

# CSO Supplemental Compliance Plan

City of Portsmouth, NH  
December 22, 2017

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1. 2017 Sewer System Evaluation Survey (SSES) Infiltration Study Executive Summary
2. SSES Investigation Overview Map (Figure ES-1)
3. Collection System Rehabilitation Manhole and Pipe Recommendations Maps



## List of Acronyms

Abbreviation	Definition
CSO	Combined Sewer Overflow
CD	Consent Decree
CSS	Combined Sewer System
CWA	Clean Water Act
I/I	Infiltration/Inflow
EPA	Environmental Protection Agency
LTCP	Long-Term Control Plan
WMP	Wastewater Master Plan
PCMP/R	Post-Construction Monitoring Plan/Report

## 1. Introduction

This updated Supplemental Compliance Plan (Plan) is being submitted as part of the City of Portsmouth, New Hampshire's obligations arising from Consent Decree 09-cv-283-PB. In accord with the Consent Decree and Consent Decree First Modification, the City of Portsmouth (City) completed identified sewer separation projects, the final identified project being completed in October 2014. Thereafter the City of Portsmouth conducted post construction monitoring which resulted in a plan and report (PCMP/R), which was submitted to the Environmental Protection Agency (EPA) in November 2016.

The EPA, by letter to the City received on April 18, 2017, commented on the PCMP/R. This Plan is part of that response to comments and incorporates comments received from EPA by letter to the City on July 10, 2017.

To summarize, this Plan requires the City to complete the construction of the sewer separation components for the projects listed in Section 2 of this report. The completion date for this work is October 2023. Following completion of the project work, the City will update its Long Term Control Plan (LTCP) as described in Section 3 of this report. The LTCP Update will include water quality data gathering and analysis, modeling tasks and a prioritized list of improvements based on the results. The LTCP update is required to be completed by October 2025.

## 2. Ongoing and Identified Projects and Programs

The City has continued to implement projects that will improve the performance of the CSS and reduce CSOs since the completion of the scheduled projects set forth in the Consent Decree and Consent Decree First Modification. Currently the projects listed below are in varying stages of planning and design and have sewer separation components. Sewer separation is one means for reducing events/volumes at CSOs 010A, 010B and 013:

- Fleet Street (Engineer Procurement Phase)
- Pleasant Street (at Court Street) (Design Phase)
- McDonough Phase 3B (Construction Phase)
- Islington Street Phase 1 (Design Phase)
- Maplewood Avenue (at Fairview Drive) (Design Phase)
- Union Street (Engineer Procurement Phase)

In recognition of the fact that the scope of work and specific schedule for each of these projects is not finalized, the City, EPA and the State have agreed that the City will complete the sewer separation components of the above-referenced projects by October 2023, with the City having the flexibility to sequence the work as may be in the best interests of the community.

In addition to the proposed sewer separation work, the City continues to evaluate inflow and infiltration (I/I) in the collection system, recognizing that removal of I/I will provide additional capacity for conveyance of CSS flows to the WWTF for treatment, resulting in a reduction in CSOs. A report summarizing the I/I evaluation and recommending sewer rehabilitation needs was completed in December 2017. This report summarized sewer rehabilitation projects for infiltration mitigation. The City will conduct Contract No. 1 work summarized in Table ES-3 on page ES-4 of the report prior to October 2023. The executive summary from this report along with several report figures showing the extents of

the SSES program and manhole and pipe rehabilitation recommendations are attached to this document. The full report was delivered to EPA under separate cover.

Sewer System Evaluation Survey work is continuing, along with an update to the drain and sewer tributary area GIS-based mapping and additional inflow investigations. The City continues to perform closed-circuit television inspections of its sewer system, and through an asset-based approach, invests in rehabilitation and/or replacement of deteriorated sewers each year. A dedicated GIS staff supports all of these efforts, and maintains the sewer and drainage infrastructure databases. The City has also begun to explore the development of a sump pump disconnection program and a service lateral upgrade program. All of these I/I efforts will be evaluated as a component of the LTCP update which will begin in October 2023.

