OVERVIEW AND RECOMMENDATIONS FOR SEWER SYSTEM

B&V PROJECT NO. 185502

PREPARED FOR

City of Fairview Park, Ohio

30 OCTOBER 2014

BLACK & VEATCH
Building a world of difference.

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1.0 Purpose

The City of Fairview Park, Ohio (City) has been experiencing severe flooding over the past decade, and in some areas as far back as 1963, based on the first documented report we found discussing flooding issues within the City. Flooding is occurring throughout the City with the severest occurring in the West and Southwest areas of the City.

The City has made a significant investment of approximately $9 Million over the past 15 years in your sewer system. The City has experienced a reduction in flooding in areas of investment, with the next step to develop a plan to further reduce flooding in other areas of the City.

The City of Fairview Park retained Black & Veatch Corp. to perform the following scope of services:

1. Review of all data available
2. Develop recommendations for location and number of flow meters
3. Develop general recommendations based on our review of data for "next steps" to take (i.e., flow metering, CCTV, inspections, testing, model, etc.) for critical areas within the City.

The goal and objective of this overview is to provide the City a road map to address and resolve the City's flooding problems. A phased approach will provide an opportunity to identify the root cause of the problem thereby the ability to develop and implement a plan to reduce flooding within the City.

This approach will include a collaborative effort with the City, City Engineer, Mackay Engineering Surveying Company and Black & Veatch to develop the right solutions to solve your basement flooding and challenges with your sanitary and storm sewer system. `

The following pages provide an overview and recommendations for next steps for the City.

2.0 Existing Sewer Infrastructure

The City's system was constructed to operate separate storm sewer and sanitary sewer systems. The sanitary system is serviced by two facilities. North Olmsted Wastewater Treatment Plant (WWTP) serves the Ward 5 area and the rest of the City is serviced by the Rocky River WWTP. Based on system characteristics, the sewer system can be divided into five areas. The five areas are: 1- Area North of Lorain Road and West of West 210th Street; 2- Area North of Lorain Road and East of West 210th Street; 3- Area south of Lorain Road, North of old Parkview Village and West of West 210th Street; 4-Ward 5 Area (old Parkview Village); and 5-Area South of Lorain Road and East of West 210th Street.

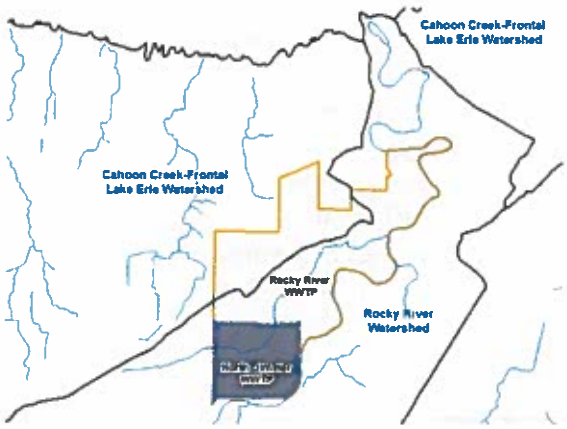


Figure 1: Watershed Areas

The area North of Lorain Road and West of West 210th Street drains North towards Lake Erie. Both the storm and sanitary sewers drain through a gravity sewer into the City of Rocky River collection system. This part of the City was built in the 1920's and 1930's. Sections of this area continue to experience basement flooding.

The area North of Lorain Road and East of West 210th Street drains North toward Lake Erie. Both storm and sanitary sewers drain through a gravity sewer into the City of Rocky River collection system. This part of the City consists of both older and newer systems. Some systems were built in the 1920's and 1930's, while others were built in the 1970's and 1980's.

The area South of Lorain Road, North of Mildred Avenue and West of West 210th Street drains North toward Lake Erie. Both storm and sanitary sewers drain North into the Rocky River collection system. This area was built in the 1920's through 1950's.

The Ward 5 area (old Parkview Village) drains toward North Olmsted for sanitary sewer and to Coe Creek for storm sewer. This area was built in the 1950's and 1960's. Sections of this area continue to experience basement flooding.

The area South of Lorain Road and East of West 210th Street drains North to Rocky River for sanitary sewer and to Coe Creek for Storm Sewer. This area was constructed in the 1940's through 1960's.

The majority of the system was constructed before the 1980's. Most of the projects completed after the 1980's were sewer rehabilitation projects, with a few sewer replacement projects to address local issues. Since the majority of the system was constructed between 50-90 years ago, in addition to the sewers being past their useful design life, they more than likely do not meet current design standards. Current standards for sizing of storm sewers in residential areas are typically based on a 5-year storm event and are not constructed within the same trench as a sanitary sewer. Based on our review of past reports these construction conditions appear to be standard practice and are typical of that era. It has also been documented the storm sewers were not designed for a 5-year storm event. Additional field investigations would be required to confirm these statements.

3.0 System Characterization

Over the past 15 years, the City has spent approximately $9 million to address collection system issues and basement flooding in the entire City and to reduce inflow and infiltration (I/I) to the Rocky River WWTP. This $9 million consisted of sewer maintenance projects, sewer repair projects, pump station improvements and sewer replacement projects. The sewer maintenance and repair projects and pump station improvements have successfully kept the storm and sanitary sewer collection system and pump stations functioning. The sewer replacement projects performed have successfully reduced or eliminated basement flooding and corrected pipe deficiencies in the areas where the work was performed. These completed projects also decreased the amount of wet weather flow to the Rocky River WWTP.

One project of note is the 2004 Wooster Rd project, a joint project with Rocky River which removed the bottleneck at the City boundary and greatly improved the capacity of the system in this area.

Figure 2 shows the rehabilitation projects and Figure 3 shows the rehabilitation projects completed over the past 15 years as previously described. Full size maps of each figure are included in the Appendix.

