Hazen

Jones Falls Sewershed Comprehensive Evaluation

News & Information

Q2 2023 ISSUE
SUMMER UPDATE

INTRODUCTION

Jones Falls Sewershed Comprehensive Evaluation

Under six months remain to complete a draft of this wide-scale project. Baltimore County and their Engineering Consultant, Hazen and Sawyer, continue preparing the draft report, which will document the completed long range comprehensive evaluation of the needs in the Jones Falls Sewershed. The following are being evaluated:

- Future capacity needs driven by planned development, potential re-development, and possible future connection of unserved areas of the sewershed, including nearly 1,000 septic facilities throughout Jones Falls. *Update: Future Capacity Analysis is Complete.*
- Strategies needed to further protect the environment, residents, and business and reduce the possibility of potential sanitary sewer overflows (SSOs) and potential basement backups.
- Best Management Practices for continued proactive operation and maintenance of the sanitary sewer system. *Update: A section of the report will outline best management practices.*
- Options to address potential sewer system needs and improve long-term sustainability and resiliency.
- Assist in the development of a Capital Improvement Program (CIP) strategies to address needs/challenges at year 2025, and at 20-year and 50-year planning horizons. *Update: Projects have been identified based on modeling analysis and asset management - costs are currently being developed for those projects*

What Area Does the Jones Falls Sewershed Encompass?

The Jones Falls Sewershed includes approximately 1,124,000 linear feet (LF) of gravity sewers ranging from 6- to 42-inches in diameter and approximately 6,200 sewer manholes and structures. The area served by this sewershed is shown in below.

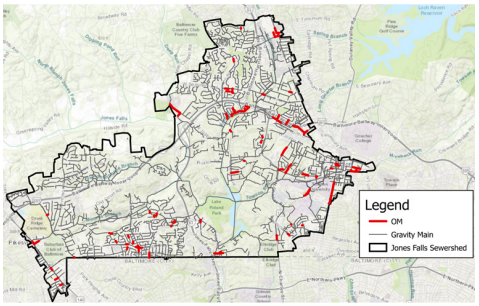

Figure 1: Jones Falls Sewershed

The entire engineering assessment completed will be documented in a comprehensive report that will provide a flexible framework assisting Baltimore County developing strategies and informed, asset-based, risk-based, and prioritized Capital Improvement Plan budgets for near-term and long-term system improvements in the Jones Falls Sewershed.

Work on the Comprehensive Report continues with a Draft anticipated in late 2023. Improvements therein will both protect the environment and residents/businesses.

Baltimore County remains firm in meeting the following commitments and achieving the long term planning goals.

Commitments:

- Maintain proper sanitation so communities can continue to thrive and prosper.
- Continue prioritization of clean water access.
- Conduct planning projects that are necessary for the County to meet future utility challenges and build upon past improvements.
- Revitalize utility infrastructure to meet forecasted population and employment growth.

Planning Goals:

1. Enhance resiliency and sustainability through properly planned infrastructure improvements.
2. Preserve and protect the environment through projects that improve water quality.
3. Focus planning efforts on assessment and improvement of the existing sewer system.
4. Track and prioritize needed sewer system improvements and proactively repair/replace infrastructure.

Project Accomplishments through Q2 2023

A brief update on critical project accomplishments made through the most recent quarter, which build upon prior accomplishments, are included below.

Data Review

- [x] Comprehensive review of over 17,500 available historical records.

Field Data Gathering/Reconnaissance

- [x] Completed a Hot Spot Analysis associated with SSO, basement backup, and work order data.

Hydraulic Model Expansion

- [x] Completed a gap analysis of the existing model to assess ways the model could be improved upon for use as a tool to better estimate the impacts that rainfall has on sewer system operations. The existing model, constructed over ten years ago, was found to not accurately represent current wet weather flow conditions. This is not unusual given the age of the model. The existing model properly predicted wet weather flows at only 1 of 39 meters *(Figure 2)*.

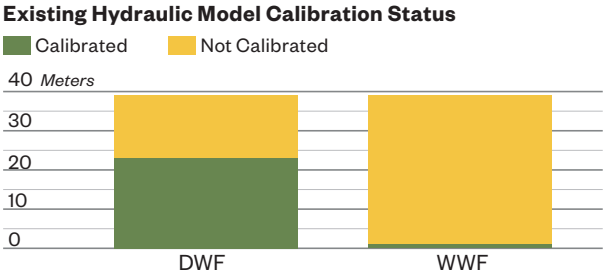

Figure 2

- [x] Based upon the model gap analysis, completed field survey of 106 manholes to update the hydraulic model.