### **3. Water Quality Data Gathering and Analysis and LTCP Update**

The last LTCP Update was completed in 2010 as part of the 2010 Wastewater Master Plan. Water quality data gathering and analysis and a LTCP update will begin in October 2023, and is a critical step in the adaptive long-term CSO control program. The City will implement a scope of work consistent with the CSO Control Policy including the following:

- Water Quality Monitoring and Continue CSO Monitoring
- Collection System Modeling
- Receiving Water Body Modeling
- Consideration of Sensitive Areas
- Evaluation of Alternatives
- Review of Costs and Performance Considerations
- Operation and Maintenance Plan(s)
- Update of Nine Minimum Controls
- Project Implementation Schedule
- Post Construction Monitoring Plan

The LTCP update will also include public information and participation components throughout the program.

As required by the CSO Control Policy and the CWA, the LTCP update will be submitted to and approved by the NPDES Permitting Authority prior to implementation.

The first step in determining the additional controls needed for compliance is to establish post-construction baseline conditions. This includes the parameters outlined in the PCMP/R (rainfall, flows, CSO activations), as well as water quality monitoring data.

From January through June 2000, NHDES collected water quality samples from South Mill Pond and analyzed them for enterococcus bacteria. Four of the 25 samples collected during this period exceeded the single sample maximum of 104 colonies/100 ml and one of the 30-day geometric means exceeded the 35 colonies/100 ml threshold. As a result, the pond was assessed as not meeting its uses due to bacterial contamination. The updated LTCP will include sample collection and analysis during a similar time period to evaluate impacts of the system improvements and to guide future improvements.

A collection system model of the City's combined sewer collection system was updated and re-calibrated as documented in the November 2016 PCMP/R. This model, in addition to any other relevant modeling frameworks (e.g., water quality, etc.) will be utilized in the LTCP update as appropriate. The goals will be to:

- Evaluate impact of projects currently underway
- Identify and recommend an approach to achieve the CWA goals

In accordance with the Consent Decree requirements, the City will proceed with the LTCP Update based on the schedule provided in Section 4 of this Supplemental Compliance Plan.

#### 4. Supplemental Compliance Plan Schedule

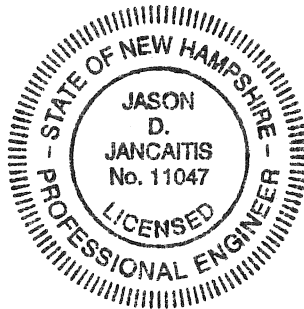
	Task	Start Date	End Date
Construction	<b>Implement Sewer Separation Projects</b> <ul style="list-style-type: none"> <li>Fleet Street</li> <li>Pleasant Street</li> <li>McDonough Phase 3B</li> <li>Islington Street Phase 1</li> <li>Maplewood Avenue</li> <li>Union Street</li> </ul>	Ongoing	October 2023
	<b>Project Initiation, Meetings, Administration</b>	October 2023	October 2025
LTCP Update	<i>Kickoff meeting with City (internal)</i>		
	<i>Public/external stakeholder meetings</i>		
	<b>Data Gathering/Monitoring</b>	October 2023	August 2024
	<i>Water quality monitoring</i>		
	<i>Gather rainfall, system flows, CSO discharge, and stormwater data</i>		
	<i>Compile collected data</i>		
	<i>Progress meeting to review data</i>		
	<b>Hydraulic Modeling</b>	January 2024	October 2024
	<i>Establish baseline conditions/calibration</i>		
	<i>Identify alternatives/run scenarios</i>		
	<b>Receiving Water Modeling</b>	January 2024	October 2024
	<i>Establish baselines conditions/calibration</i>		
	<i>Run scenarios</i>		
	<b>Develop LTCP Update</b>	November 2024	October 2025
	<i>Evaluate Alternatives/Identify Recommended Approach</i>		
	<i>Draft LTCP Update</i>		
	<i>Stakeholder and Regulatory Review and Comment</i>		
	<i>Revised LTCP Update</i>		

