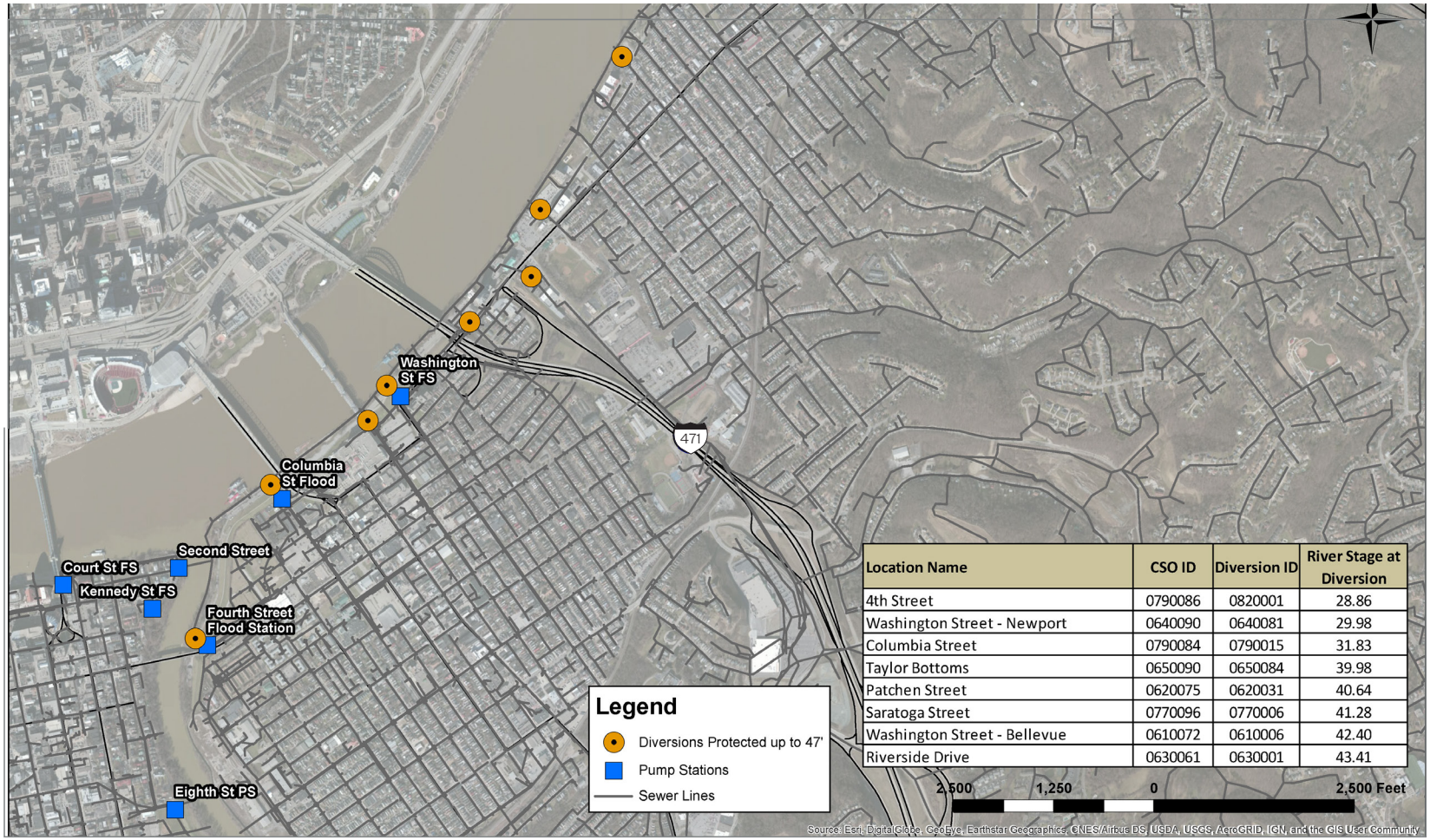
Project Metrics

Estimated Overflow Reduction (Typical Year): 107 MG
Cost Per Gallon Removed (Typical Year): $0.06



NOTES:

1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***
3. ***RWI Program shortened to three phases instead of four to more efficiently construct the improvements.***



Location Name	CSO ID	Diversion ID	River Stage at Diversion
4th Street	0790086	0820001	28.86
Washington Street - Newport	0640090	0640081	29.98
Columbia Street	0790084	0790015	31.83
Taylor Bottoms	0650090	0650084	39.98
Patchen Street	0620075	0620031	40.64
Saratoga Street	0770096	0770006	41.28
Washington Street - Bellevue	0610072	0610006	42.40
Riverside Drive	0630061	0630001	43.41

Project Summary Sheet

2029 CSO Solution

Bromley Pump Station Improvements

Project Status: Conceptual Planning

Estimated Capital Cost: $1,820,000

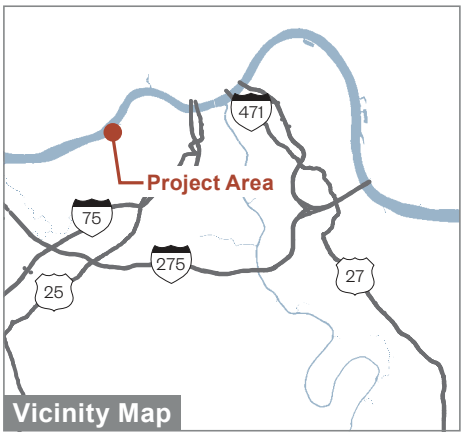
Primary Improvement

Conveyance ☐ EQ Storage ☐ PS and Force Main ☒

Upgraded Lift Station Capacity: 45 MGD

Project Metrics

Estimated Overflow Reduction (Typical Year): 60 MG
Cost Per Gallon Removed (Typical Year): $0.03



NOTES:

1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 CSO Solution

SR9 Sewer Separation

Project Status: Conceptual Planning

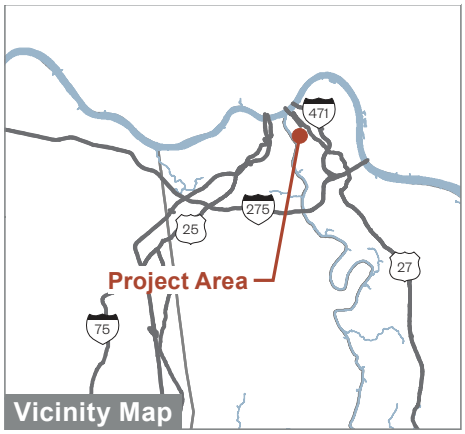
Estimated Capital Cost: $1,850,000

Primary Improvement

Sewer Separation ☒ EQ Storage ☐ PS and Force Main ☐

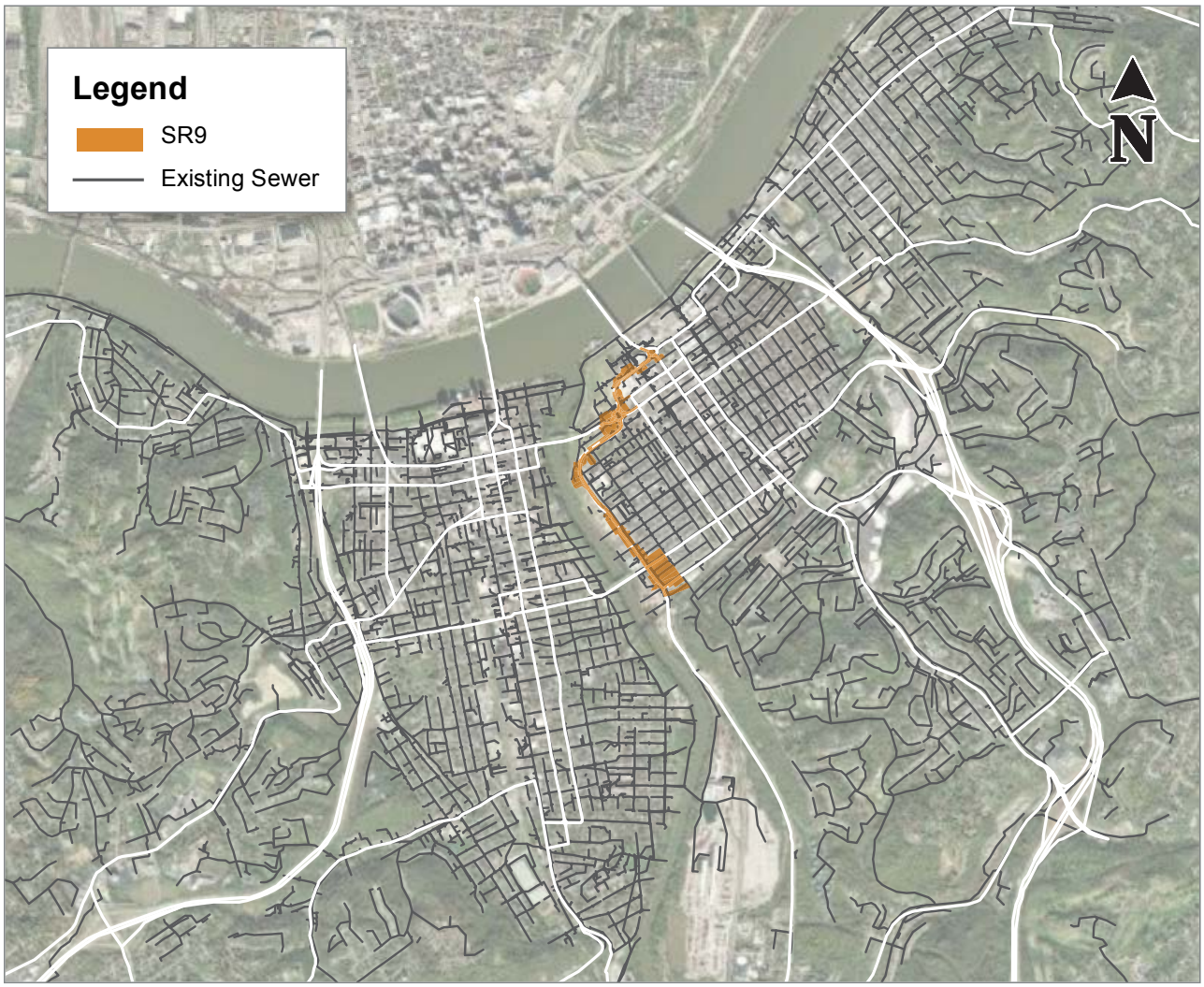
Project Metrics

Estimated Overflow Reduction (Typical Year): 10 MG
Cost Per Gallon Removed (Typical Year): $0.19



NOTES:

1. ***CSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Licking River Siphon EQ Tank

Project Status: Conceptual Planning

Estimated Capital Cost: $20,510,000

Primary Improvement

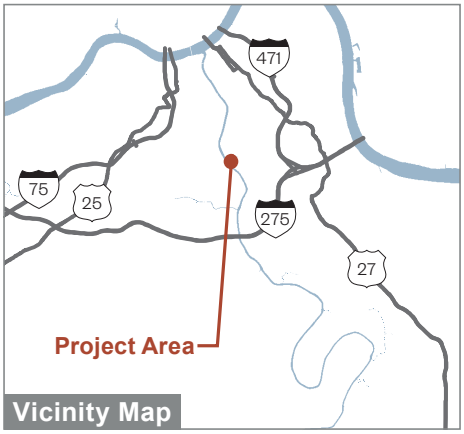
Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Storage Volume: 6.6 MG

Pumping Rate: 22.4 MGD

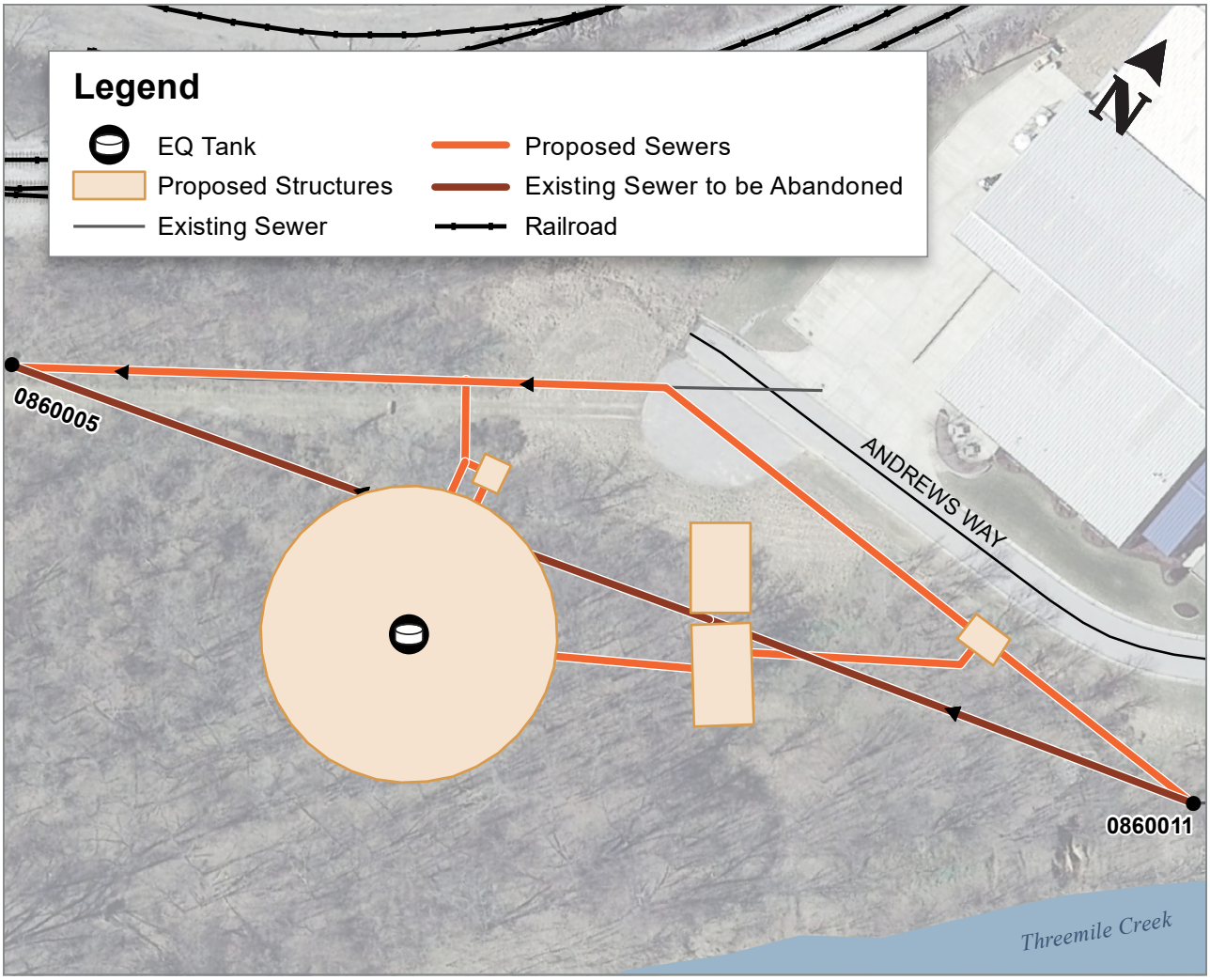
Project Metrics

Estimated Overflow Reduction (Typical Year): 5.0 MG
Cost Per Gallon Removed (Typical Year): $4.10