- [x] Completed a flow, level, and rainfall monitoring data analysis to assess current high rainfall dependent inflow and infiltration (RDII) sewer service areas. These areas respond more dramatically to rainfall *(Red areas shown in Figure 3)*.

- [x] Selected additional flow monitor locations to refine the hydraulic model calibration effort.

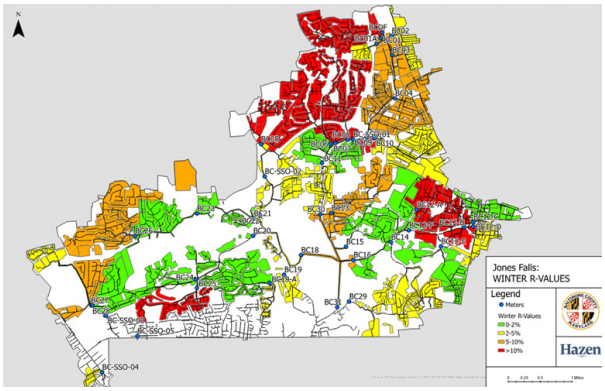

Figure 3 :
Winter High RDII Areas within the Jones Falls Sewershed

- [x] Baltimore County deployed 26 additional flow monitors, which provided the project team with 1 year of new flow monitoring data to work with. Monitoring and data gathering will continue for dry weather, wet weather, and high groundwater flow. Expanding the hydraulic model to include all sewers in the sewershed allows for a more detailed sewershed wide analysis. The original model was only required to include pipes 10-inches and larger. The number of manholes in the model increased from 1,513 to 6,715 while the number of pipes increased from 1,342 to 6,919.

Hydraulic Modeling Validation

- [x] Expanded model calibration/verification with new flow monitoring data was completed using data collected through Fall 2022.

Stakeholder Engagement

- [x] Met with the following stakeholders in the sewershed to better understand potential increases in residential and employment populations: GBMC, St. Joseph Medical Center, Sheppard Pratt, Towson University.

Dashboards

Development of a series of Project Dashboards that are being used to present evaluation findings. These will be expanded once capacity analysis is completed *(Figure 4)*.

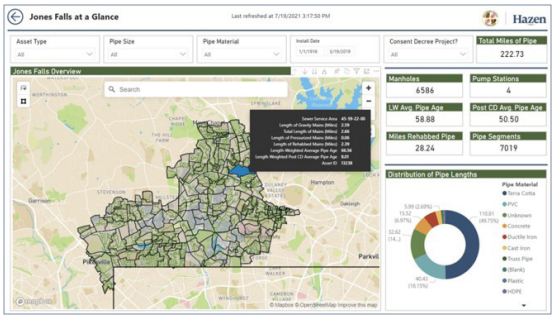

Figure 4

Environmental Investigations

Environmental investigations in and near all large water features within the sewershed (Lake Roland, Jones Falls, etc.) began in Fall 2021 and will continue, on an as needed basis during model capacity evaluation.

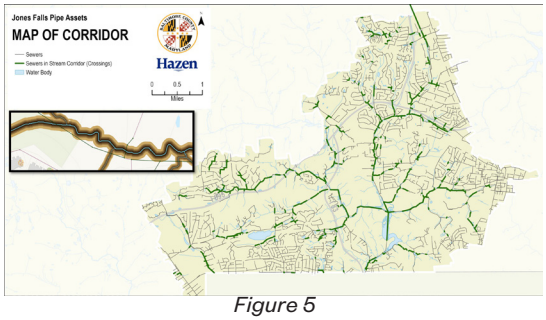

Figure 5

Climate Change

Assessed the potential impacts climate change may have on rainfall within the sewershed, including more frequent and higher intensity storm events.