## **Attachment 1: Sewer System Evaluation Survey (SSES) Infiltration Study, Executive Summary**



# Sewer System Evaluation Survey (SSES) Infiltration Study

Volume I of II



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City of Portsmouth, NH  
December 2017



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## EXECUTIVE SUMMARY

### INTRODUCTION

The City of Portsmouth, New Hampshire (City) is a community of 16.8 square miles located along the Piscataqua River that was originally settled in 1623. Consequently, portions of the approximately 94 miles of the gravity sewer collection system are over 100 years old and have deteriorated over time. As a result of the City's aging infrastructure, the sanitary sewer collection system has areas that are structurally deficient and subject to high infiltration/inflow (I/I) rates due to condition and high groundwater. The City's wastewater needs are serviced by a combined (16 miles) and separated sanitary sewer (78 miles) collection system that flows to two separate facilities; the Peirce Island and Pease Wastewater Treatment Facilities (WWTF). The Pease WWTF serves the area known as Pease International Tradeport, while the Peirce Island WWTF serves the residents, businesses, and industrial areas of Portsmouth and Newcastle, NH. The Peirce Island WWTF currently has an average design flow of 4.8 million gallons per day (MGD) with plans to upgrade to 6.1 MGD average design flow.

In addition to the cost of treating clean groundwater and stormwater entering the collection system, the increased volume is contributing to operational problems such as surcharged pipes and manholes and more frequent discharges from combined sewer overflows (CSOs) in the collection system.

During the Spring of 2015, Woodard & Curran completed a wastewater metering study of the separated sanitary system that delineated sewer basins and measured each basins wastewater flows. The results of this metering study were compiled into the *City of Portsmouth Infiltration/Inflow Analysis* dated 30 June, 2016. As a result of the metering study, sewer basins were characterized as having excessive infiltration, inflow, or both. A total of 14 sewer basins accounting for 187,125 LF of sanitary sewer pipe were found to experience excessive infiltration. The purpose of this study is to investigate each sewer basin using standard Sewer System Evaluation Survey (SSES) techniques with the goal of locating sources of infiltration. The investigative techniques utilized were manhole inspections, flow isolation, and closed circuit television (CCTV) sewer pipe inspection. This report will present recommended rehabilitation methods and associated construction costs to eliminate/reduce the amount of infiltration entering the City's collection system. During the course of the investigation structural defects (fractured or broken structures) were located and when severe enough, these defects were recommended for rehabilitation as well, even if infiltration was not observed at the time of CCTV inspection. Although, it may not be fiscally feasible to address all defects or remove all the I/I from the system, addressing the major structural defects and removing a significant volume of I/I can be achieved over the course of the phased plan and will reduce risk associated with the City's collection system. It should be noted that the plan to address active defects in the system may take several years and we recommend that the City continue to conduct a regular SSES/asset management/maintenance plan in parallel to keep the system operating effectively.

### FINDINGS FROM INVESTIGATIONS

From April-July of 2017, Woodard & Curran in conjunction with sub-consultants (Flow Assessment Services and Ted Berry Company) performed flow isolation, CCTV inspection, manhole inspections in the areas experiencing excessive infiltration. Woodard & Curran also partnered with Underwood Engineers (UE) to complete a detailed "Pilot Area" study in defined locations in the City that share public and private infrastructure. The result of this study showed that 90% of the I/I visually observed and estimated in these pilot areas originates from private laterals and therefore private infrastructure rehabilitation should be addressed. UE also completed a feasibility assessment that concluded that Woodlands Avenue Pump Stations and West Road Pump Station flow data could be used as an estimate for future I/I reduction in the area. Figure ES-1 – *2017 Field Investigation Summary* illustrates fieldwork conducted by Woodard & Curran and sub-consultants in the City during the calendar year. Investigations revealed a varying degree of both structural and operational and maintenance (O&M) related defects throughout the collection system consistent with older New England municipalities. Table ES-1 – *Summary of 2017 Sewer Infrastructure Investigations Findings* shows the quantity of work completed and percentage of investigations resulting in rehabilitation recommendations.