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Licking River Siphon Conveyance

Project Status: Conceptual Planning

Estimated Capital Cost: $7,380,000

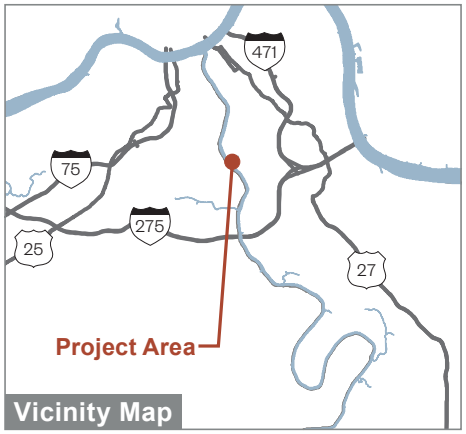
Primary Improvement

Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

8-inch to 16-inch:	0 LF	30-inch to 42-inch:	2,790 LF
18-inch to 27-inch:	1,600 LF	48-inch and Greater	1,660 LF

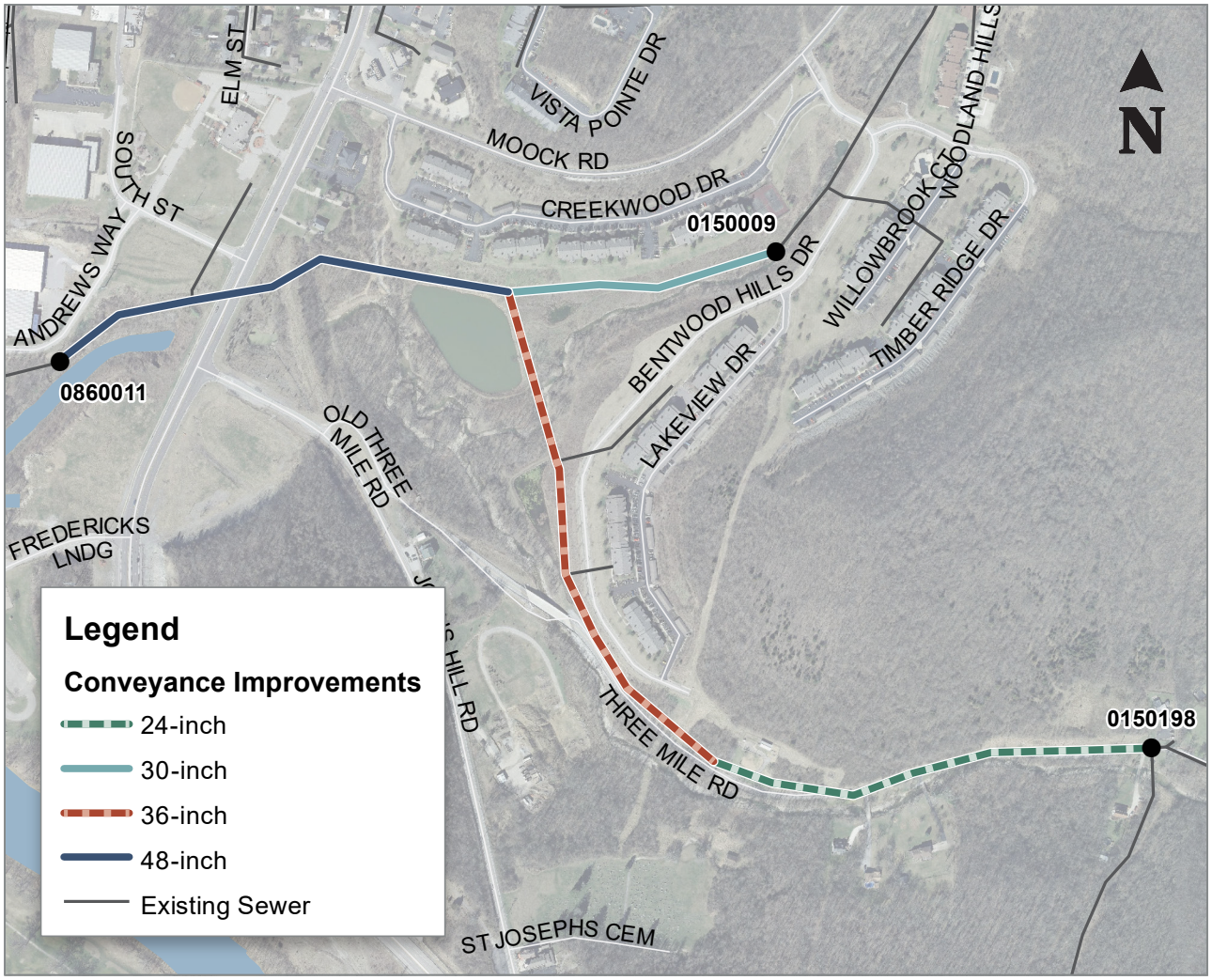
Project Metrics

Estimated Overflow Reduction (Typical Year):	5.0 MG
Cost Per Gallon Removed (Typical Year):	$1.48



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Lakeview EQ

Project Status: Conceptual Planning

Estimated Capital Cost: $24,070,000

Primary Improvement

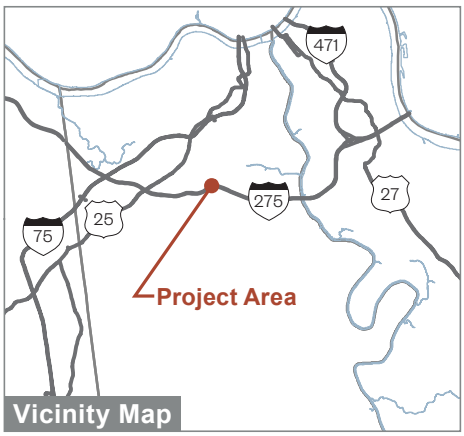
Conveyance ☐ EQ Storage ■ PS and Force Main ☐

Storage Volume: 8.6 MG

Pumping Rate: 36 MGD

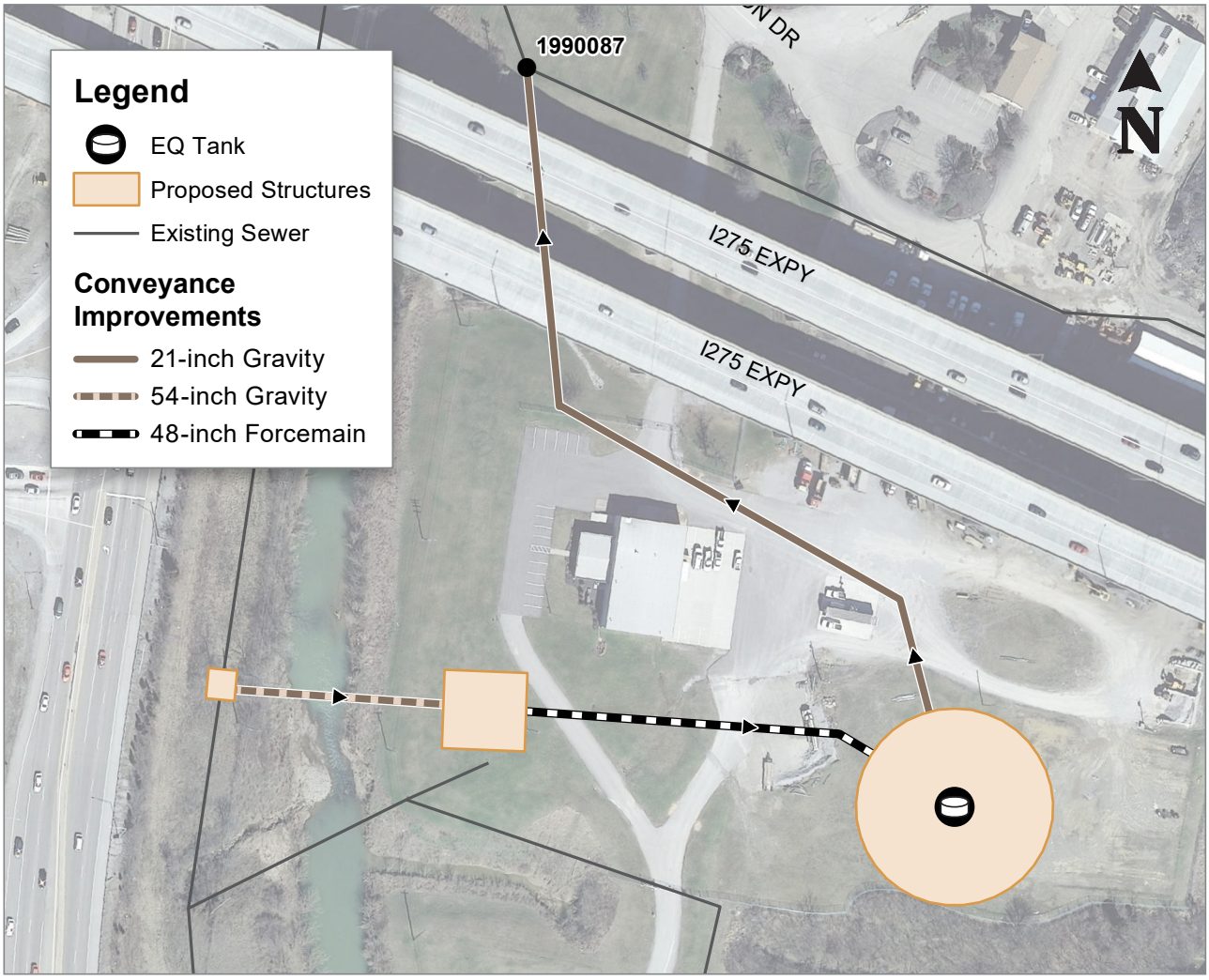
Project Metrics

Estimated Overflow Reduction (Typical Year): 6.5 MG
Cost Per Gallon Removed (Typical Year): $3.70



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

W6 Pump Station and Conveyance Piping

Project Status: Conceptual Planning

Estimated Capital Cost: $26,600,000

Primary Improvement

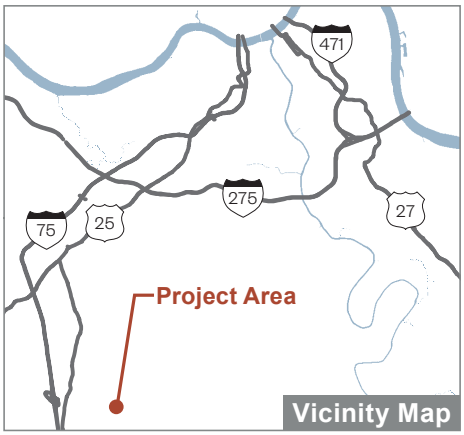
Conveyance ☒ EQ Storage ☐ PS and Force Main ☒

New Pumping Rate: 5.0 MGD 18-inch Gravity: 2,580 LF

18-inch Force Main: 33,300 LF

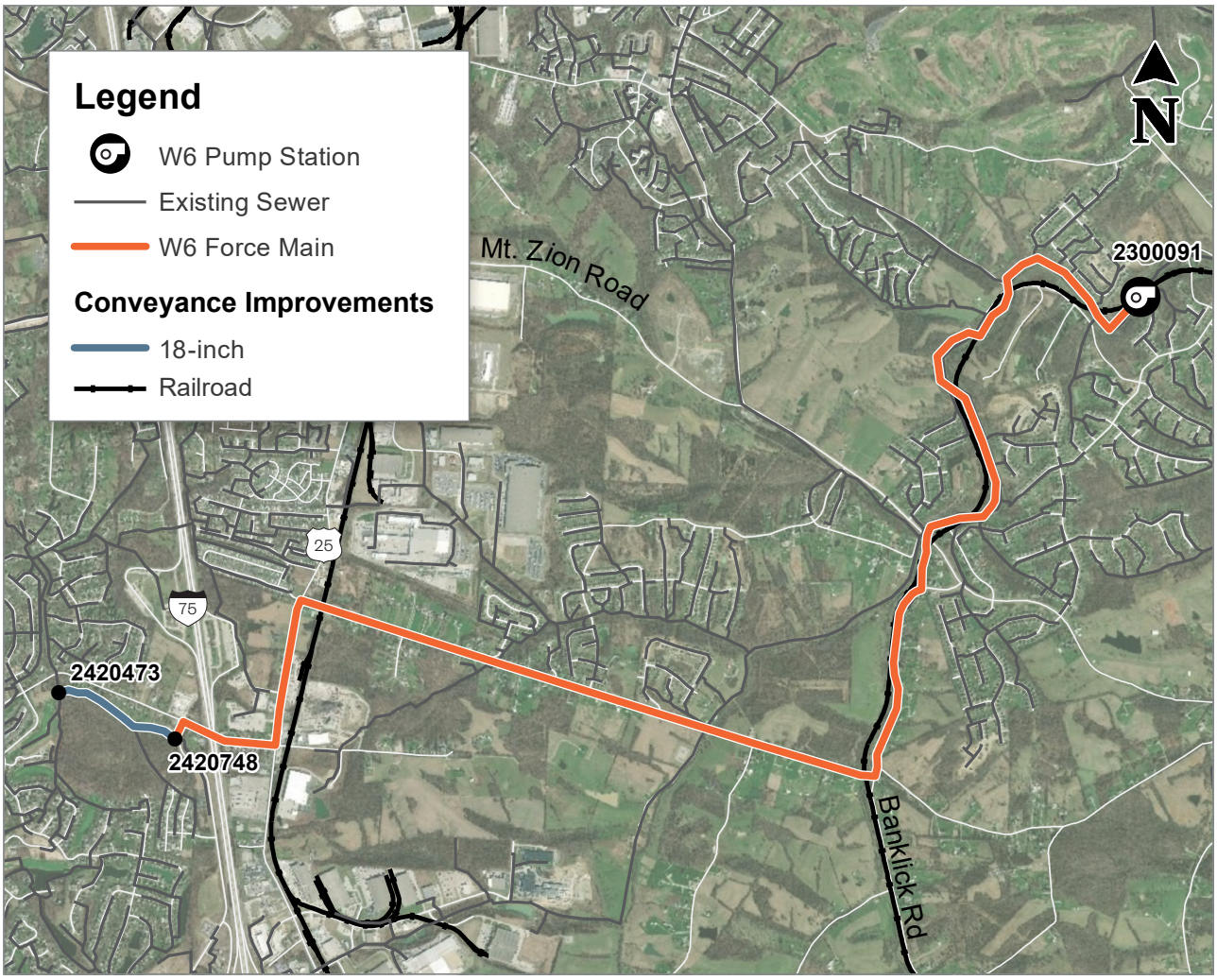
Project Metrics

Estimated Overflow Reduction (Typical Year): 9.8 MG
Cost Per Gallon Removed (Typical Year): $2.71