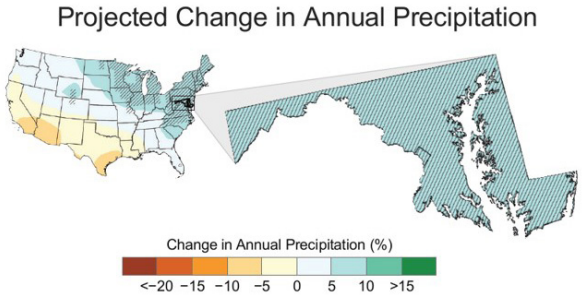

Figure 6

Mobile GIS

Implemented Mobile GIS to streamline data gathering. It replaces maps and redundant data entry, allowing gathered data to be immediately shared within the project team.

Population Estimates

Developed future population estimates, both residential and employment, which will contribute to future flows within the sewershed.

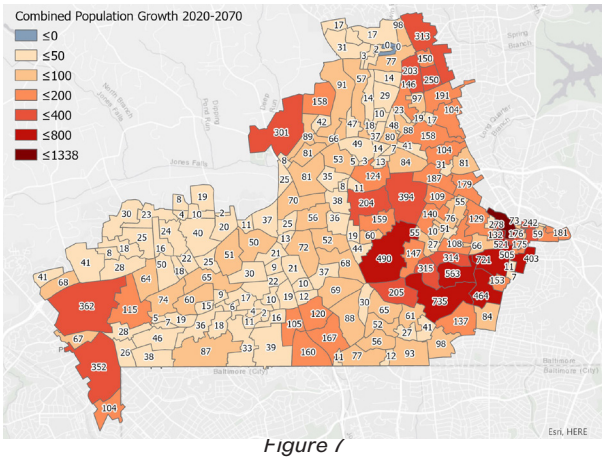

Figure 7

Water Meter Billing

Distributed water meter billing information to the hydraulic model for increased accuracy in sewer modeling.

COF Criteria	Social			Financial	Environment
	Vibrant Communities	Workforce Empowerment	Equitable Decision Making	Government Accountability	Sustainability
Environmental Impact	x		x		x
Transportation Impact	x	x	x	x	
Critical Facilties	x		x		
Diameter		x		x	x
Pipe Accessibility				x	x

Figure 8

Consequence of Failure Criteria

Developed Consequence of Failure Criteria, which are being used to assess and prioritize each option/alternative/strategy within the sewershed. These criteria account for a Triple Bottom Line evaluation including Social, Financial, and Environmental impacts.

Future Innovation Areas

Identify — **Identify innovation options that offer the County the most value.**

- Leverage existing data
- Utilize the County's Tools (CityWorks, InfoWorks, etc.)
- Address known concerns within the sewer system (RDII, energy usage, etc.).

Assess — **Assess the return on investment for potential use elsewhere in the sewer system.**

- Pilot/test and assess results

Position — **Position the County as a leading utility in sewer system design & operation.**

Baltimore County and Hazen have been having ongoing discussions with respect to future innovations. The goals of these future projects are as shown above.

Flow Monitoring

Flow monitoring data from 32 flow monitors has been analyzed for the data collected from November 2021 through October 2022 providing 1 year of new data. Flow data has been imported in the HazenQ software, integrated with previously collected 2018 flow data. Connectivity diagram has been updated to include new locations. Flow data has been reviewed for quality.

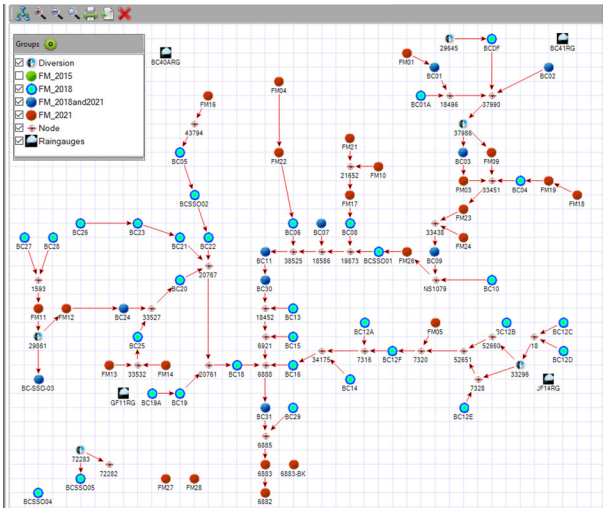

Figure 9

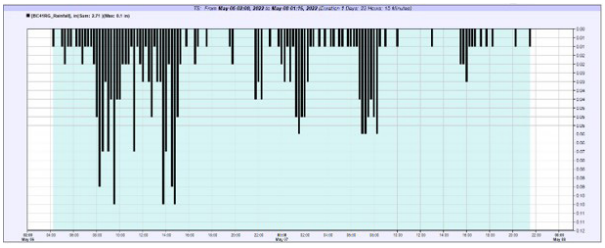

Figure 10

Rainfall

Rainfall data from multiple rain gauges has been analyzed using the data collected from November 2021 through October 2022 providing 1 year of new data. Rainfall has been imported in the HazenQ software and return period calculated.