Measurements taken during springtime flow isolation of the City's sanitary sewer pipe showed that approximately 30% of the sanitary sewer investigated experienced high rates of infiltration (> 1,750 gallons per day per inch-diameter mile) and yielding as much as 913,000 gallons per day of groundwater entering the collection system. CCTV inspection of 46,066 linear feet (LF) of pipe located an estimated 140,400 gallons per day of infiltration entering the sewer system. Of the 428 manholes successfully inspected, approximately 143,136 gallons per day of infiltration was located.

As part of the scope of services, Woodard & Curran performed a review of existing CCTV data collected by City crews. The data consisted of manhole to manhole segments of at least 1,000 linear feet that had been investigated during high groundwater conditions. The results of this analysis were transmitted to the City in July 2017. A copy of this report is included as an Appendix to this report.

**Table ES-1: Summary of 2017 Sewer Infrastructure Investigations Findings**

Investigation Activity	Type of I/I Sources and Defects Identified	Work Completed	% Defective or Additional Investigation
Flow Isolation	Infiltration	174,070 LF	30%
CCTV Inspection	Infiltration, Structural, and O&M Defects	33,359 LF	74%
Manhole Inspections	Infiltration, Structural, and O&M Defects	403 Manholes	40%
City Existing CCTV Review	Infiltration, Structural, and O&M Defects	14,500 LF	27%
Pilot Area Study	Infiltration, Structural, and O&M Defects	25 Manholes & 12,707 LF CCTV	0% & 9%

## RECOMMENDATIONS FOR FUTURE INVESTIGATION

During the Spring 2017 SSES program, various potential I/I and structural/O&M defects could not be inspected for reasons including but not limited to: buried manhole covers, inability to locate a manhole, or intruding laterals in a pipeline. It is recommended that the City continue their infiltration study by completing the asset investigations outlined in **Appendices A and B**.

Proactive planning and continuous system investigation is critical to the long-term health of the collection system. The City has contracted with Woodard & Curran to complete the second portion of the 2017 SSES program which was guided by the recommendations developed in the *City of Portsmouth Infiltration/Inflow Analysis*. This inflow scope has been developed by Woodard & Curran, approved by the City and NHDES, and is in the process of execution. Sewer basins measured to have an excessive response to rainfall will be studied to locate defects that allow rainfall into the sanitary sewer that may contribute to an increase in flows at the City's treatment plant during storm events. Investigative techniques such as smoke testing, rainfall simulation, building inspection, and manhole inspection are recommended.

## RECOMMENDATIONS FOR FUTURE REHABILITATION

The City's collection system is aging and requires rehabilitation and maintenance to reduce blockages or sanitary sewer overflows (SSOs) and maintain service to residents and businesses. As part of the 2017 SSES investigation, Woodard & Curran identified approximately \$1,890,000 in recommended collection system rehabilitation and improvements work. Of the total recommended rehabilitation, approximately \$1,240,000 is aimed at removal of infiltration. Woodard & Curran recommends that a 20% engineering fee and 30% contingency be included, resulting in a total estimated Program cost of \$2,957,000. A summary of estimated costs to rehabilitate all collection system defects

identified during the 2017 SSES investigation is included in Table ES-2 – *Collection System Rehabilitation Summary of Costs*.

**Table ES-2: Collection System Rehabilitation Summary of Costs**

Investigation Type	Work Completed	Rehabilitation Recommendations	Infiltration Rehabilitation	Structural and O&M Rehabilitation	Total Estimated Cost
CCTV	32,329 <sup>1</sup> LF	Infiltration, Structural, and O&M	\$880,000	\$300,000	\$1,180,000
Manhole Inspection	393 <sup>1</sup> Manholes	Infiltration, Structural, and O&M	\$310,000	\$290,000	\$600,000
Pilot Area Study	24 Manholes & 12,000 LF CCTV	Infiltration, Structural, and O&M	\$10,000	\$20,000	\$30,000
City CCTV Review	14,500 LF CCTV	Infiltration, Structural, and O&M	\$35,000	\$40,000	\$75,000
<b>Total Rehabilitation Cost:</b>			<b>\$1,240,000</b>	<b>\$650,000</b>	<b>\$1,890,000</b>
Contingency (30%):			\$372,000	\$195,000	\$567,000
Engineering Cost (20%):			\$330,000	\$170,000	\$500,000
<b>Total Estimated Cost:</b>			<b>\$1,942,000</b>	<b>\$1,015,000</b>	<b>\$2,957,000</b>