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Bullitsville PS Improvements

Project Status: Conceptual Planning

Estimated Capital Cost: $9,970,000

Primary Improvement

Conveyance ☐ EQ Storage ☒ PS and Force Main ☐

Storage Volume: 1.3 MG

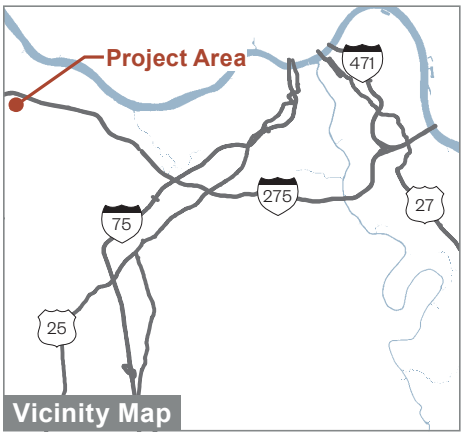
EQ Pumping Rate: 7.7 MGD

Upgraded Bullitsville PS Pumping Rate: 3.0MGD

Project Metrics

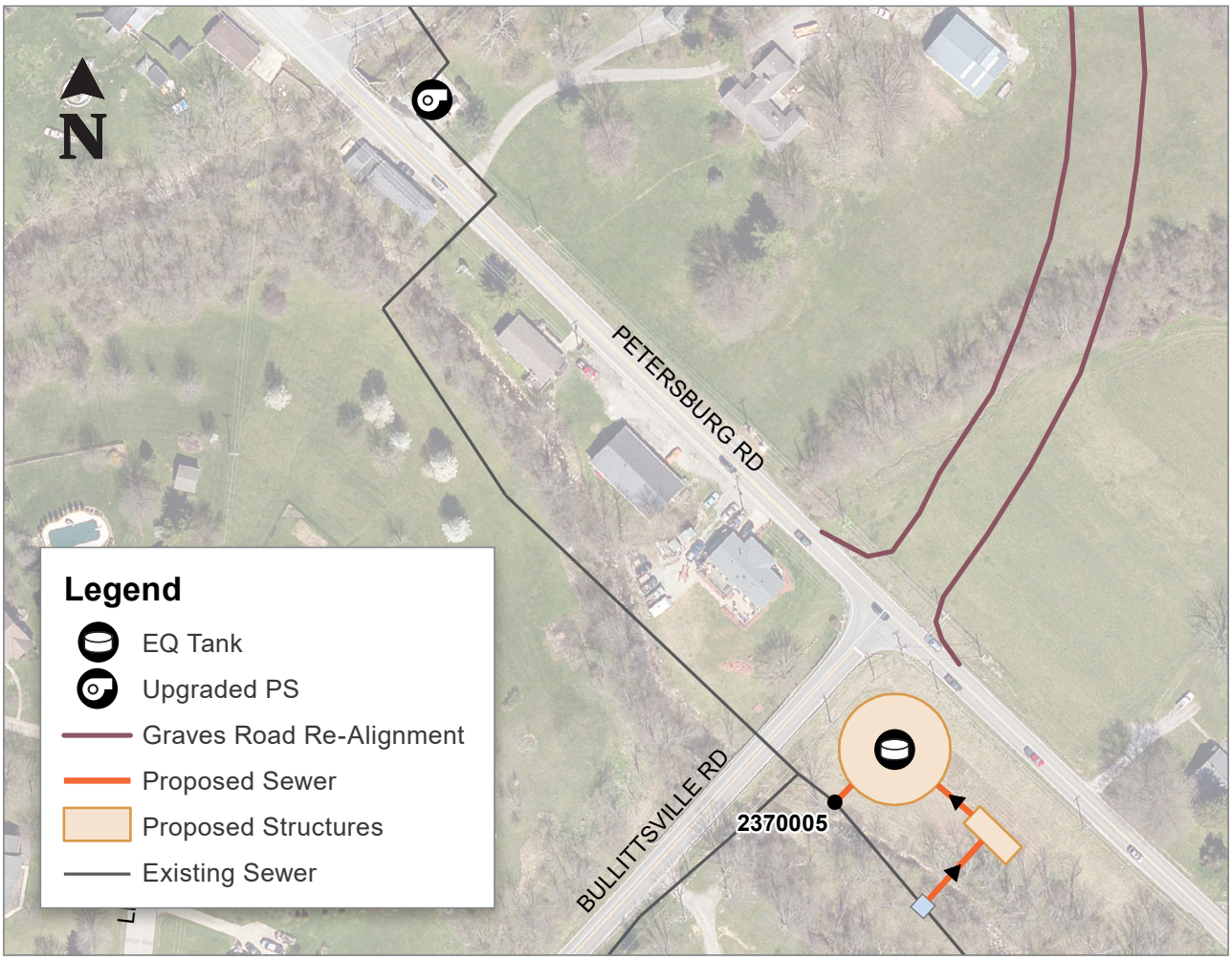
Estimated Overflow Reduction (Typical Year): 1.0 MG

Cost Per Gallon Removed (Typical Year): $9.97



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Waterworks Rd Conveyance: Phase I

Project Status: Conceptual Planning

Estimated Capital Cost: $5,410,000

Primary Improvement

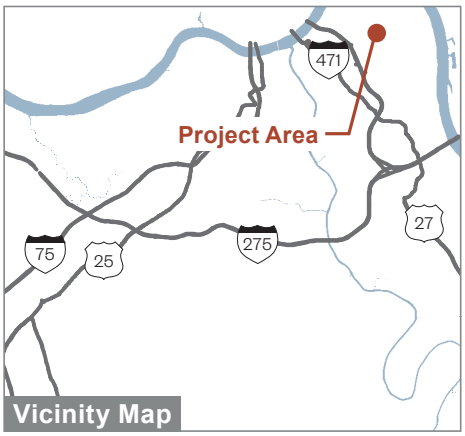
Conveyance ☒ EQ Storage ☐ PS & Force Main ☐

8-inch to 15-inch: 0 LF 18-inch to 24-inch: 1,450 LF

18-inch to 24-inch: 5,090 LF

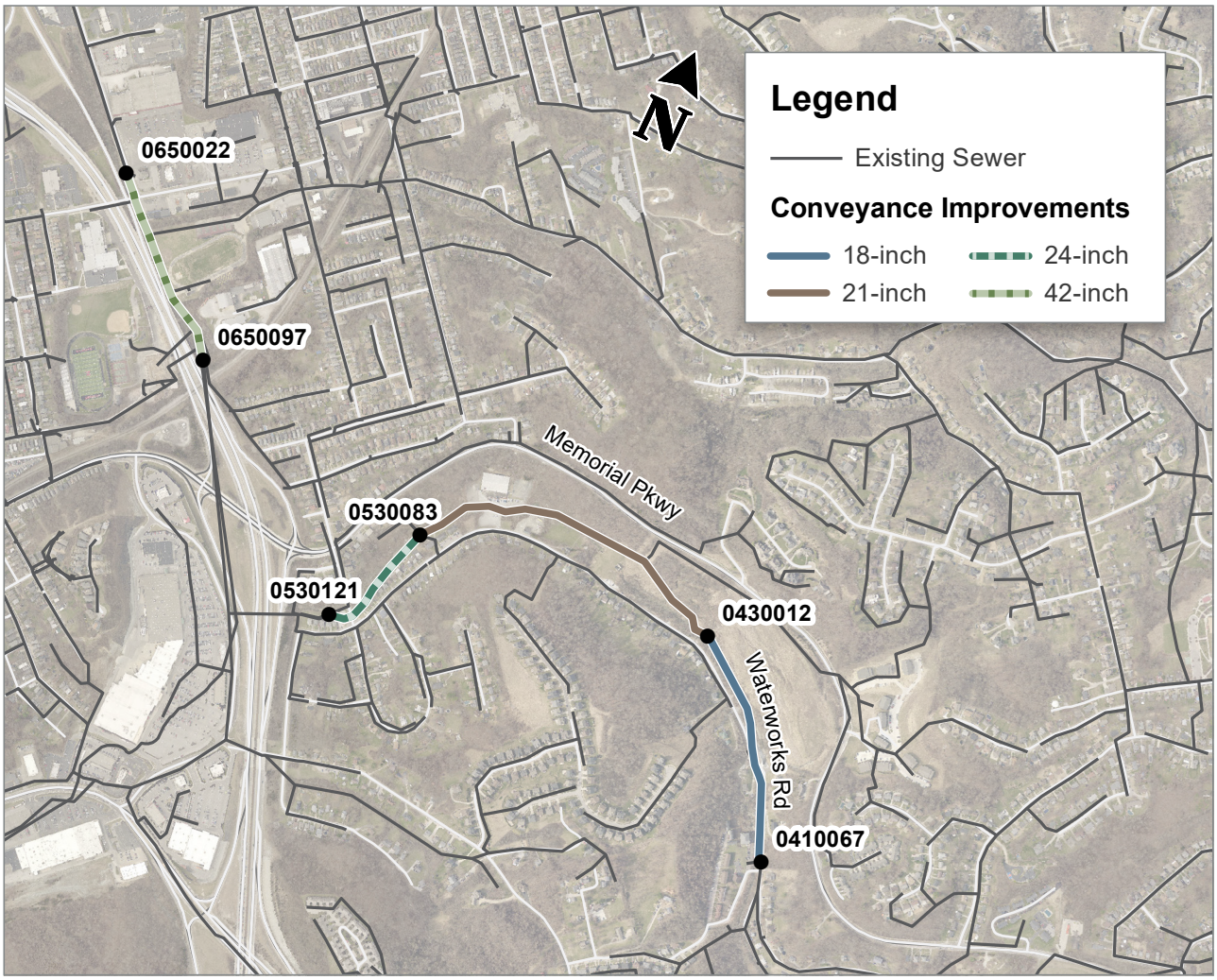
Project Metrics

Estimated Overflow Reduction (Typical Year): 1.0 MG
Cost Per Gallon Removed (Typical Year): $5.41



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Waterworks Rd Conveyance: Phase II

Project Status: Conceptual Planning

Estimated Capital Cost: $3,470,000

Primary Improvement

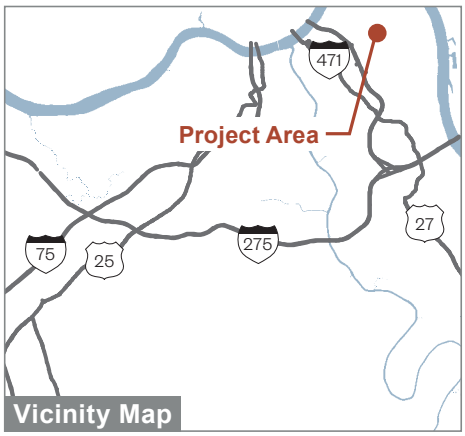
Conveyance ☒ EQ Storage ☐ PS & Force Main ☐

8-inch to 15-inch: 3,950 LF 27-inch to 42-inch: 0 LF

18-inch to 24-inch: 1,980 LF

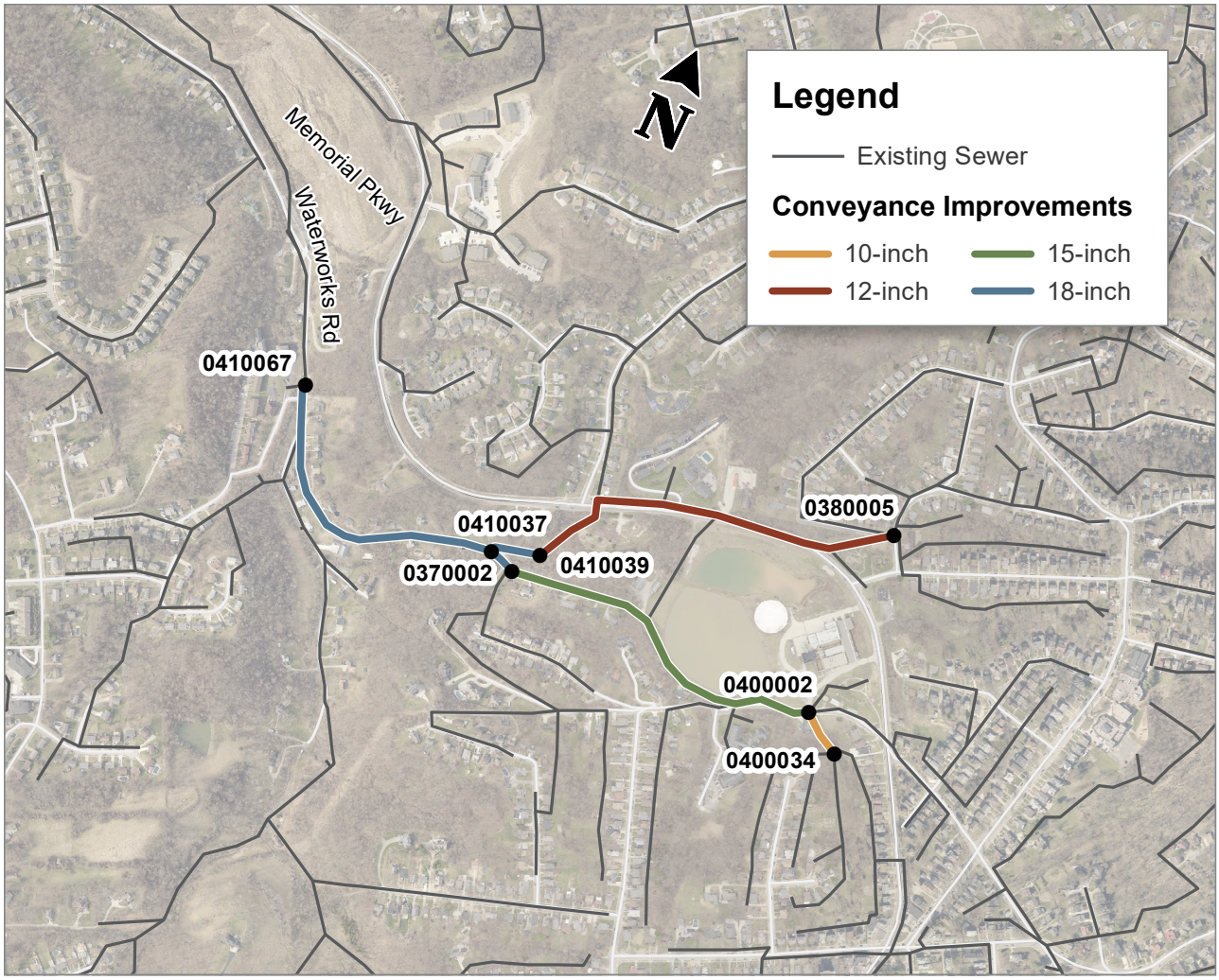
Project Metrics

Estimated Overflow Reduction (Typical Year): 1.0 MG
Cost Per Gallon Removed (Typical Year): $3.47