Dry Weather Flow (DWF) Calibration

DWF Calibration is now complete! The model results now match closely with flow monitoring data from 2018 through Fall of 2022. As can be seen in Figure 11, during dry periods the red and blue lines fall on top of one another.

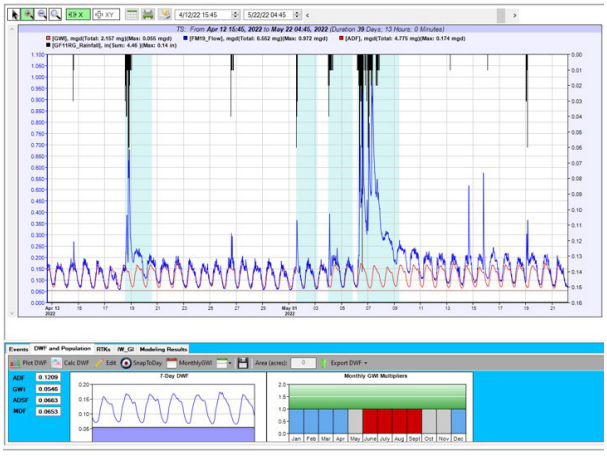

Figure 11

Stream Asset Prioritization

- Developed Framework: Existing approach modified to fit Baltimore County; New COF category introduced - Public Health/ Environmental Impact
- Completed Desktop Analysis: LOF and COF factors decided upon and calculated; Risk scores assigned to all assets; Areas of interest identified with all levels of risk.

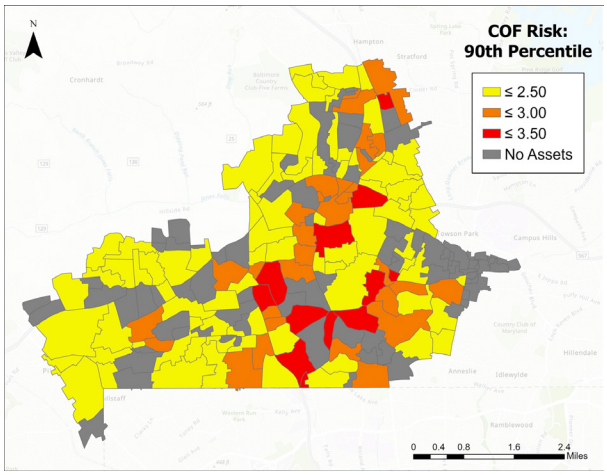

Figure 12

Wet Weather Calibration

- Following dry weather calibration, wet weather calibration was undertaken to calibrate the hydraulic model to real storm events that have occurred historically.
- Model was calibrated at meter locations by assessing flow, volume, and depth.

Hydraulic Characteristic	Calibration Criteria
Peak Flow Rate	-15% to +25% of measured, or ±0.1 mgd
Flow Volume	-10% to +20% of measured, or ±0.1 mg
Maximum Depth	Unsurcharged: within ±15% of observed or ± 0.3 ft Surcharged: -0.3 ft to + 1.6 ft of observed
Shape	The shape of the modeled and metered curves should be similar for flow and depth
Timing	The timing of the peaks, troughs, and recessions of modeled and metered curves should be similar for flow and depth, and occur within one-hour from observation

Figure 13

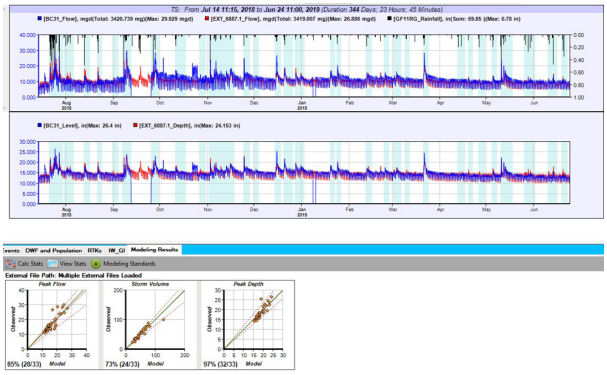

Figure 14

Historical and Synthetic Storms

- Model results from historical storm events were compared against model results from synthetic storm events to evaluate model calibration quality.