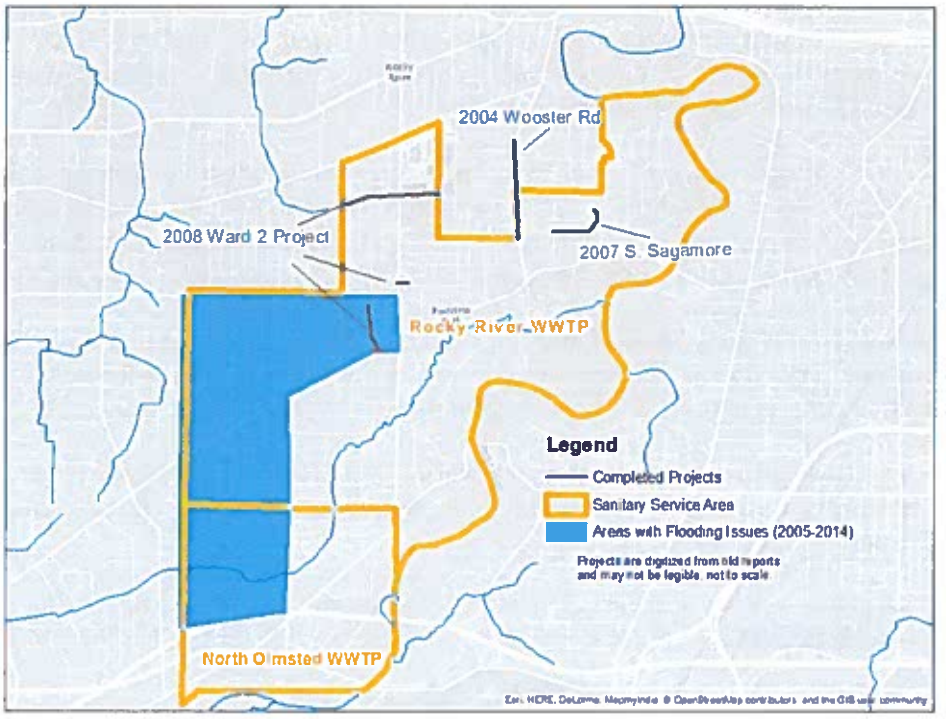


Figure 2: Completed Replacement Projects

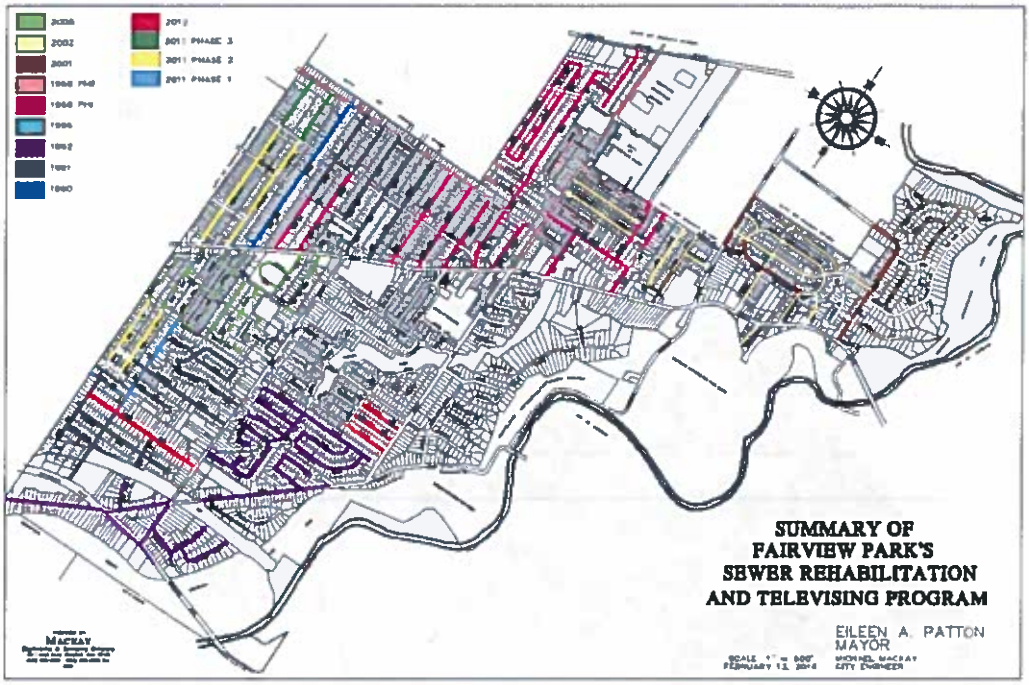


Figure 3: Sewer Rehabilitation and CCTV Program by Mackay Engineering & Surveying Co.

In addition to the above work previous system wide capacity issues were studied in two comprehensive studies, the 1963 Havens and Emerson and the 1983 Ward 5 SSES report. As shown in Figure 4 below, wide spread storm sewer capacity issues were identified in the area north of Lorain Rd; sanitary deficiencies were found in Ward 5 and some areas along Coe Creek. A detailed project list is located in the Appendix.

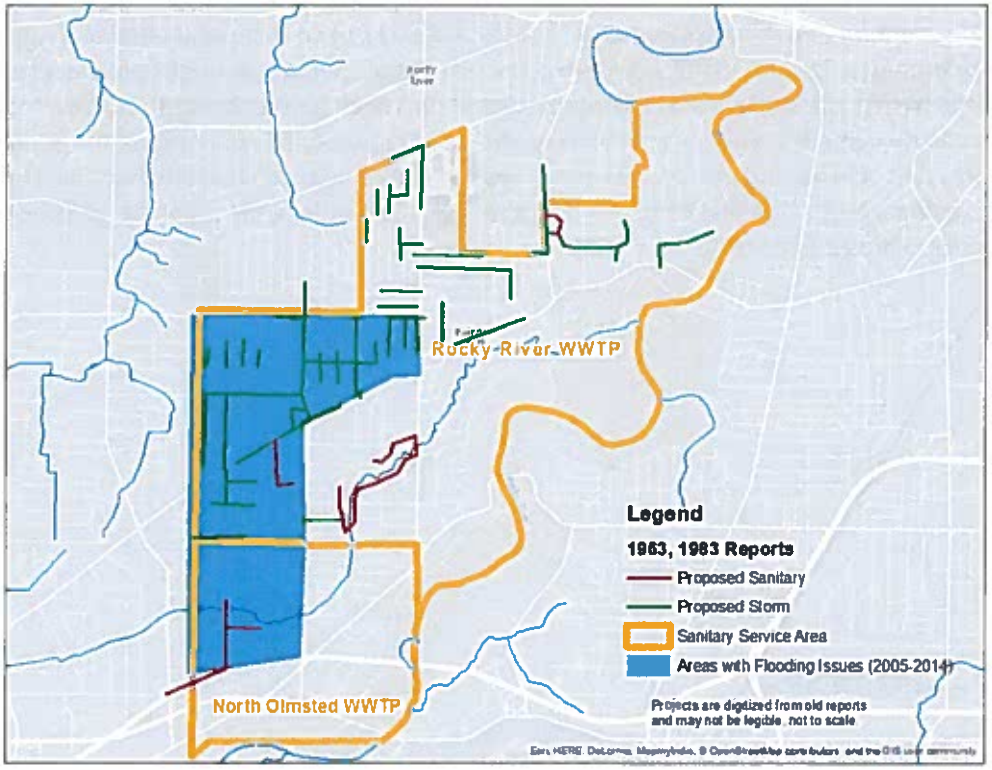


Figure 4: Previous Master Planning Projects

However, as shown on the flooding map in Figure 5, the May 2014 storm event still caused basement backups in the Ward 5 area and the August 2014 storm event caused basement backups in the northwest corner north of Lorain Road. These events were high intensity rains in very localized areas. Recent sewer rehabilitation projects were completed in parts of these areas. A full size map is included in the Appendix.