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***



Project Summary Sheet

2029 SSO Solution

Bromley Crescent Springs Conveyance

Project Status: Conceptual Planning

Estimated Capital Cost: $7,290,000

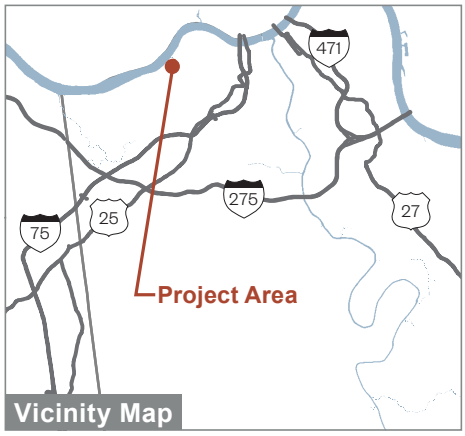
Primary Improvement

Conveyance ☒ EQ Storage ☐ PS and Force Main ☐

8-inch to 16-inch: 0 LF	27-inch to 42-inch: 6,050 LF
18-inch to 24-inch: 0 LF	48-inch and Greater: 0 LF

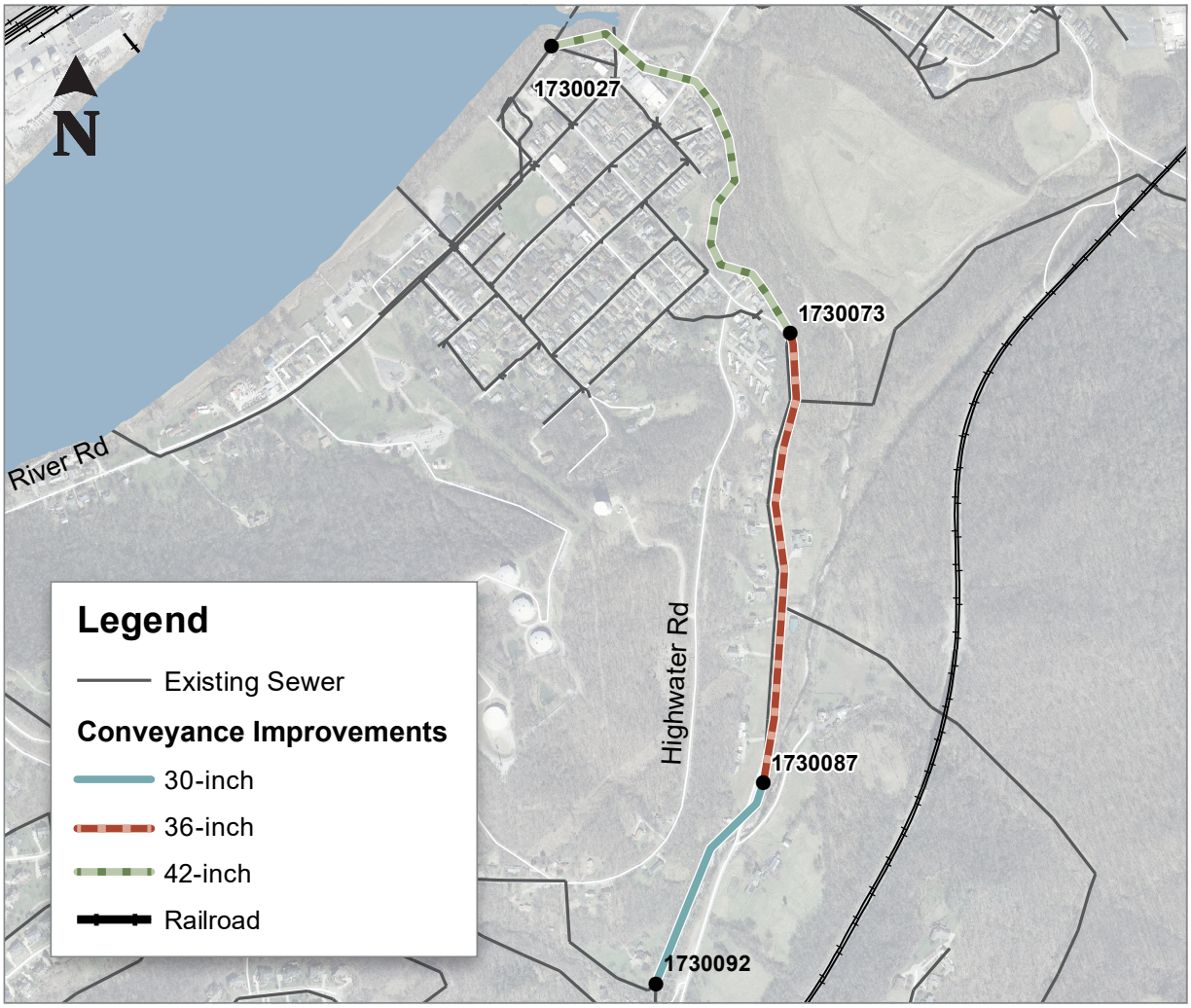
Project Metrics

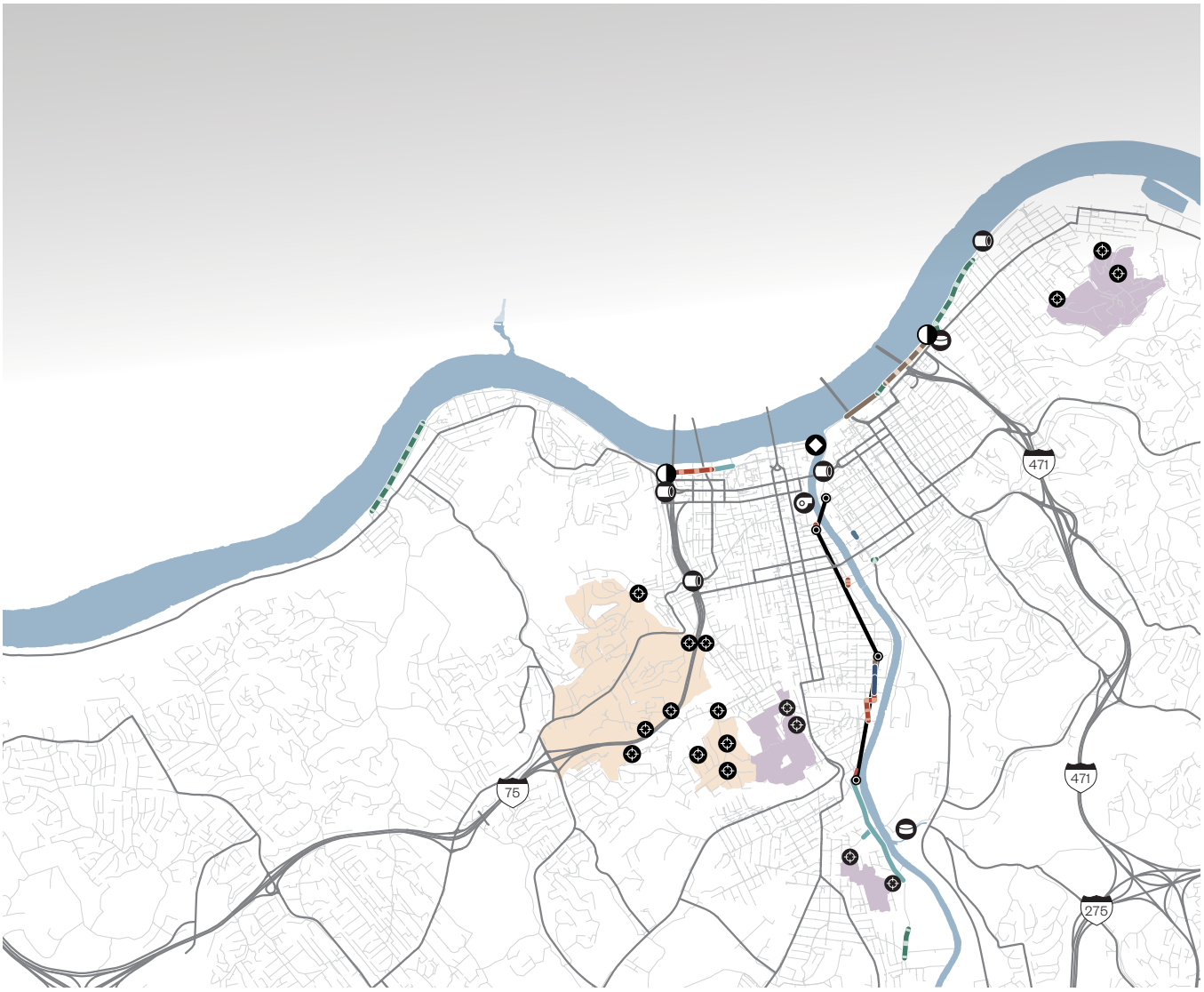
Estimated Overflow Reduction (Typical Year): 1.3 MG
Cost Per Gallon Removed (Typical Year): $5.60



NOTES:

1. ***SSO benefit is as of the current 2029 model and includes only the overflows listed in this subsection. Confirmation of overflow metric compliance is summarized at the end of this section.***
2. ***Costs are based on preliminary planning level capital cost estimates in 2019 dollars.***