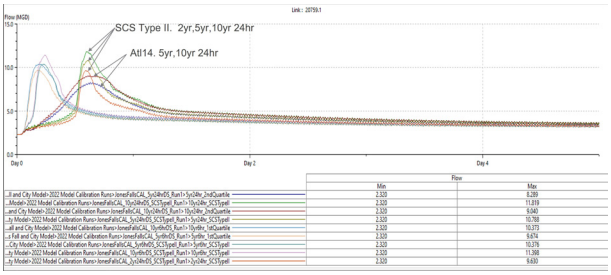

Figure 15

RDII Evaluation

- Completed an evaluation of areas within the sewershed that, based on flow monitoring, indicate the highest response to rainfall. These areas (in red) may be locations where a strategy of comprehensive rehabilitation to reduce inflow and infiltration may be applicable and cost effective.

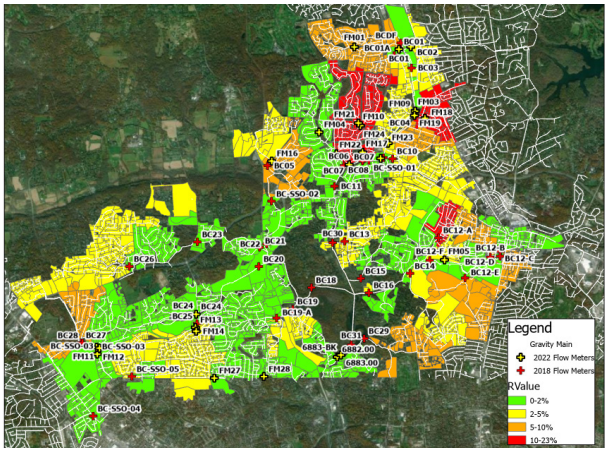

Figure 15

Potential Investigation Areas

Identified areas within the sewershed where rehabbed mains (purple lines) were completed in areas with high R-Values. Deployment of smart manholes in these areas may be beneficial for the County to quantify rehabilitation results.

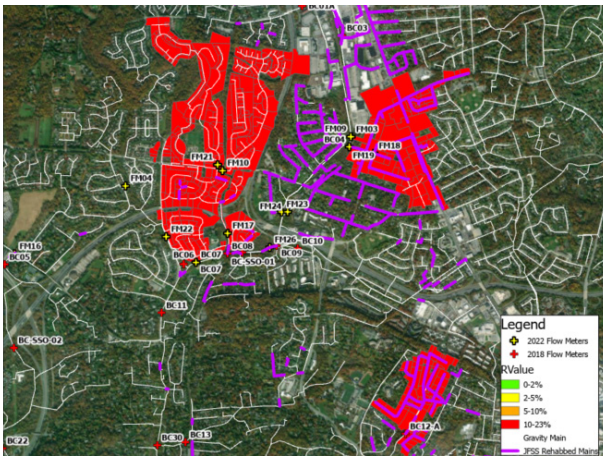

Figure 16

Model Calibration Area	Model R-Value	Max Potential I&I Reduction
BC07	10.6%	40%
BC08	15.3%	50%
BC12A	11.3%	40%
FM10	11.7%	40%
FM17	10.9%	40%
FM18	22.6%	60%
FM19	18.4%	55%
FM21	10.1%	40%

Figure 17

Performance Criteria

Performance criteria to measure success of potential strategies to protect customers and the environment were developed.

Design Storm: Historical Storm Evaluation

Evaluated 10 years of historical storm events to identify a synthetic design storm that most closely mimics historical storm events that have occurred within the sewershed to assess capacity of the system and identify areas where strategies may be needed to improve capacity.