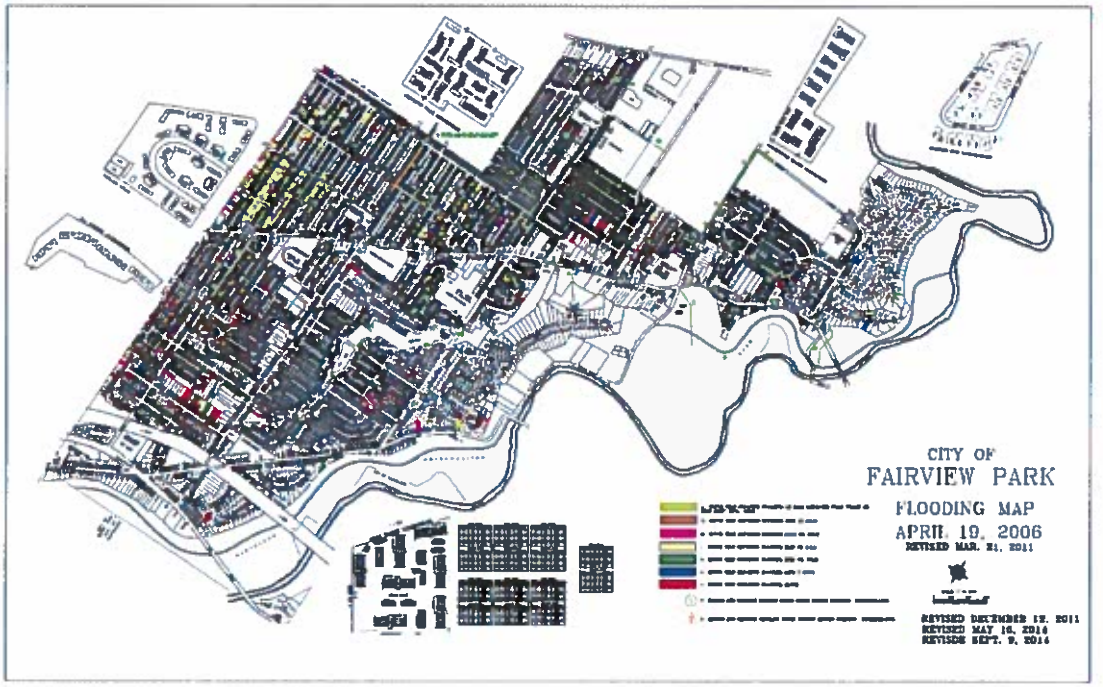


Figure 5: Flooding Map by Mackay Engineering & Surveying Co.

In addition, sanitary and storm sewer sizes, grades and flows need to be evaluated to determine if they are properly sized. In many older areas the storm and sanitary sewers were constructed in the same trench, the storm sewers are constructed on a shelf above the sanitary sewers and pass directly through the sanitary manholes as shown in Figure 6. The majority of the manholes are constructed of brick and mortar. The pipes are typically constructed of vitrified clay (typical five foot sections) with slip-seal joints. As the pipes age, cracks along the pipes, at joints and in the manholes started to develop.

As a result, when it rains, water migrates out of the storm sewer and enters the sanitary sewer through cracks and other deficiencies within the infrastructure. This source of water entering the sewer system is identified as Inflow and Infiltration (I/I). Another source of inflow into the sanitary comes from private home owner connections into the sanitary sewers. While this was an acceptable practice when the sewers were constructed, subsequent legislation has made it illegal to connect storm water connections into a sanitary sewer.

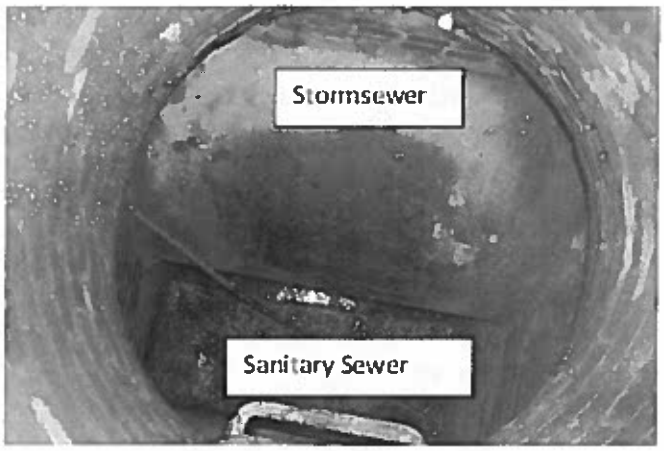


Figure 6: Typical Storm and Sanitary Sewer Configurations in the City

The sanitary sewers are relatively shallow compared to the basements in many areas of the City. During a storm event, in areas where the storm sewer is undersized, runoff cannot be conveyed by the storm sewer system resulting in flooding of the streets. The resulting flood water ends up in the sanitary sewer causing basement backups locally or downstream where bottlenecks may exist.

Due to the fact that the storm and sanitary sewer were built so close to each other, most of the sanitary sewer issues cannot be solved without addressing the storm water system capacity issues.

4.0 Summary of Reports and Information Reviewed

A detailed list of past sewer reports and project memos completed for the City over the years was prepared by Mackay Engineering and Surveying Company on Feb 19, 2014 and submitted to the City. Black & Veatch received various forms and level of information for each of the below reports and memos:

- 1963 (January) – Summary of the Comprehensive Plans of Sanitary Sewerage and Storm Drainage for the City of Fairview Park, Prepared by Havens & Emerson
- 1983 (February) – Ward 5 SSES Report, Prepared by Alex Kanarefff & Associates
- 2006 (April) – Sewer Evaluation Report, Prepared by Mackay Engineering & Surveying Co.
- 2006 (May) - Sewer Study Project List
- 2009 (November) – Future Sewer Projects Preliminary Estimate of Probably Cost, Prepared by Mackay Engineering & Surveying Co.
- 2011 (December) - COE Creek HEC RAS Study, Prepared by Mackay Engineering & Surveying Co.
- 2011 (December) – Long Term Action Plan to Alleviate Basement Flooding, Prepared by Mackay Engineering & Surveying Co.
- 2011 (December, updated) - Flooding Map, Prepared by Mackay Engineering & Surveying Co.
- 2011 & 2012 – Summary of Houses that failed smoke testing, Prepared by Mackay Engineering & Surveying Co.
- 2014 (February) – Sewer Grouting Map, Prepared by Mackay Engineering & Surveying Co.
- Listing of major sewer projects completed since 1991.

Below is a brief summary of projects proposed in 2009 to be completed as part of the City's Capital Improvement Plan (CIP) and as shown on Figure 7 to eliminate and separate inverted sewers (storm over sanitary with plated common manholes) on Stanford Avenue, Belvidere Avenue, and Carolyn Avenue and to separate the deteriorating storm and sanitary sewers that are in the same trench on Woodstock Avenue and Eastwood Avenue. A full size map is included in the Appendix.