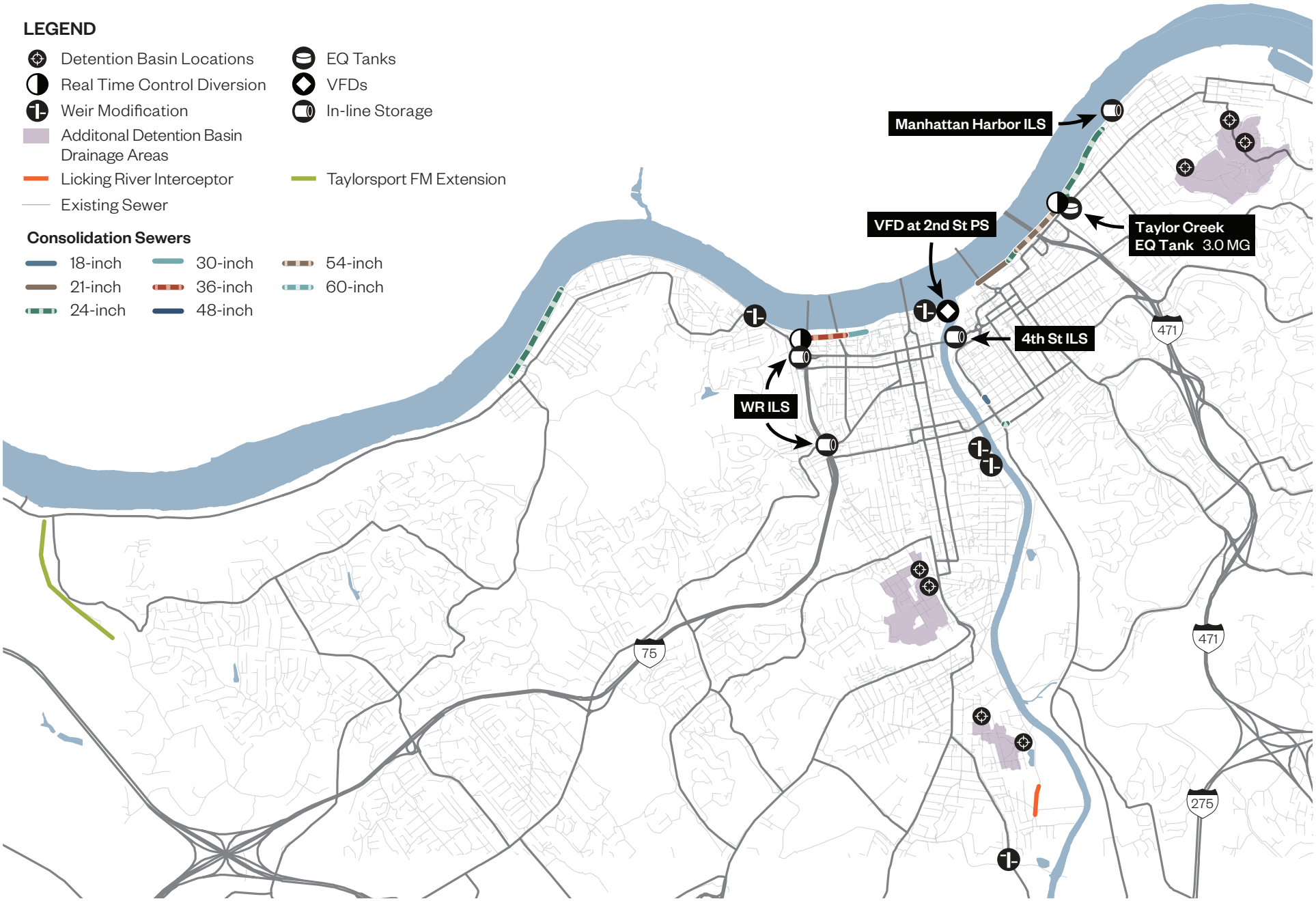


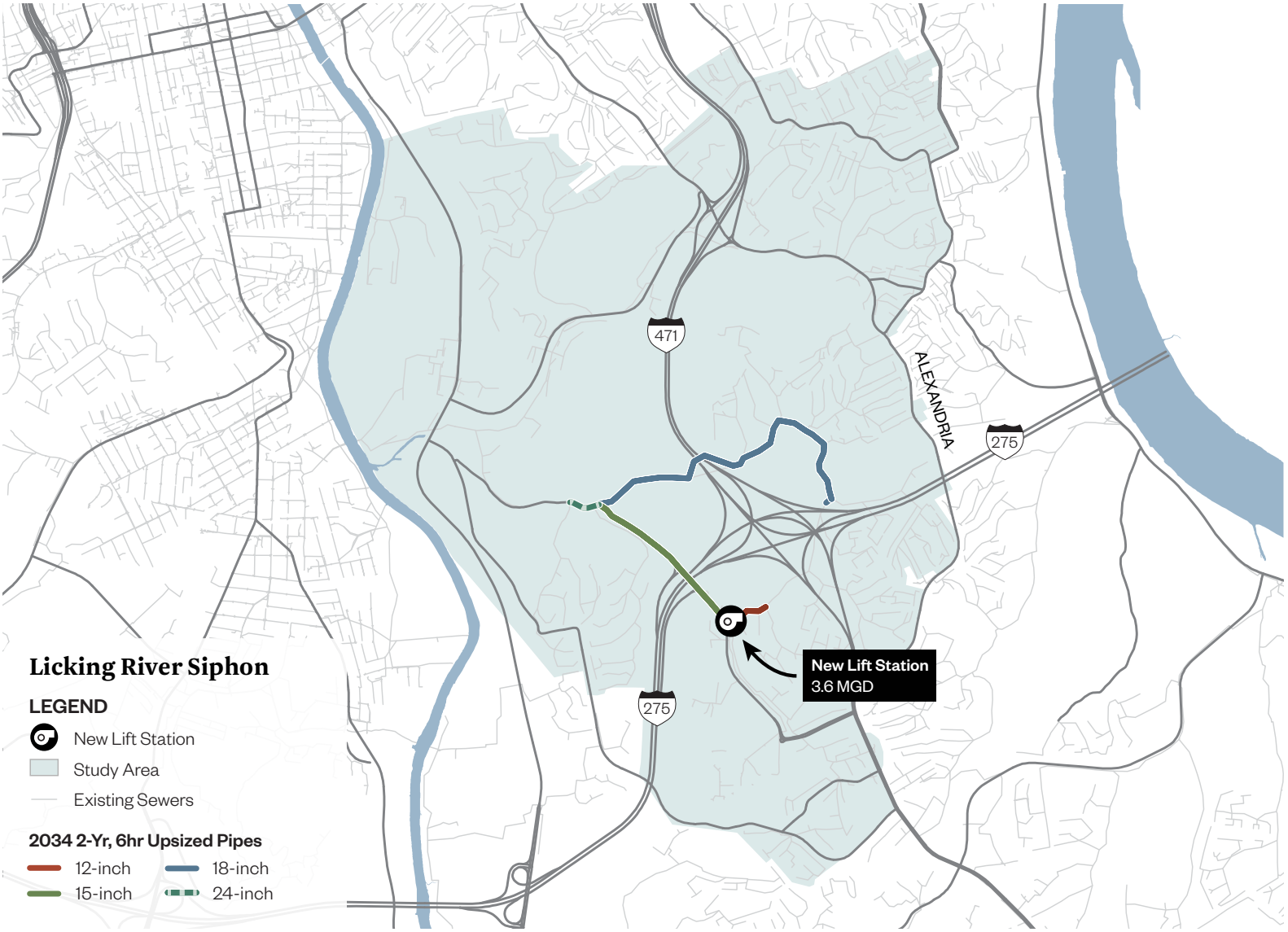


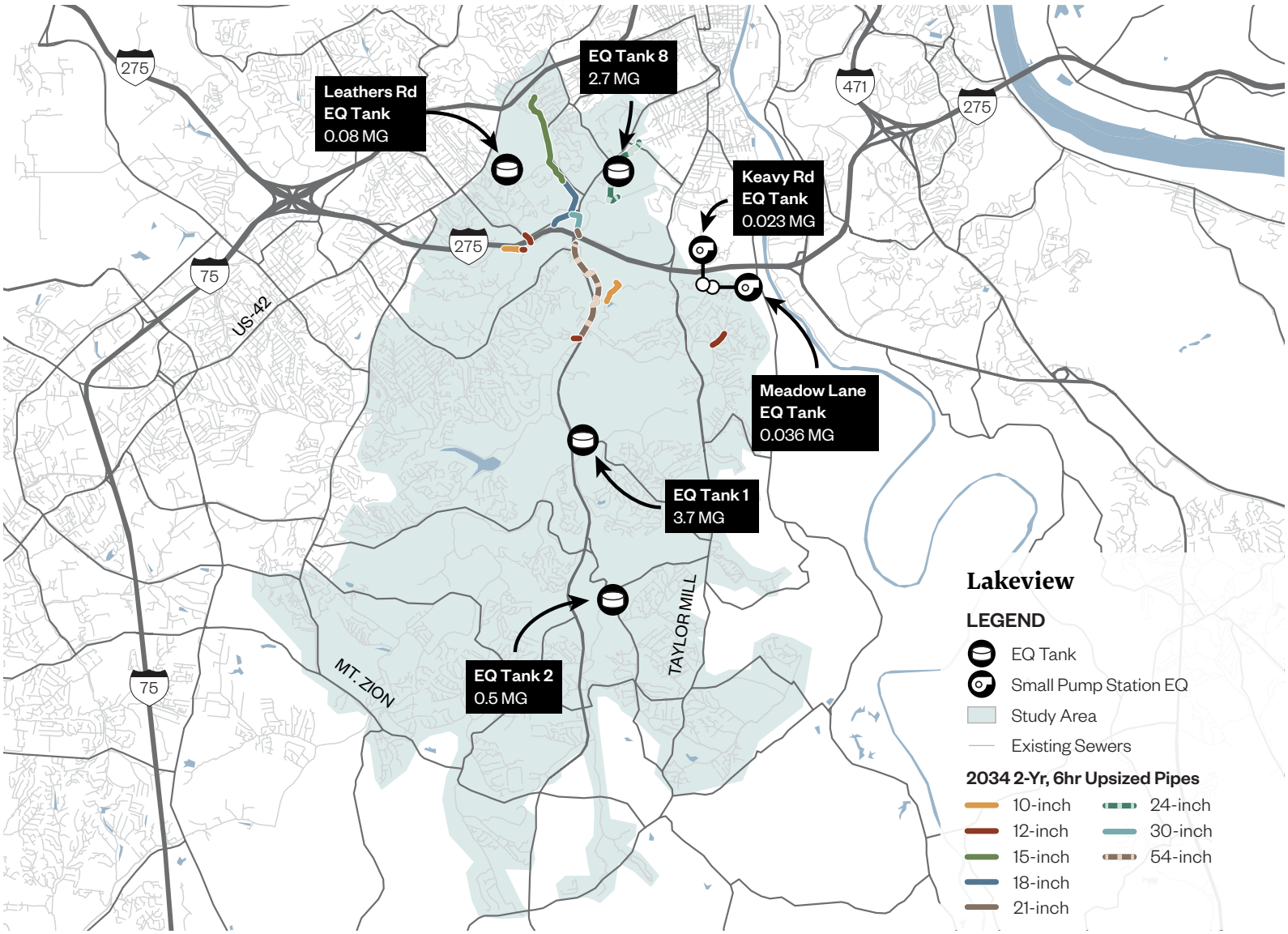


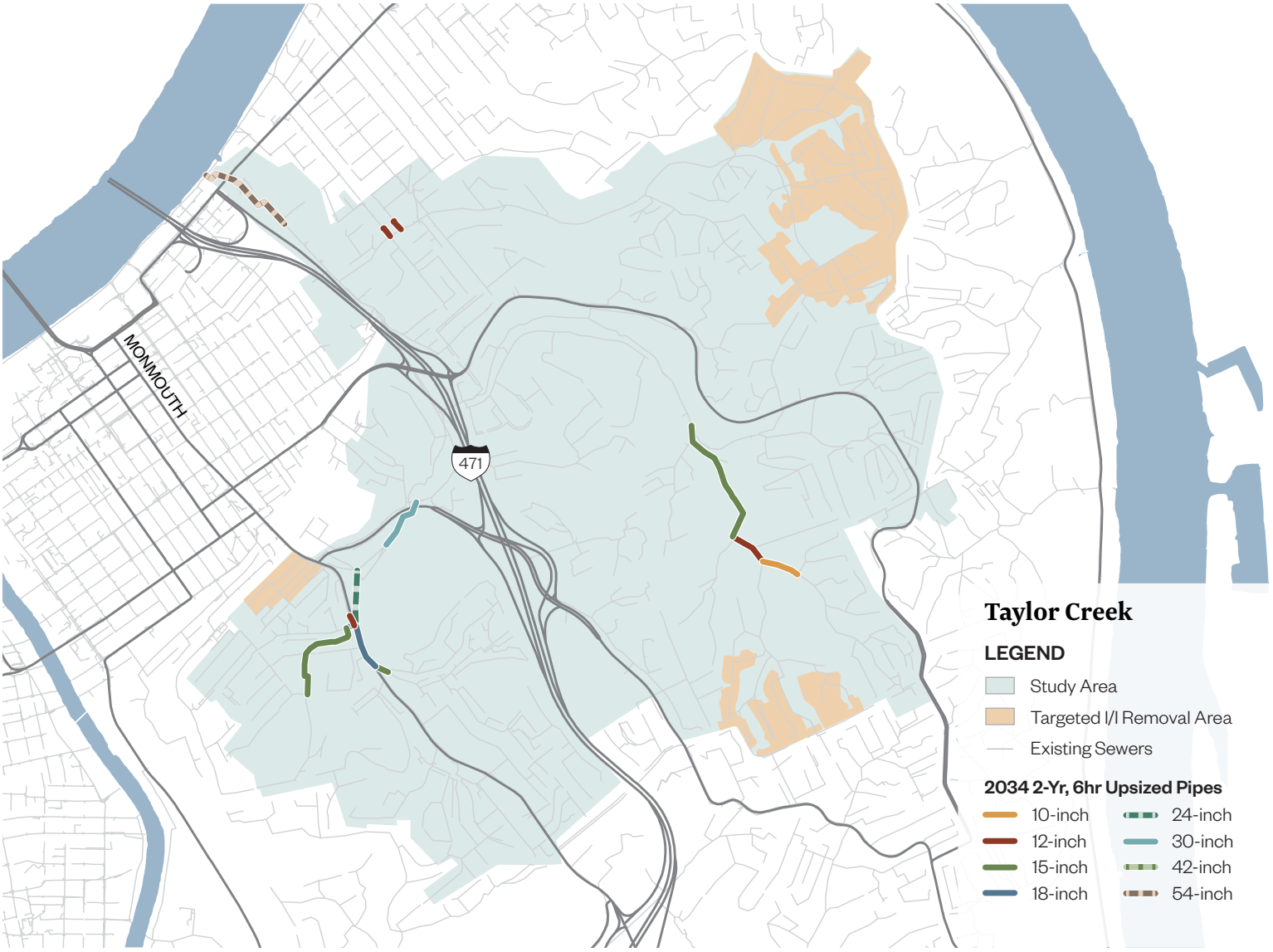
2034 Improvements

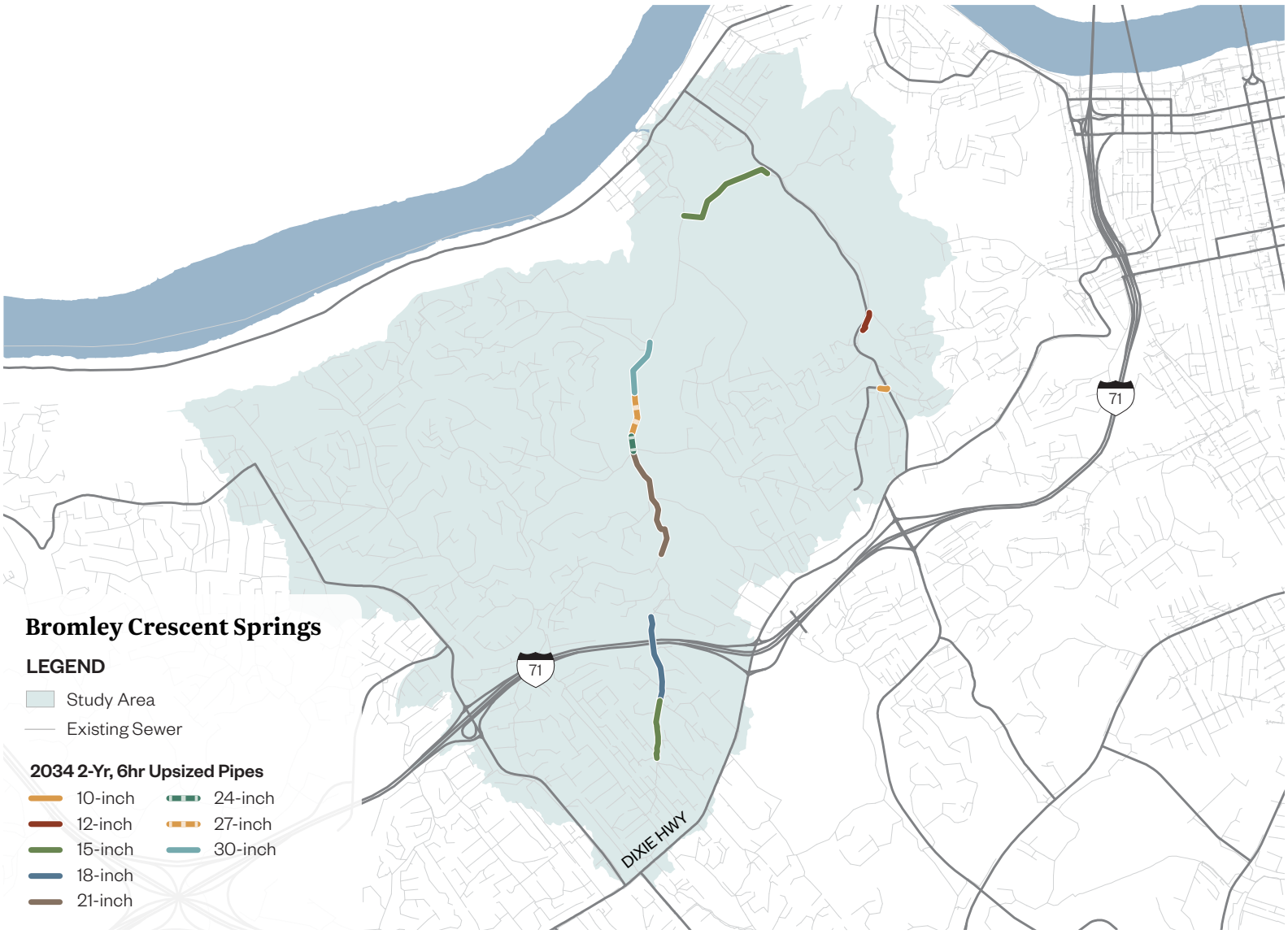
CSS Solution

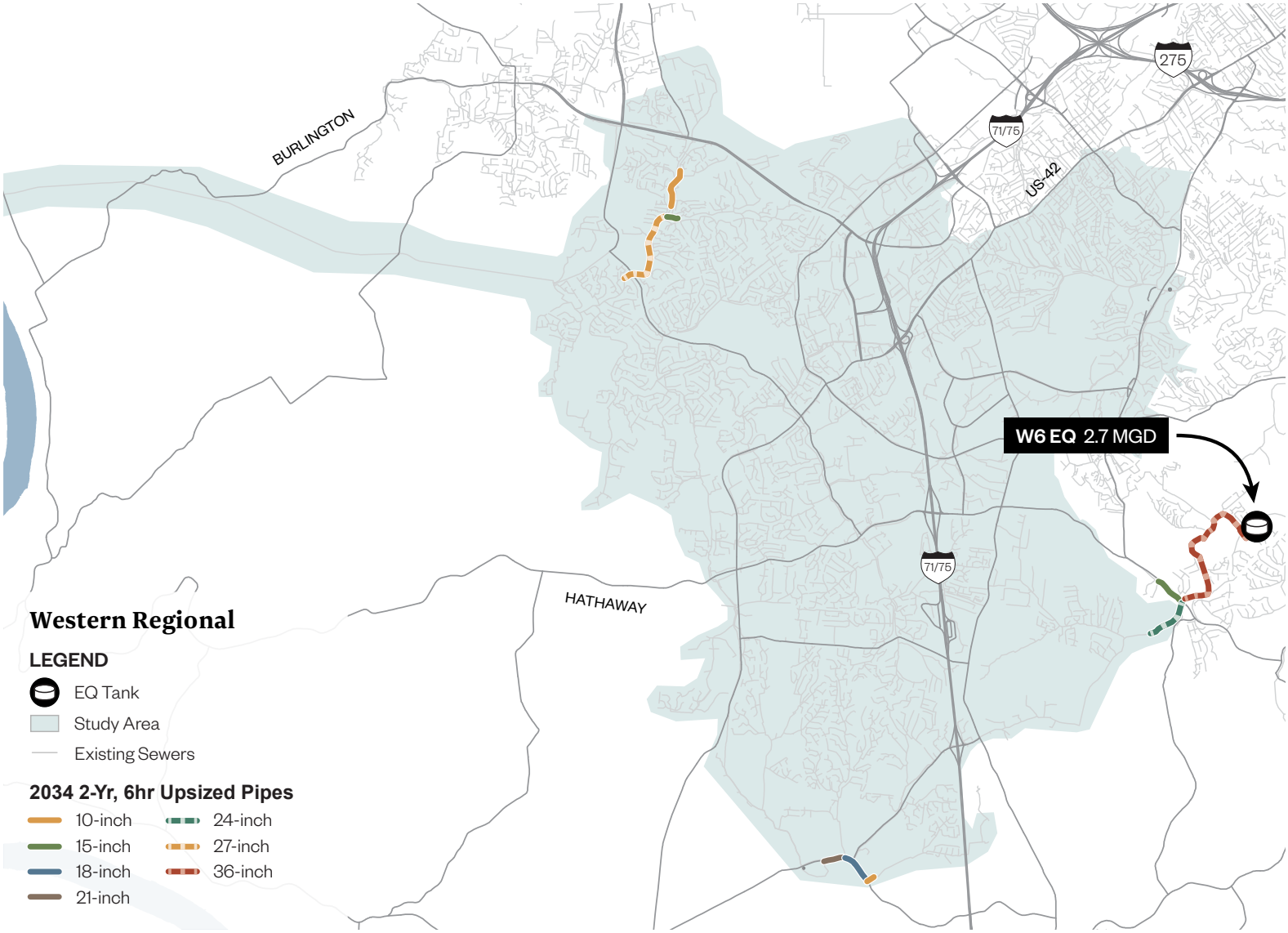


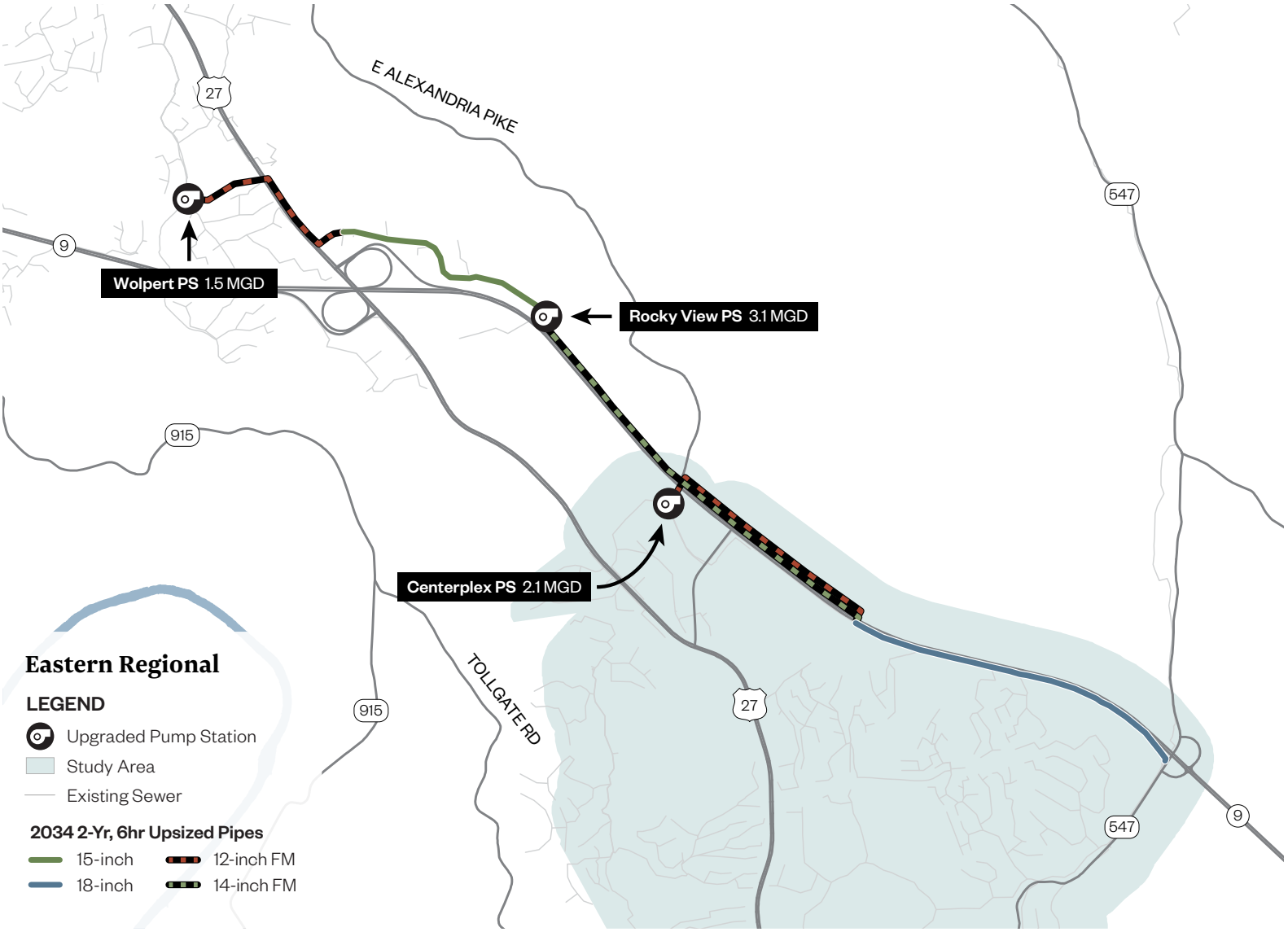

Licking River Siphon
LEGEND
New Lift Station
Study Area
Existing Sewers
2034 2-Yr, 6hr Upsized Pipes
12-inch
18-inch
15-inch
24-inch
471
275
ALEXANDRIA
275
New Lift Station
3.6 MGD


Leathers Rd
EQ Tank
0.08 MG
EQ Tank 8
2.7 MG
Keavy Rd
EQ Tank
0.023 MG
Meadow Lane
EQ Tank
0.036 MG
EQ Tank 1
3.7 MG
EQ Tank 2
0.5 MG
275
75
US-42
471
MT. ZION
TAYLOR MILL
Lakeview
LEGEND
EQ Tank
Small Pump Station EQ
Study Area
Existing Sewers
2034 2-Yr, 6hr Upsized Pipes
10-inch
12-inch
15-inch
18-inch
21-inch
24-inch
30-inch
54-inch

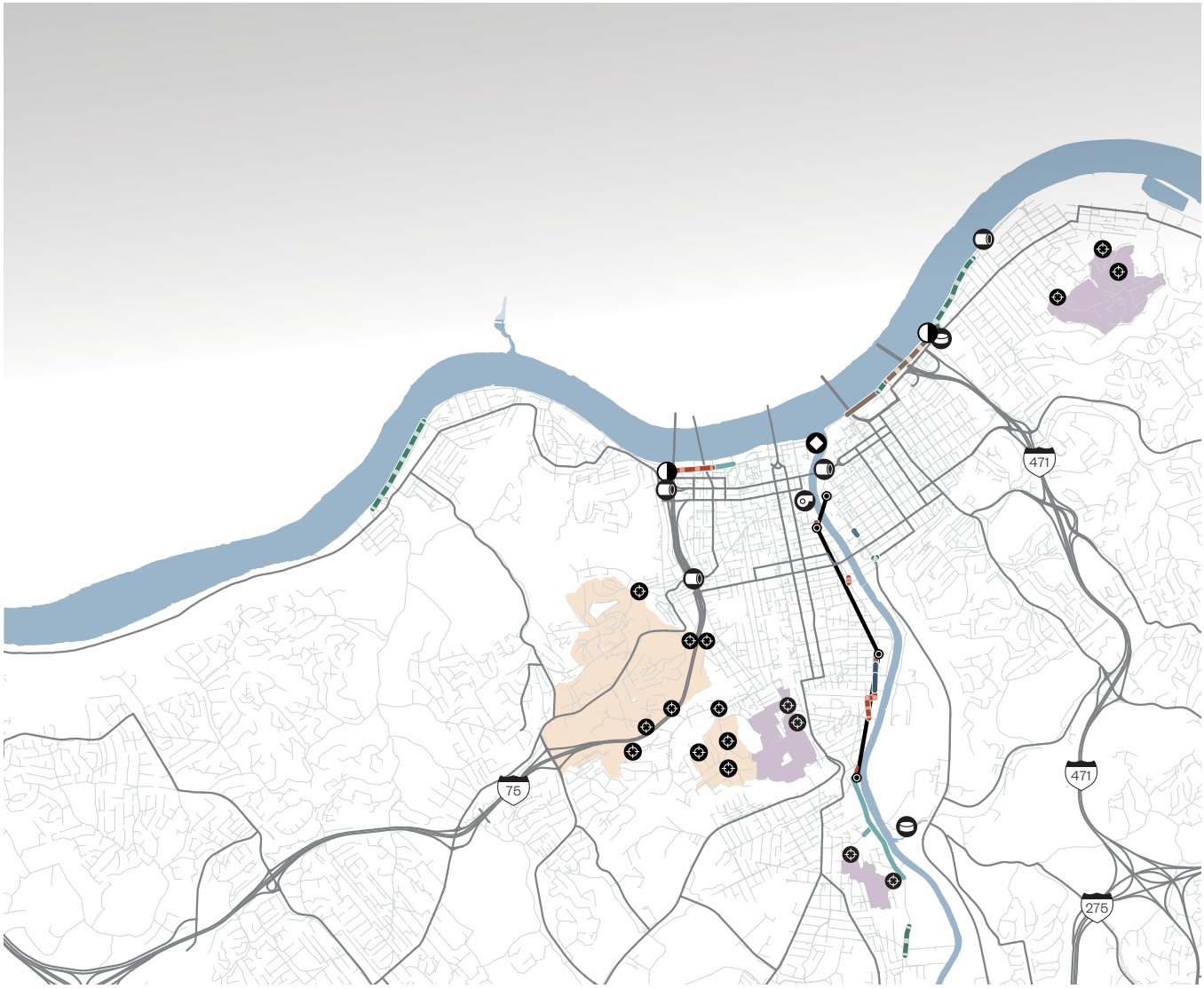

MONMOUTH
471