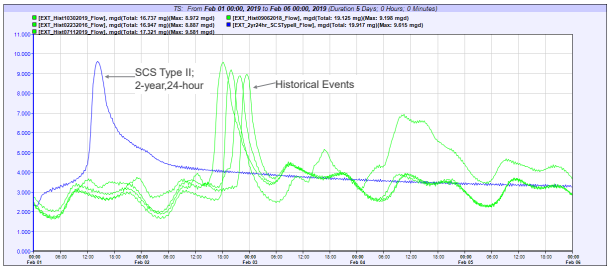

Figure 18

Future Flow Results

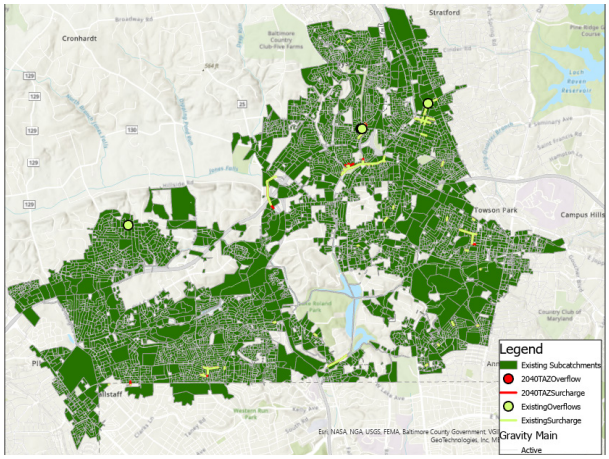

Figure 19

Capacity analyses were completed to identify needs and strategies to improve capacity.

Looking Ahead

Upcoming Project Tasks

Engineering evaluation work continues with the focus now on documenting the results of the evaluation completed in a comprehensive report. Planned upcoming project tasks are highlighted below.

Continued stakeholder engagement to fully understand the unique dynamics within the Jones Falls Sewershed, including community interests and potential residential and employment growth over the next 50 years.

CIP needs to include current conditions, conditions through year 20, and conditions out to year 50.

The results of the asset management evaluation and hydraulic capacity evaluation are now being documented in a comprehensive report.

What to expect going forward?

Given that this project is intended to map out what the sewer system needs might be over a 50 year period, it is important to cover all possible aspects of what the sewer system could become by the year 2050 (~30 year period) and 2070. These tasks are now all underway and will help provide a complete picture of the near- and long-term sewershed strategies:

- Capacity assessment using the calibrated model under future flow conditions.
- Development of a framework/strategy for future CIPs.
- Development of Asset Management Program features that allows for proactive protection of the environment, residents, and businesses. An initial asset management framework has been completed in collaboration with hydraulic model capacity assessments to provide a comprehensive risk-based program. *(see Figure 20).*

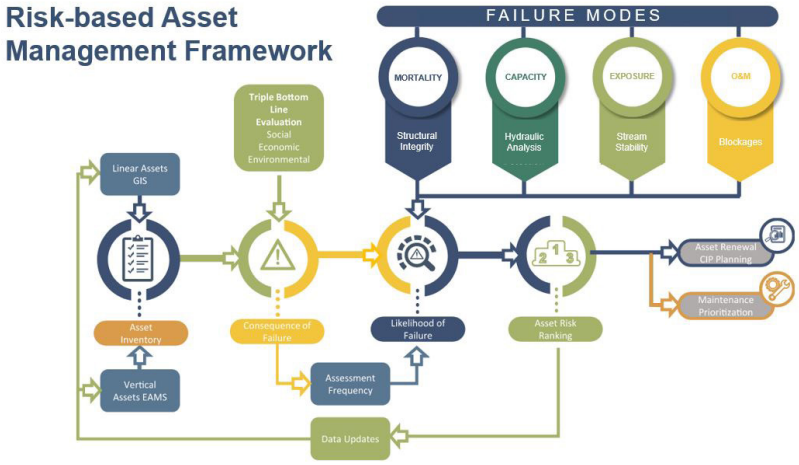

Figure 20

Target Completion Date

The draft report is anticipated to be completed in late 2023. Baltimore County will continue to provide updates on the project, on a regular basis. Data continues to be gathered through flow and level monitors located throughout the sewershed for continual monitoring purposes, as Baltimore County is committed to protecting the environment. Dry weather calibration was completed in Q4 2022 and wet weather calibration was completed in Q1 2023. Capacity evaluations for 2025, 2030, 2040, 2050, and 2070 were completed in Q2 2023. Using the improved hydraulic model will allow for development of frameworks/strategies/options to be made on needs throughout the entire sewershed and at the neighborhood level.

Fall 2023 Update to Follow!