- Woodstock Avenue (W. 210th St to Alberta Ave)
- Woodstock Avenue (Alberta Ave to W. 204th St)
- Stanford Avenue (entire length)
- Belvidere Avenue (entire length)
- Eastwood Avenue (300th East to W. 210th to W. 204th)
- Carolyn Avenue

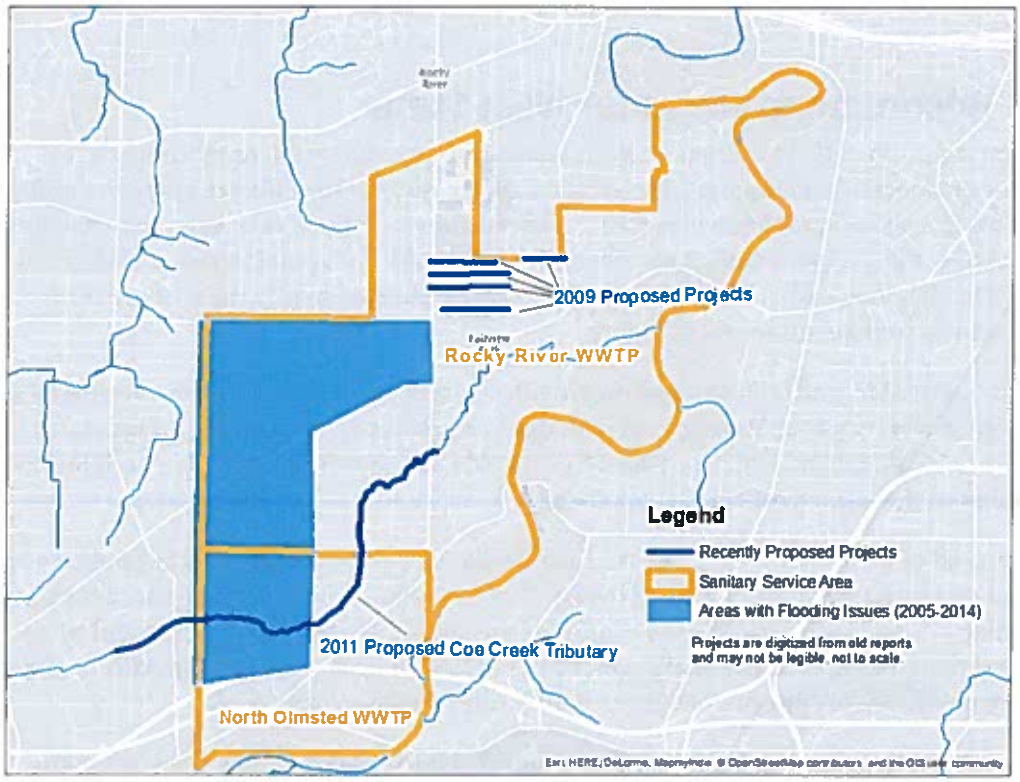


Figure 7: Recently Proposed Projects included in the City's CIP

In 2011, the Coe Creek HEC-RAS Study was conducted by Mackay Engineering and Surveying Co. to study the feasibility of relieving flooding issues along Coe Creek. Modifications to the creek bed and culverts to lower the water levels in Coe Creek during rain events were evaluated. The study recommended lowering Coe Creek and the culverts beginning with the Eaton/Bain Park culvert and working upstream with an estimated construction cost of over $2 million.

5.0 Recommendations for Next Steps

Over the years, the City has adopted a systematic approach that involves reaching out to residents, inspecting and repairing the sanitary sewer system. The effort resulted in localized successes in areas where the sewers were replaced. However, flooding and basement water backups are still one of the top issues for residents and City. As a result, a comprehensive and detailed engineering and planning process is recommended to identify the root cause of flooding in the remaining areas in the City.

The City's past SSES and I/I investigation provided a basic guide for improvements identified within your sewer system. However, as with most communities, recommendations were not always implemented and results are 30-50 years old and require updating due to changing conditions in the infrastructure and community.

The removal of I/I from private properties can be challenging and a financial burden on your customers depending on the source of the I/I. Cost can range from several hundred for the disconnect of roof drains into the thousands for the disconnection of foundation and sump pump systems. Based on these challenges, communities typically exhaust all means to remove I/I from public sewers prior to moving to addressing private sources of I/I.

Based on current successes, the city will continue its efforts to make improvements to the collection system to remove I/I from the public sewers while at the same time recognizing there exists I/I concerns from private sources which also needs to be addressed.

The goals of our recommendations are to provide the City with simple steps to develop your plan to identify and develop a long term solution to resolve your flooding issues.

5.1 SHORT TERM RECOMMENDATIONS

We recommend the City suspend moving forward with projects identified within your CIP that are not directly associated with severe flooding areas. Projects identified in areas with minor or more localized flooding should first be reviewed to see if cleaning or CCTV of the sewer has been performed since the flooding occurred. Also, at this time, it may be difficult to identify if the flooding is a result of a capacity issue with the sanitary or storm, or may be an opportunity to successful remove I/I to the system in lieu of replacement. This step may identify a less costly solution to rehabilitation or replacement.

To fully understand the interaction of your sanitary sewer system it is critical to model your system. Modeling can be expensive, therefore we are recommending a "skeletal model" of the areas identified above which continue to flood. This will provide information on the current capacity, available capacity, bottlenecks, and amount of I/I entering the system. Flows into the system will be calculated based on the EPA Ten States Standards. The model will require calibration with flow metering data to verify the model. These two steps should be completed as soon as possible to provide an understanding of the conditions in this area.

We anticipate the short term steps to occur over the next year. Some of the following tasks are quick and simple tasks that can be completed by the city or others. Other tasks require a larger investment of time and technical expertise and should be completed by an engineer.

We recommend the following steps:

Table 1: Short Term Steps

STEP	TASK	BENEFIT	WHEN
1.	Development of Skeletal Model using the free EPA SSOAP	Determine Hydraulic capacity of the sewers (sanitary and storm), bottlenecks, capacity issues. The flow metering data will be used to validate the results of the model	Immediately
2.	Flow Metering	Establishes dry weather flows in the sewer and I/I entering the sewer system based on rainfall events.	Ideal conditions are to meter during all season, but due to cost recommend performing during Spring Months (March -May) with the option to extend if significant storms are not recorded.
3.	Level Monitoring Program	Considered a cost effective tool to quickly identify bottlenecks in the system. A simple level sensor can be easily installed and maintained by the City. All the hardware is installed on the back of a manhole cover so the sensor can be easily moved from one location to another. As a result, the City can easily monitor a large number of sites by moving the level sensors around between storms.	Same as Tasks 2. This Tasks is considered optional
4.	Coe Creek HEC-RAS Study Update	A detailed study of the impact on the collection system is recommended to compare the hydraulic grade lines in the storm and sanitary collection systems before and after the project.	This Task can either be started immediately or after completion of Task 1-3.
5.	Perform detailed review of recent CCTV inspection reports and recommendations from the past 5 years.	Identify critical structural issues and areas identified with significant I/I. These results will be evaluated with the flow metering and model to establish a priority to perform both public and private I/I removal programs.	This Task can either be started immediately or after completion of Task 1, or concurrent with Task 2.