Taylor Creek
LEGEND
Study Area
Targeted I/I Removal Area
Existing Sewers
2034 2-Yr, 6hr Upsized Pipes
10-inch
12-inch
15-inch
18-inch
24-inch
30-inch
42-inch
54-inch


Bromley Crescent Springs
LEGEND
Study Area
Existing Sewer
2034 2-Yr, 6hr Upsized Pipes
10-inch
12-inch
15-inch
18-inch
21-inch
24-inch
27-inch
30-inch
71
71
DIXIE HWY


BURLINGTON
HATHAWAY
275
71/75
US-42
W6 EQ 2.7 MGD
Western Regional
LEGEND
EQ Tank
Study Area
Existing Sewers
2034 2-Yr, 6hr Upsized Pipes
10-inch
15-inch
18-inch
21-inch
24-inch
27-inch
36-inch


E ALEXANDRIA PIKE
27
9
547
915
Wolpert PS 1.5 MGD
Rocky View PS 3.1 MGD
Centerplex PS 2.1 MGD
TOLLGATE RD
Eastern Regional
LEGEND
Upgraded Pump Station
Study Area
Existing Sewer
2034 2-Yr, 6hr Upsized Pipes
15-inch
18-inch
12-inch FM
14-inch FM


Banklick EQ Tank
2.6 MG
Banklick
LEGEND
Combined System
EQ Tank
Sediment Removal
Existing Sewer
2034 2-Yr, 6hr Upsized Pipes
15-inch