A prioritized database of each manhole and pipeline rehabilitation recommendation has been developed as part of this report and can be found in Section 4, as well as Appendices A and B. While it would be ideal to rehabilitate every collection system defect or infiltration source uncovered during the 2017 SSES investigations, the cost to perform this operation may be uneconomical, with reducing returns (in terms of infiltration removed from the system) for lower priority rehabilitation items. In order to mitigate the risk of future conveyance failures in the collection system, we recommend a phased sewer system rehabilitation program focused on addressing sources with the highest infiltration rate and most severe defects encountered during the SSES investigations while maintaining a database of the remaining defects for future rehabilitation consideration.

Table ES-3 summarizes the costs associated with the recommended plan, termed the Collection System Infiltration Removal Plan.

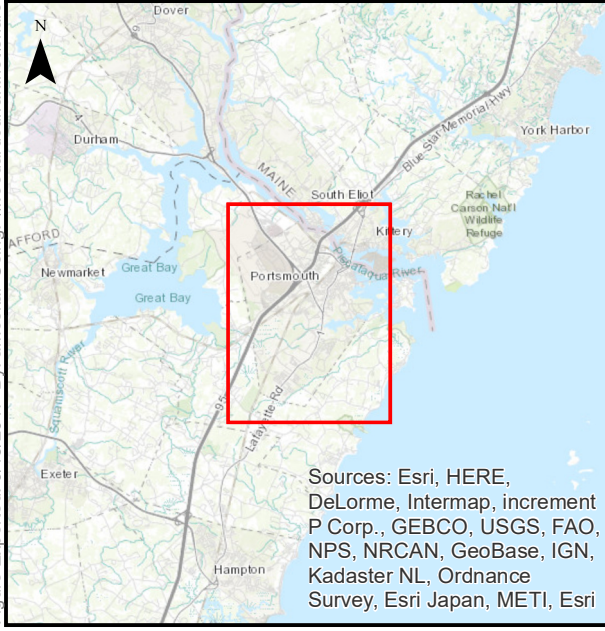
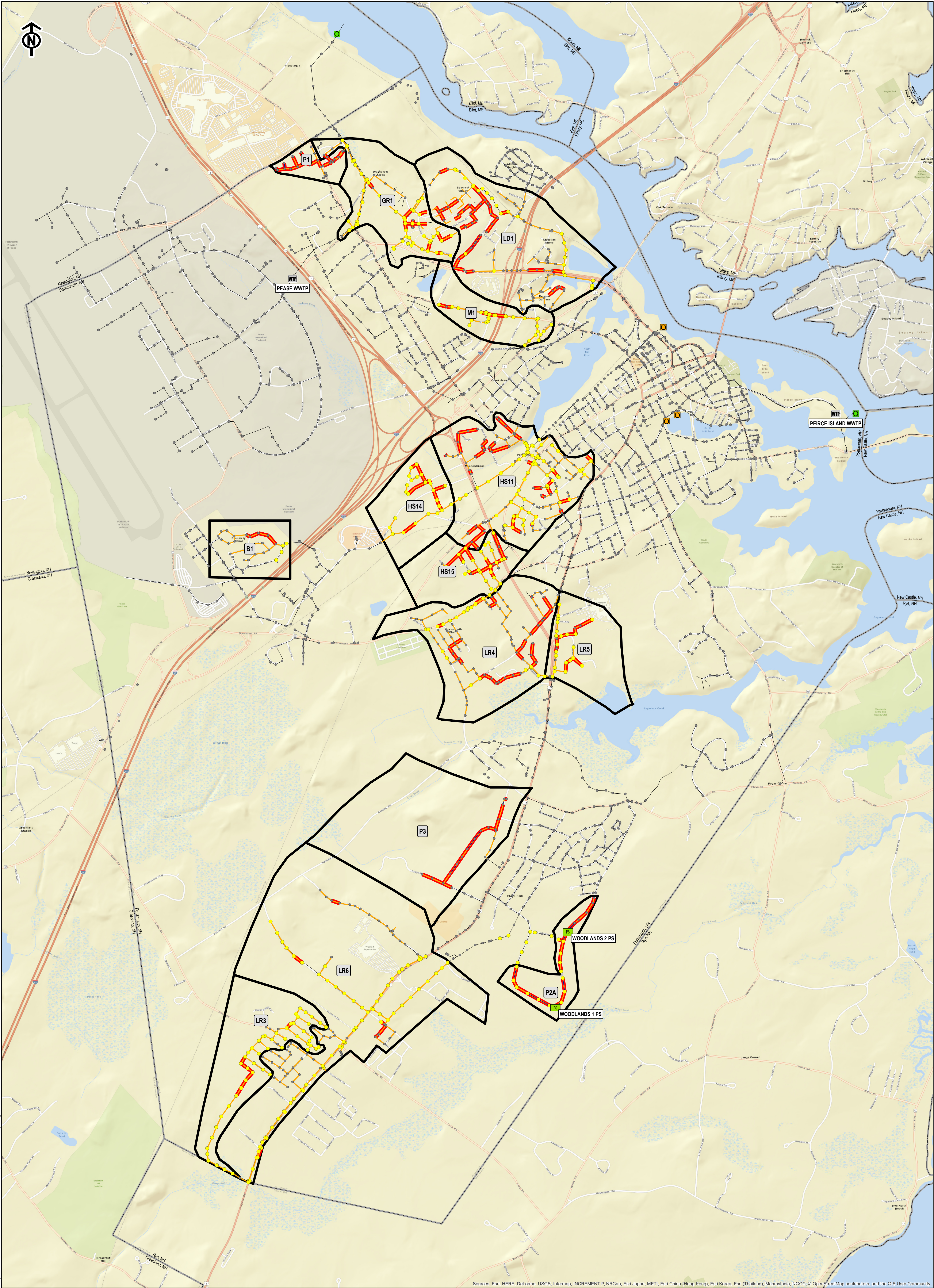
**Table ES-3: Collection System Infiltration Removal Plan Summary of Costs**