STEP	TASK	BENEFIT	WHEN
6.	Review current Best Management Practice (BMP)Procedures	Determine if appropriate resources and funding is available to maintain a proactive program in lieu of a reactive program. Some examples include: regular cleaning of sewer and storm sewer systems, sweeping of streets, dredging of ditches, exercising valves and pump station maintenance. Improve documentation of flooding incidents to trace the causes when possible, applying asset management principles for maintenance work. There is also newer technology called SL-RAT that can be used prior to performing CCTV inspection to prioritize which sewers have a potential for higher deficiencies that can be implemented either by the City or a contractor. Depending on findings, work with City to revise BMP procedures.	Immediately
7.	City Ordinance Review	Determine Legal Mechanism to address Private I/I issues	Immediately
8.	Evaluate I/I removal options (Private)	Based on the results of Tasks 1-3 and 5 above identify next steps to further investigate and identify private property issues. This step would use data already collected by the City Engineer in 2011 and 2012. Based on the amount of I/I evaluate the cost effectiveness and other non-monetary reasons to move forward with recommendations for removal.	Complete after Tasks 1-3, 5 and 7
9.	Evaluate I/I removal options (Public)	Based on the results of Tasks 1-6 above identify next steps. Steps may include removal of private property, replacement/rehabilitation of storm or sewer lines.	Complete after Tasks 1-6, suggest performing concurrent with Task 8
10.	Evaluate alternatives for implementation	With the advancement over the years with trenchless technologies, use of this technique is very common in lieu of past grouting and point repairs. In older sewers and especially Vitrified clay pipe (VCP) sewers with joints every five feet these techniques shift the I/I problem to the next weakest joint creating another fix in the near future. Each area identified will be evaluated for the appropriate and most cost effective solution	Complete after Tasks 1-9

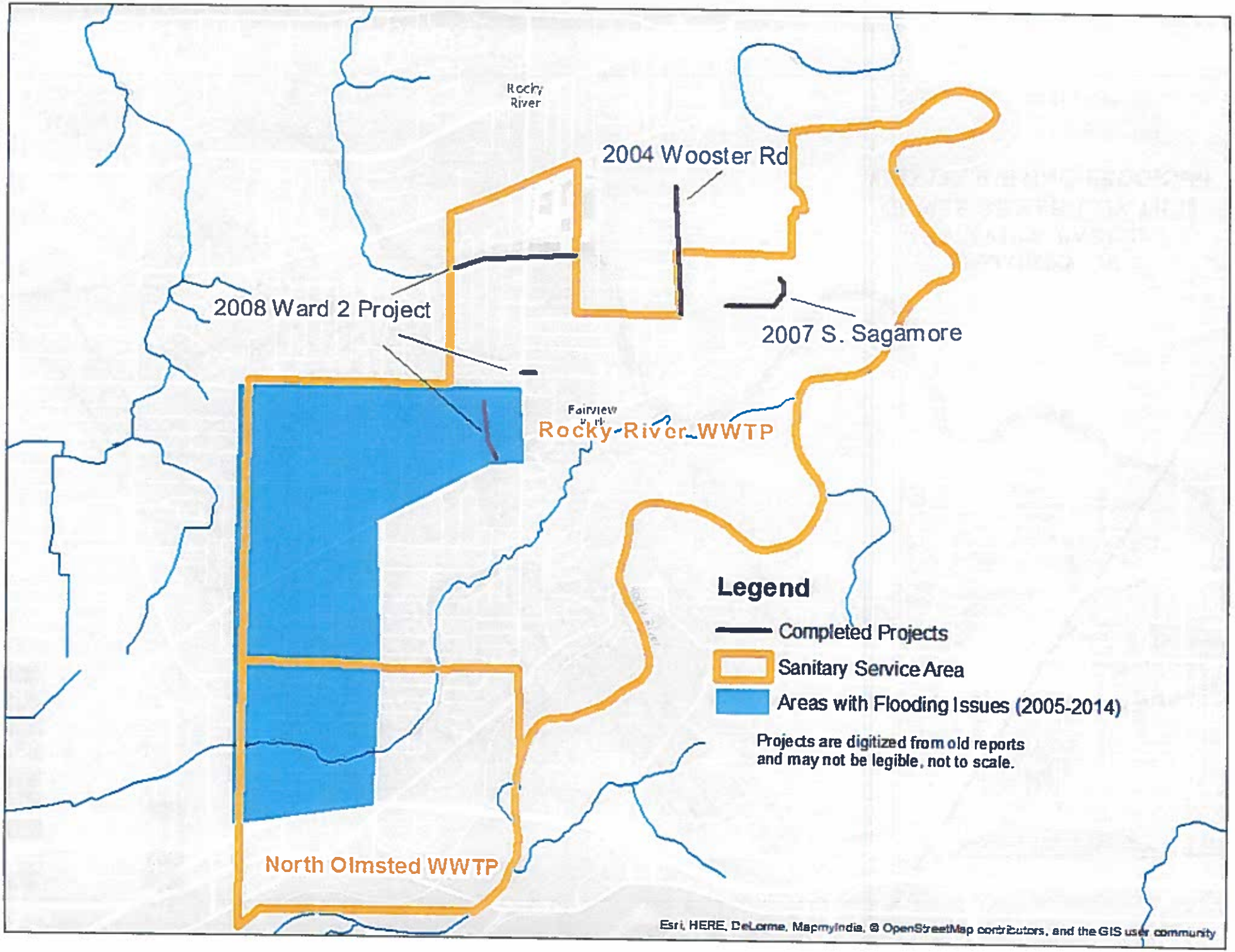
STEP	TASK	BENEFIT	WHEN
11.	Evaluate available funding options	Based on limited financial resources of the City, it will be critical to find funds to support implementation of the program	Immediately
12.	Develop list of recommended Projects/Programs for implementation	Based on the results of the above tasks, this step will provide a prioritization of projects/programs to implement based on the effectiveness to remove, cost, overall impact to City and reduction of flooding.	Complete after Tasks 1-11

5.2 LONG TERM RECOMMENDATIONS

In order to eliminate all the mainline capacity related flooding and basement backup issues, major CIP projects will likely be required in several areas including: sanitary sewers, storms sewers, BMP, identifying and removal of private property I/I. The most cost-effective way of optimizing large projects is a system wide model as noted above. The model can help the City save millions of dollars on construction by comparing a large number of alternatives to identify the most cost-effective design.

Once the City has completed the recommended Short Term Recommendations a list of prioritized projects and programs will be recommended for the City to sustain and implement Long Term.