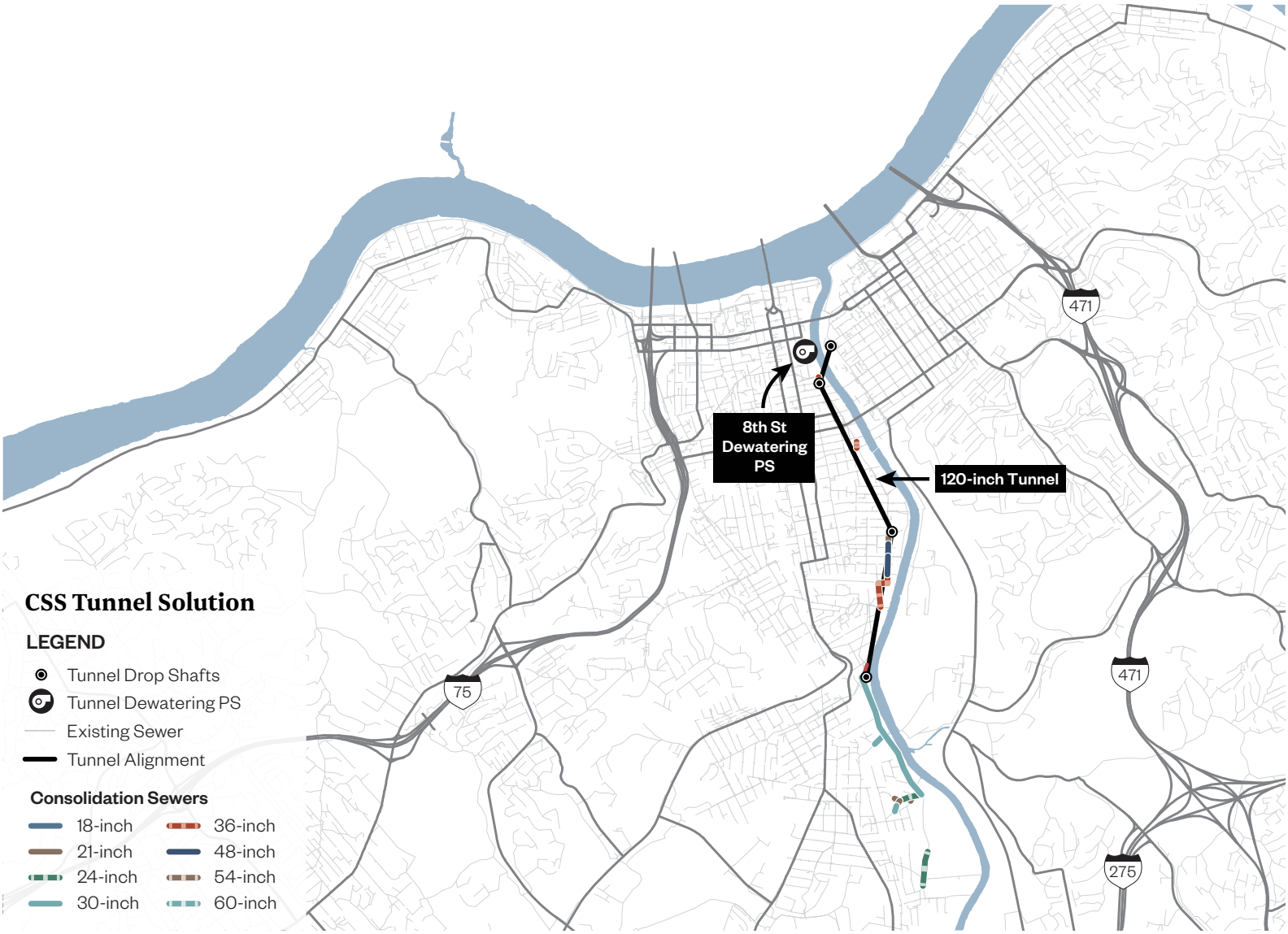


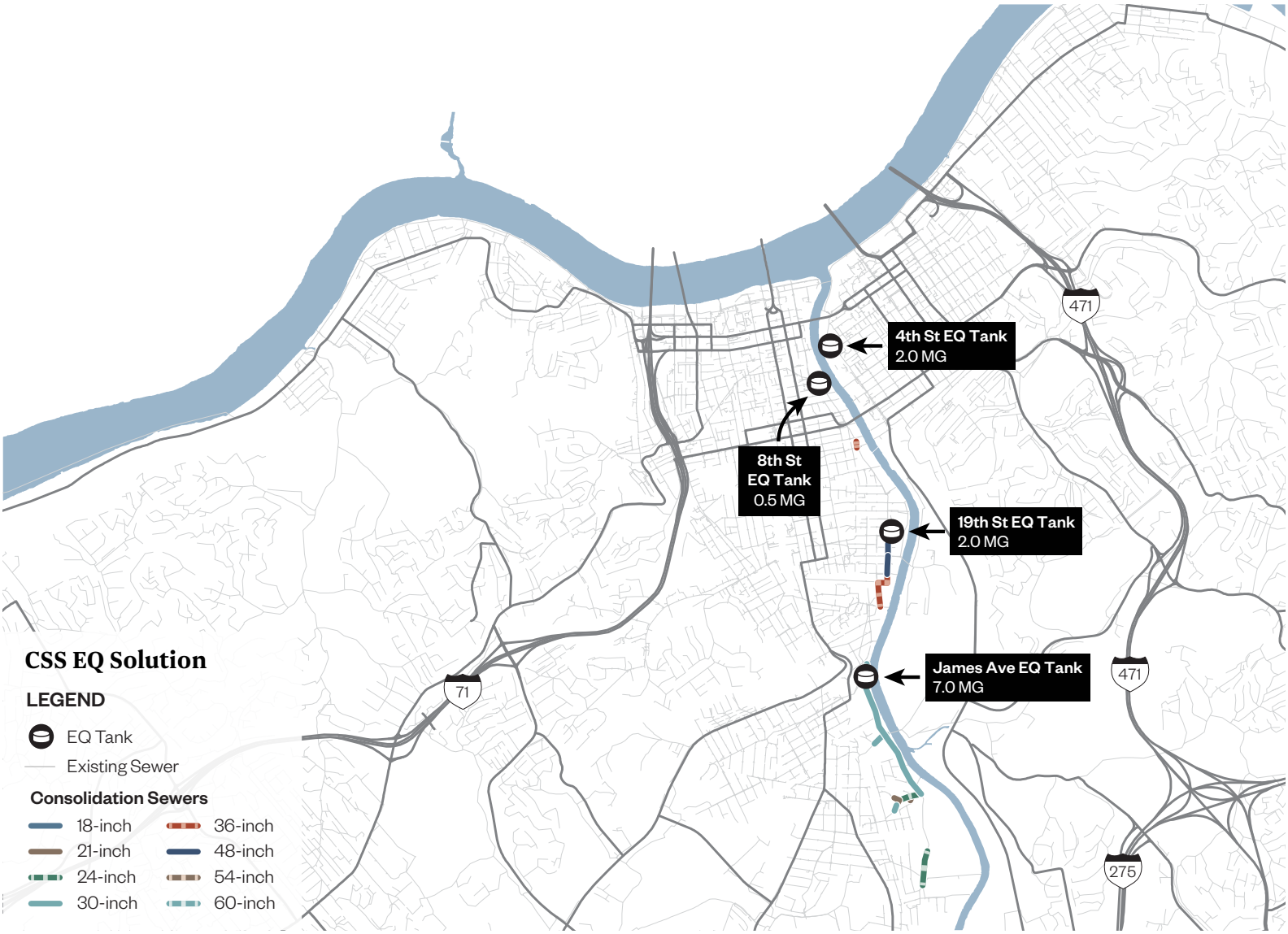


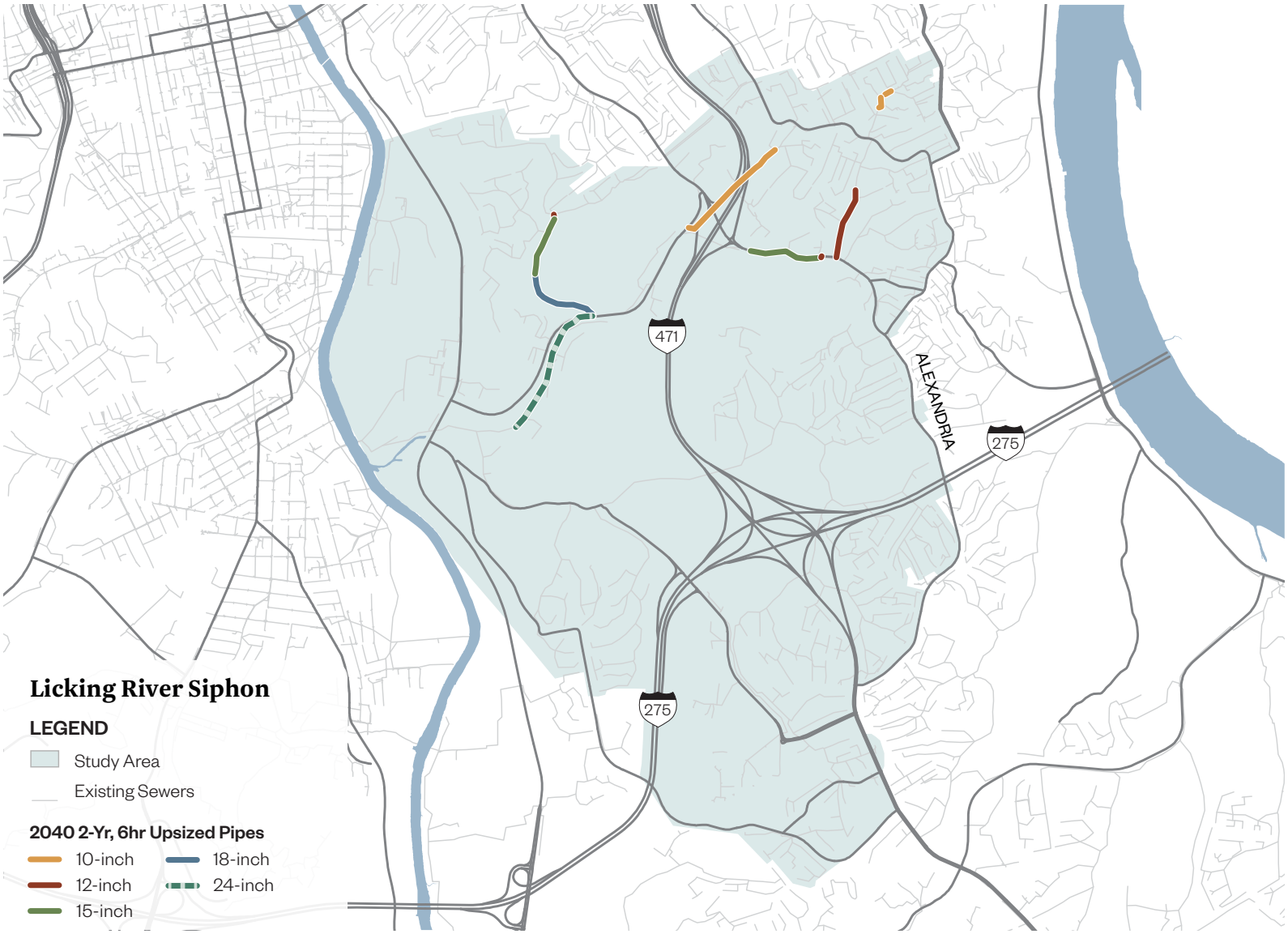




2040 Improvements


8th St Dewatering PS
120-inch Tunnel
471
471
75
275
CSS Tunnel Solution
LEGEND
Tunnel Drop Shafts
Tunnel Dewatering PS
Existing Sewer
Tunnel Alignment
Consolidation Sewers
18-inch
21-inch
24-inch
30-inch
36-inch
48-inch
54-inch
60-inch


4th St EQ Tank
2.0 MG
8th St
EQ Tank
0.5 MG
19th St EQ Tank
2.0 MG
James Ave EQ Tank
7.0 MG
471
471
71
275
CSS EQ Solution
LEGEND
EQ Tank
Existing Sewer
Consolidation Sewers
18-inch
21-inch
24-inch
30-inch
36-inch
48-inch
54-inch
60-inch