Phase	Contract #1	Contract #2	Contract #3	Contract #4	Totals
Basins Included	LR3, LR4, LR6, GR1	HS11, LR5	LD1, B1	HS14, HS15, M1	
Total Infiltration Observed	174,460	31,400	28,300	27,580	261,740
Infiltration Rehabilitation Cost	\$323,000	\$242,000	\$225,000	\$307,000	\$1,097,000
Structural/O&M Rehabilitation Costs	\$63,000	\$163,000	\$63,000	\$105,000	\$394,000
Contingency Cost (30%)	\$116,000	\$122,000	\$87,000	\$124,000	\$449,000
Total Construction Cost	\$502,000	\$527,000	\$375,000	\$536,000	\$1,940,000
Engineering Costs (20%)	\$101,000	\$106,000	\$75,000	\$108,000	\$390,000
Total Estimated Contract Cost	\$603,000	\$633,000	\$450,000	\$644,000	\$2,330,000

The data from this report is incorporated in the City's existing GIS database. The database includes spatial and attribute data for both public and private wastewater infrastructure located within the City's jurisdiction. Through the field investigations completed as part of this study a few spatial updates can be incorporated into the database, allowing for an even more accurate representation. Much of the field data collected by Woodard & Curran and sub-consultants is digital and has been incorporated into ESRI accepted data (shapefiles, feature classes, etc.) that the City can use to inform and update their asset management programs.