APPENDIX


Rocky River
2004 Wooster Rd
2008 Ward 2 Project
2007 S. Sagamore
Fairview Pk
Rocky River WWTP
North Olmsted WWTP
Legend
Completed Projects
Sanitary Service Area
Areas with Flooding Issues (2005-2014)
Projects are digitized from old reports and may not be legible, not to scale.
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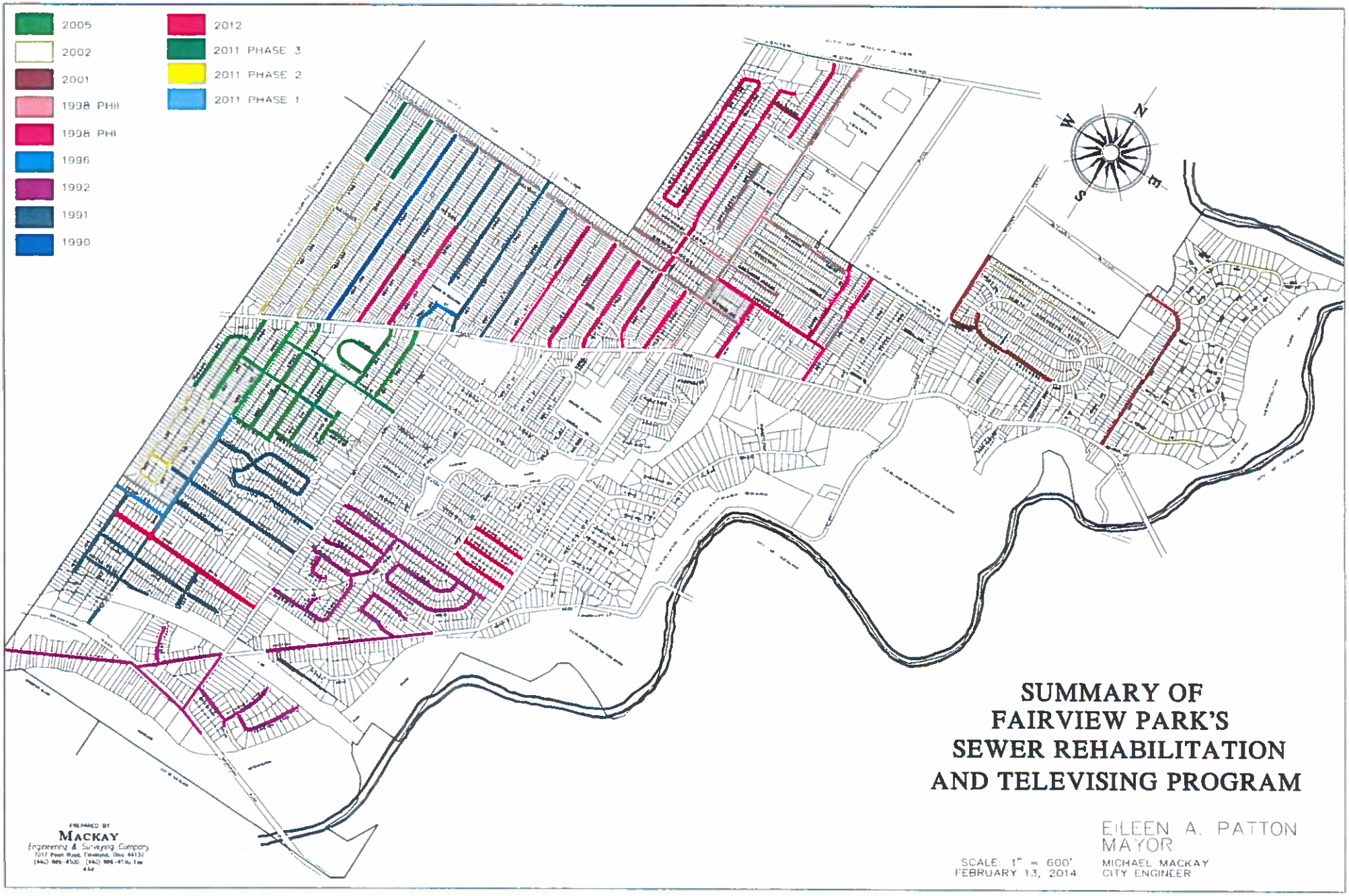
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2002
2001
1998 PHII
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2011 PHASE 3
2011 PHASE 2
2011 PHASE 1
N
W
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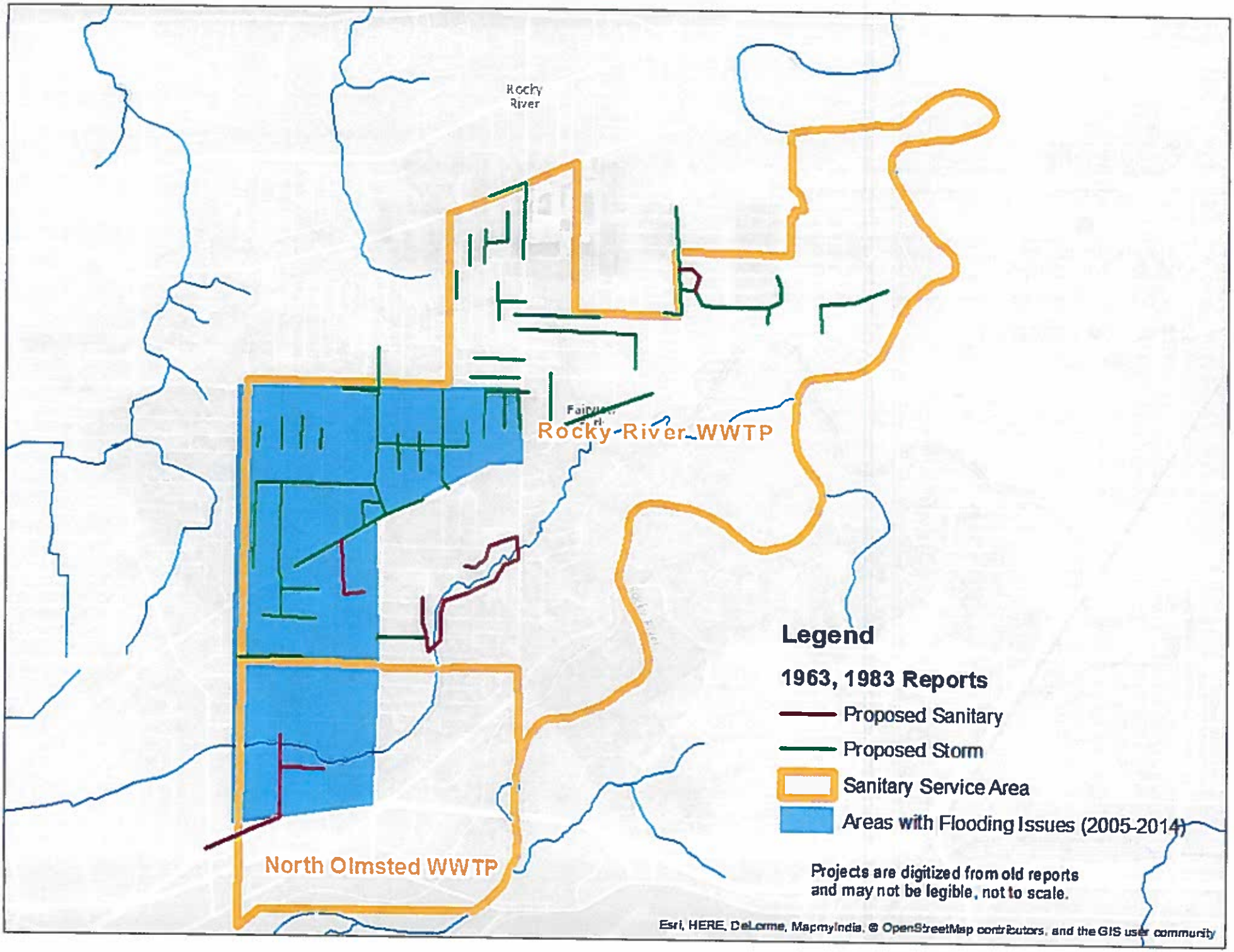
S
SUMMARY OF
FAIRVIEW PARK'S
SEWER REHABILITATION
AND TELEVISING PROGRAM
EILEEN A. PATTON
MAYOR
SCALE: 1" = 600'
FEBRUARY 13, 2014
MICHAEL MACKAY
CITY ENGINEER
PREPARED BY
MACKAY
Engineering & Surveying Company