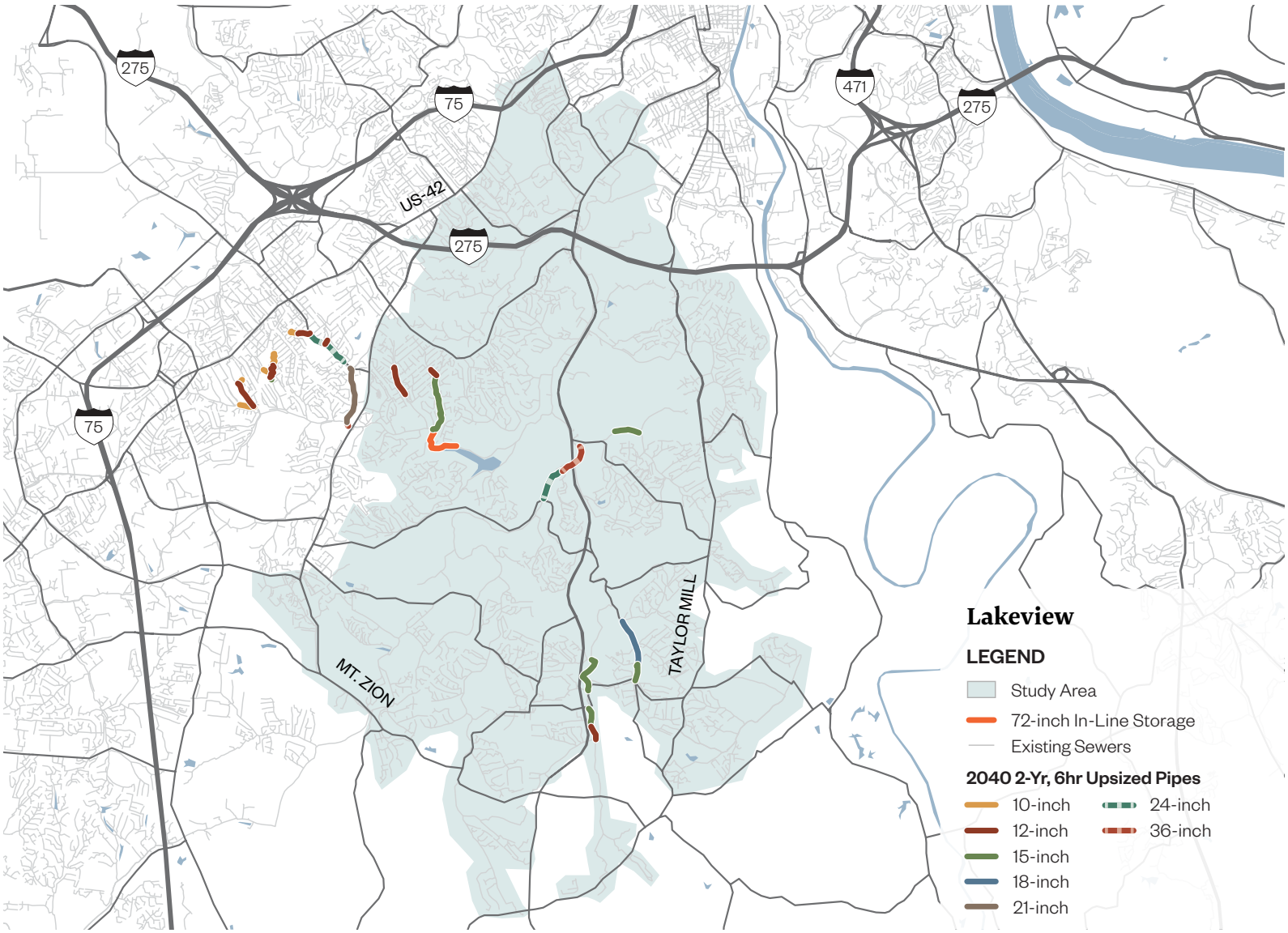
Licking River Siphon

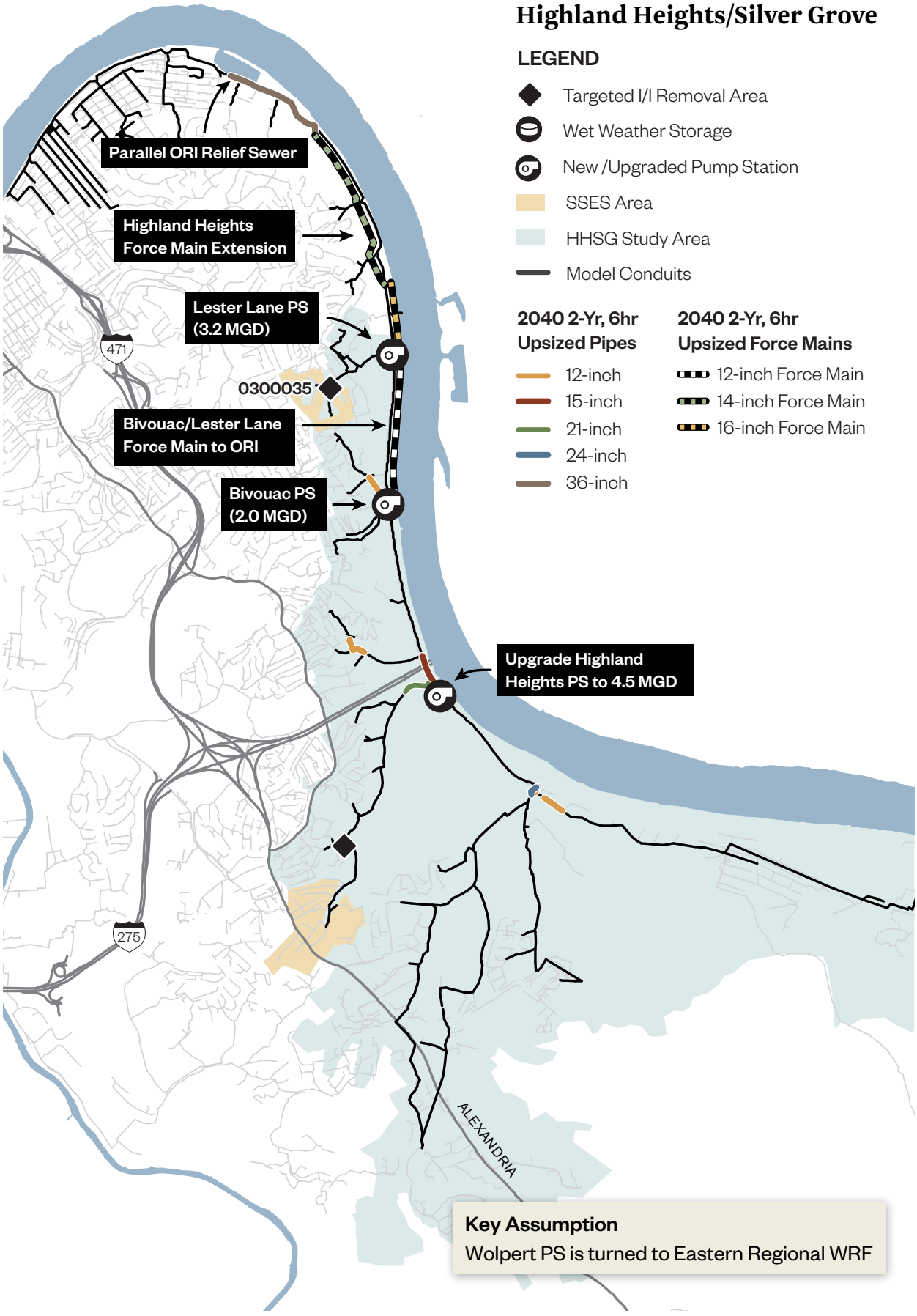
LEGEND

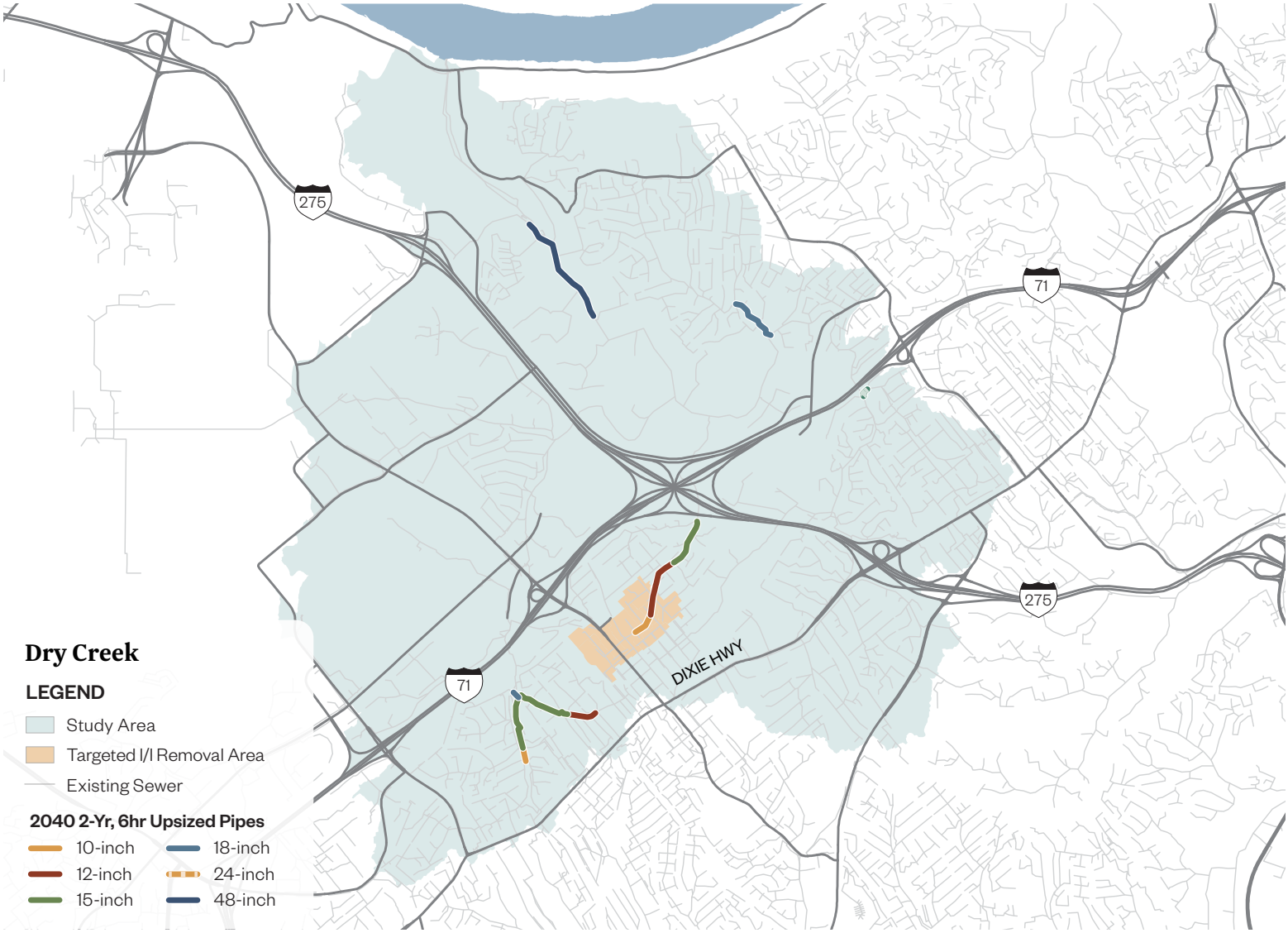
- Study Area
- Existing Sewers

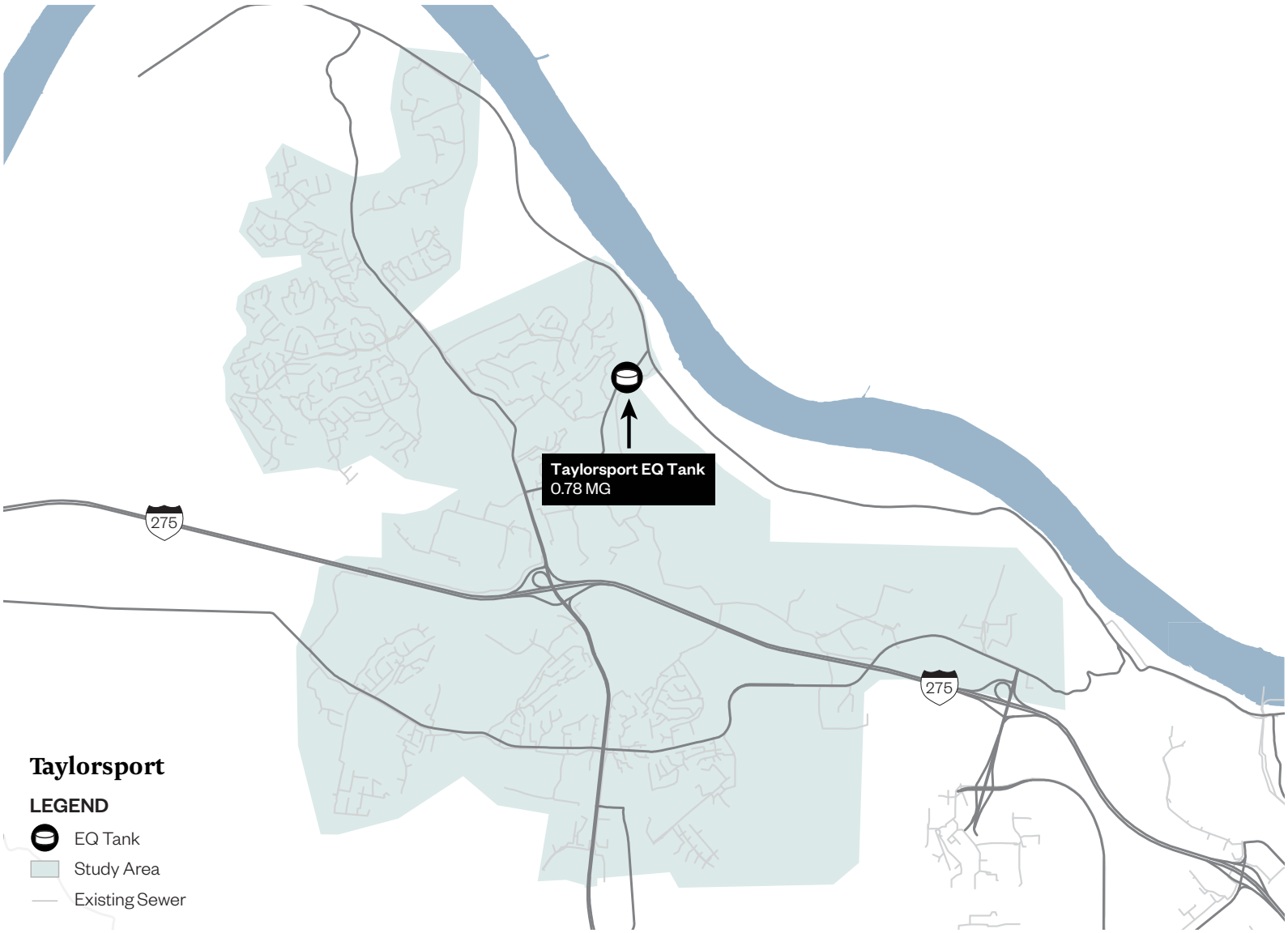
2040 2-Yr, 6hr Upsized Pipes

- 10-inch
- 12-inch
- 15-inch
- 18-inch
- 24-inch


275
75
US-42
275
471
275
75
MT. ZION
TAYLOR MILL
Lakeview
LEGEND
Study Area
72-inch In-Line Storage
Existing Sewers
2040 2-Yr, 6hr Upsized Pipes
10-inch
12-inch
15-inch
18-inch
21-inch
24-inch
36-inch


Highland Heights/Silver Grove
LEGEND
Targeted I/I Removal Area
Wet Weather Storage
New /Upgraded Pump Station
SSES Area
HHSG Study Area
Model Conduits
2040 2-Yr, 6hr Upsized Pipes
12-inch
15-inch
21-inch
24-inch
36-inch
2040 2-Yr, 6hr Upsized Force Mains
12-inch Force Main
14-inch Force Main
16-inch Force Main
Parallel ORI Relief Sewer
Highland Heights Force Main Extension
Lester Lane PS (3.2 MGD)
0300035
Bivouac/Lester Lane Force Main to ORI
Bivouac PS (2.0 MGD)
Upgrade Highland Heights PS to 4.5 MGD
471
275
ALEXANDRIA
Key Assumption
Wolpert PS is turned to Eastern Regional WRF


275
71
71
275
DIXIE HWY
Dry Creek
LEGEND
Study Area
Targeted I/I Removal Area
Existing Sewer
2040 2-Yr, 6hr Upsized Pipes
10-inch
12-inch
15-inch
18-inch
24-inch
48-inch


Taylorsport EQ Tank
0.78 MG
275
275
Taylorsport
LEGEND
EQ Tank
Study Area
Existing Sewer


Eastern Regional
LEGEND
Upgraded Pump Station
Study Area
Existing Sewer
2040 2-Yr, 6hr Upsized Pipes
12-inch
15-inch
Kees PS 1.3 MGD
Enzweiller PS 0.8 MGD

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Sanitation District No. 1 of Northern Kentucky
1045 Eaton Drive • Fort Wright, KY 41017