## **Attachment 2: SSES Investigation Overview Map (Figure ES-1)**





### Legend

Sewer Manhole	WWTF Outfall	Inspected Manholes
Sewer Pipe	Combined Sewer Overflow	Flow Isolation Pipe
Metering Basin	WWTF	CCTV Pipe
Town/State Boundary	Pump Station	Lateral Inspection

01100220033004400

Feet

## 2017 SSES I/I Investigation Overview

City of Portsmouth, NH

FIGURE ES-1

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SCALE: 1" = 1,100'

DATE: SEPTEMBER 2017

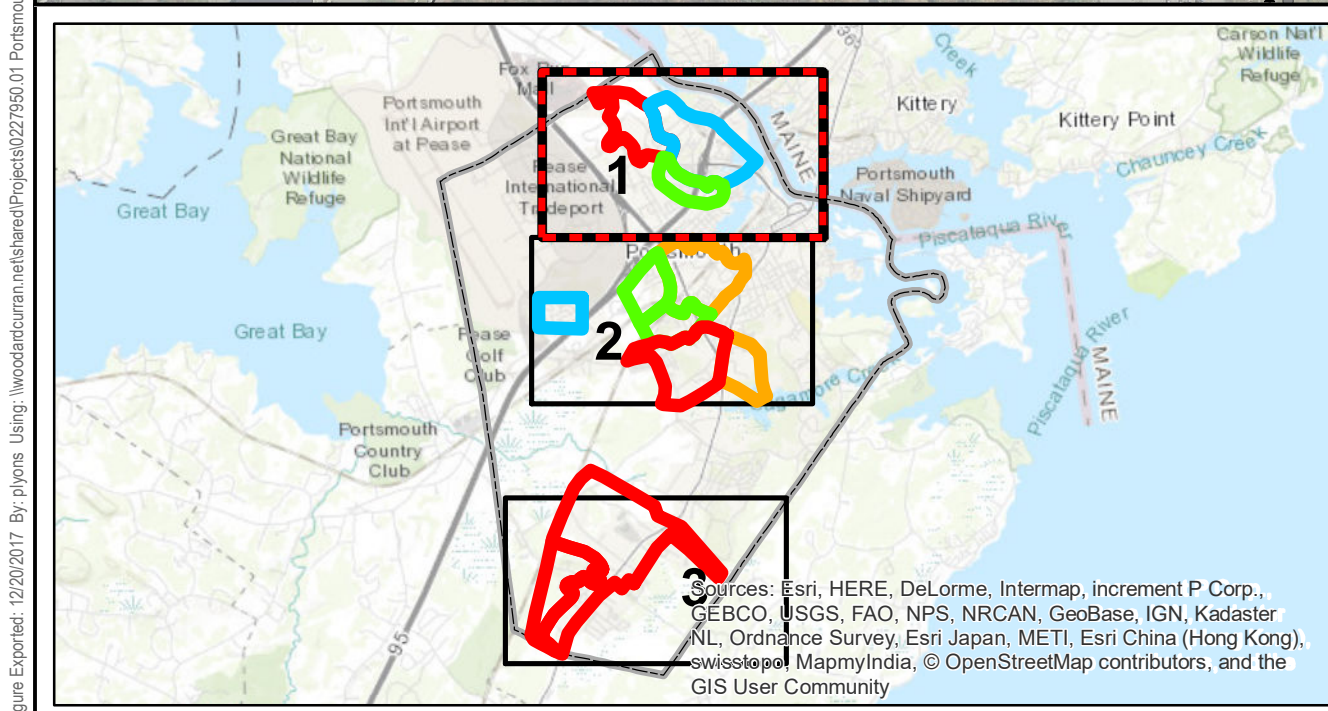
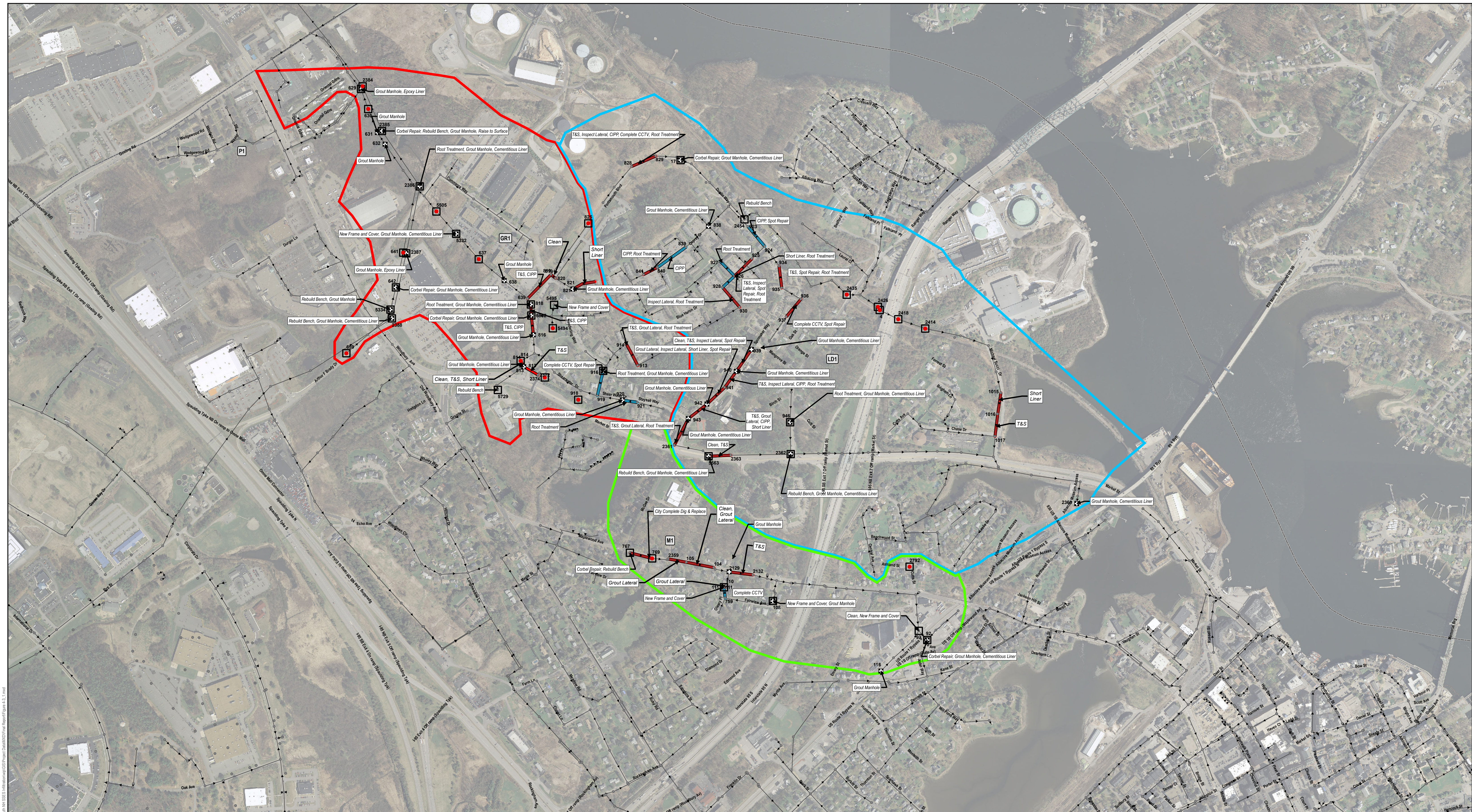
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## **Attachment 3: Collection System Rehabilitation Manhole and Pipe Recommendations Maps**





**Legend**

**Manhole Rehab**

**Type**

- Infiltration
- Infiltration & Structural/O&M
- Structural/O&M
- Monitor
- Locate Manhole

**Pipe Rehab**

**Rehabilitation Type**

- Infiltration
- Structural/O&M


**High Infiltration Sewer Basin**

**Recommended Construction Date**

- Contract 1
- Contract 2
- Contract 3
- Contract 4

**Geographical Features**

- City/Town Boundary



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City of Portsmouth, NH

**Figure 4-3: Collection System Rehabilitation**

**Manhole and Pipe Recommendations**

MAP 1 of 3