Rocky River
Rocky River WWTP
North Olmsted WWTP
Legend
1963, 1983 Reports
Proposed Sanitary
Proposed Storm
Sanitary Service Area
Areas with Flooding Issues (2005-2014)
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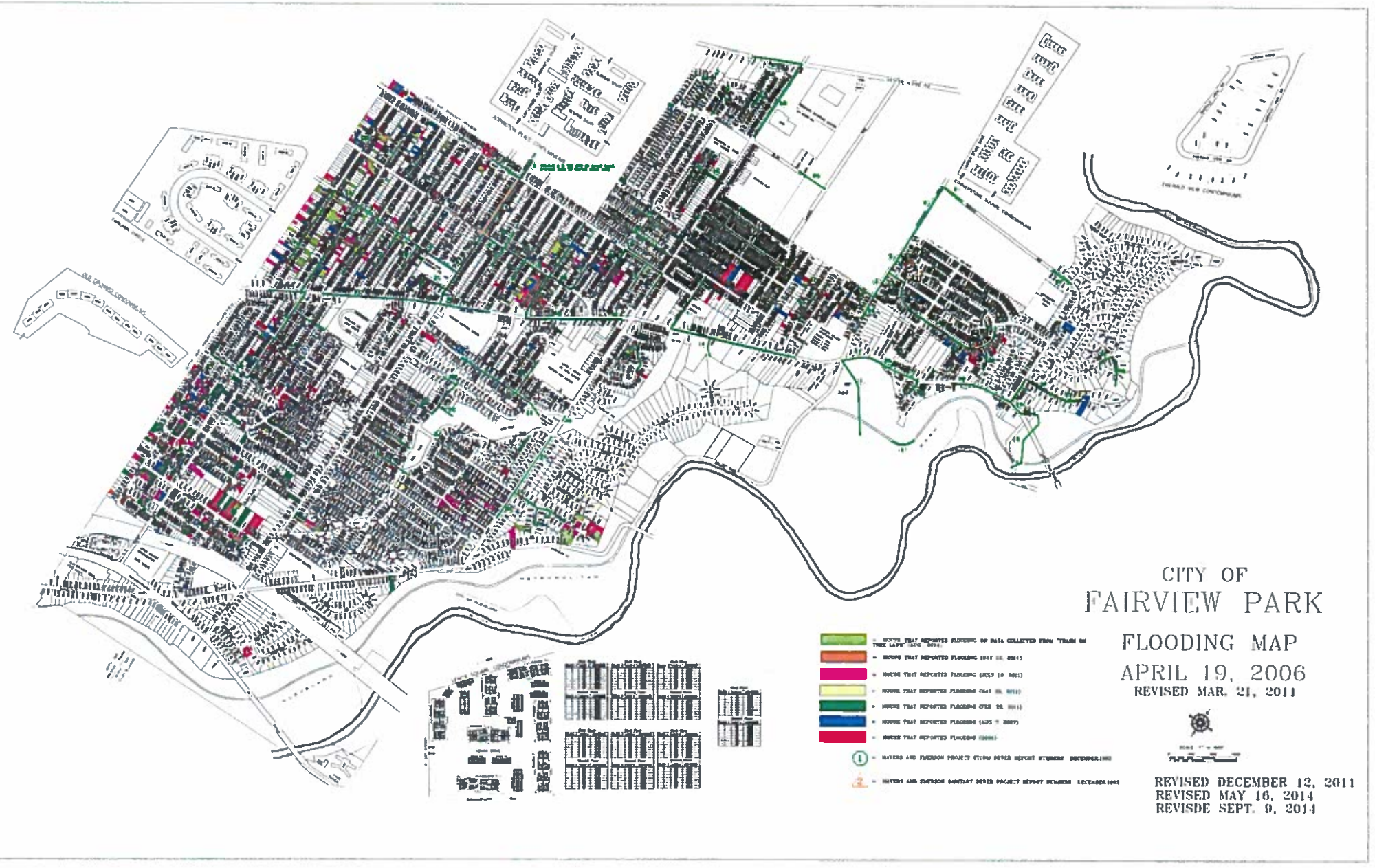

CITY OF
FAIRVIEW PARK
FLOODING MAP
APRIL 19, 2006
REVISED MAR. 21, 2011
REVISED DECEMBER 12, 2011
REVISED MAY 16, 2014
REVISDE SEPT. 9, 2014

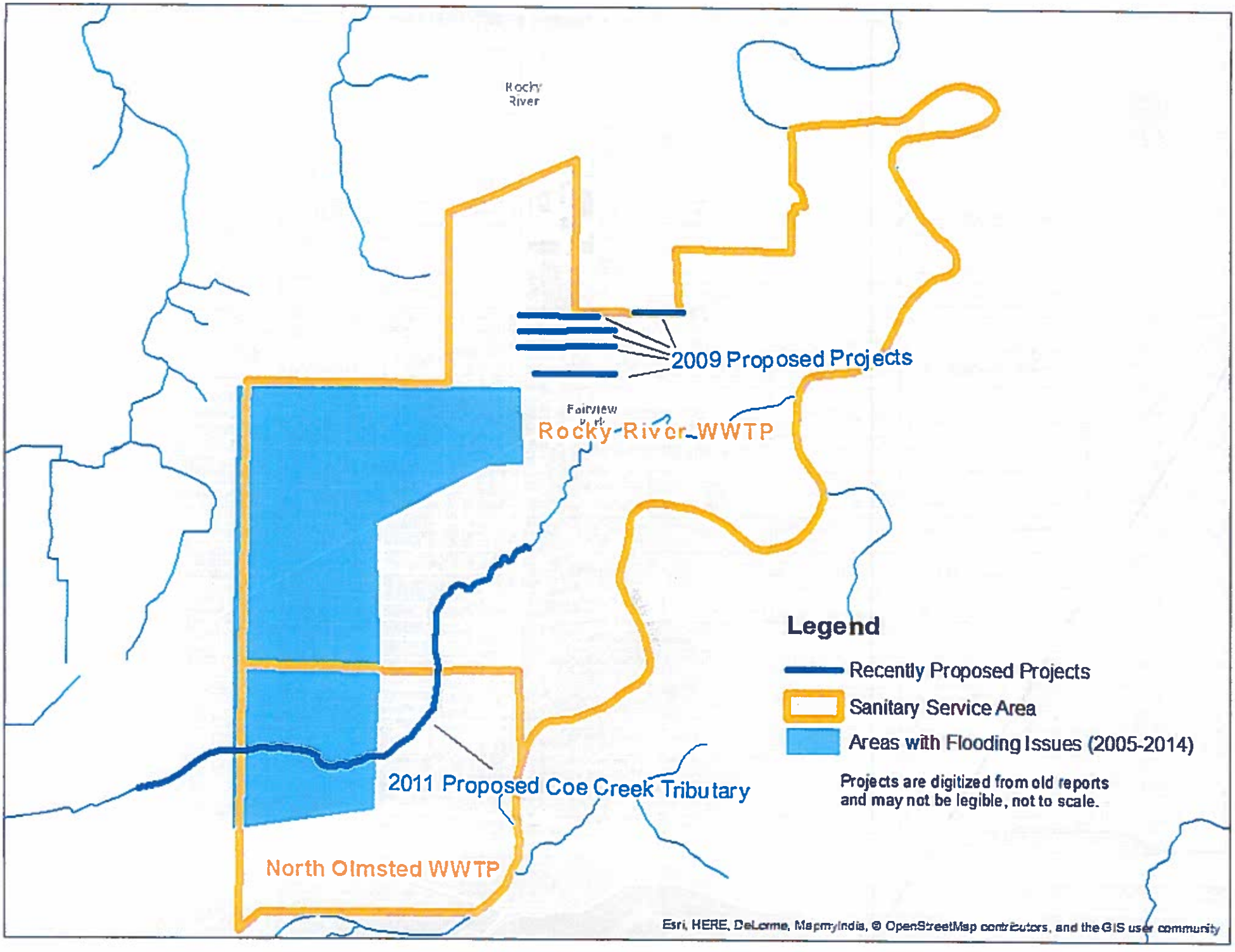
1963 Ravenna and Emerson Report Recommended Projects Compiled by Mackay Engineering & Survey Company

Sanitary Sewer Improvements

H&E Project Number	Recommended Improvement	Status	Comments
1	West 220th/Clifford/Regulator Chamber	Sanitary Relief Completed	
2	North Sagamore/Onoko (Coffinbury to West 199th)	Sanitary Relief Completed - Onoko (from Wooster to N.Sagamore) and N. Sagamore (from Onoko to S. Sagamore ending at W. 198th Street) Done 1982	

Storm Sewer Improvements

H&E Project Number	Recommended Improvement	Status	Comments
1	Mastick Road (Wooster Hill) to Rocky River	1 & 17 Combined completed in 1973	
2	Spencer Road (Center Ridge to Westwood)	Done/No Plans/No Date	Sanitary Relief Completed - Spencer (from Westwood to Addington)
3	West 220th/Alexander/W227/Morton/	No Storm - Sanitary Relief Sewer - 1982 - Not on Alexander, Sanitary on Clifford	Sanitary Relief Completed - Morton Avenue(from W.225th to W.227th), W.227th (from Lorain to Morton), W.227th (from Lorain to Clifford), W.220th (from Clifford to Westwood)
4	West 208th/Lorain Road to Coe Creek	Partially Done - a storm relief for Lorain Road into Coe Creek - No work on West 208th 1960's	
5	Coe Creek Culvert in Metro Parks	Unknown	
6	Wooster Road (Carolyn to Creek at Story Road)	2004	Sanitary Relief Completed Wooster(from Onoko to Henry)
7	Coffinberry/South Sagamore (Wooster to W198)	No Storm - Sanitary Relief Sewer - 1982	
8	Clifford/West 216th (West 220 to Lorain)	Not Done	
9	West 220th (Alexander to Lorain)	Not Done	
10	West 227th/Doris	No Storm - Sanitary Relief Sewer - 1982	Sanitary Relief Completed - Lorain to Morton
11	Stanford Avenue (West 202 to West 210)	Not Done	
12	Hilledale Avenue (West 214th to Coe Creek)	Not Done	
13	Westwood Avenue (West 212th to West 210th)	Not Done	
14	South Sagamore (West 196th to West 192nd)	Not Done	
15	Eaton Road/West 210	Not Done	
16	Circlewood Drive/Morton Ave	Not Done	
17	Lorain Road (West 164th to West 196th)	1 & 17 Combined completed in 1973	
18	Lorain Road (West 189th to the Rocky River)	Done - No date	
19	229/Alexander/Orchard/Parkview Line Easement/Lorain/Doris	Parkview Easement Completed - others not done	
20	Westwood (West 223 to West 220)	Not Done	
21	West 223/Lorain Road	Not Done	
22	Lorain/West 214/Clifford/West 215/West 217/West 219	Not Done	
23	Lorain/Bawden/West 212/West 211/West 210 /Northwood/Eastwood	Not Done	
24	West 202	Not Done	
25	Addington Boulevard	Unknown	Sanitary Relief Completed - (from Spencer Road east to City Line)
26	West 210 (Addington to Center Ridge)	Not Done	
27	Center Ridge Road	Unknown	
28	Glenber/West 212/West 213/West 214	Not Done	
29	Hilsdale/West 215/West 210	Not Done	
30	North Park/West Park/Parkdale	Not Done	
31	Eaton/Seabury/Cromwell	Not Done	
32	West 211/Eaton/Parkcliff/West 210	Not Done	
33	Angela	Not Done	
34	Carolyn	Not Done	
35	West 199/South Sagamore/West 192/West 193/West 194/West 196	Not Done	
36	Lorain Road	Not Done	
37	River Cliff/West 189/Story Road	Not Done	Sanitary Relief Completed - Story Road (from West Valley to Eldorado)
38	Lookout Circle/West Valley	Not Done	


Rocky River
2009 Proposed Projects
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