City of Shreveport, Louisiana

Condition Remedial Measures Plan (CORMP)

January 31, 2023

CITY OF SHREVEPORT

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Condition Assessment Remediation Measures Plan

SUBMITTAL CERTIFICATION

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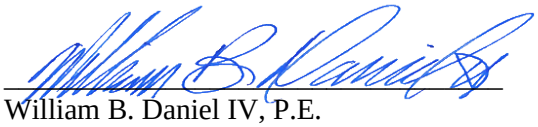

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1/27/2023
Date

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
Ac	Acres
ADDF	Average daily dry-weather flow
BKI	Burk-Klienpeter, Inc
BMcD	Burns & McDonnell Engineering Company, Inc.
CARMP	Capacity Assessment Remedial Measures Plan
CORMP	Condition Remedial Measures Plan
CCTV	Closed-Circuit Television
CDG	Civil Design Group, LLC
cfs	Cubic feet per second
City	City of Shreveport
CIPP	Cured-In-Place Pipe
EPA	Environmental Protection Agency
Ft	Feet
fps	Feet per second
Gal	Gallons
GIS	Geographic Information System
GPS	Global positioning system
Hr	Hour
In	Inches
IFB	Issue for Bid
IFC	Issue for Construction

Abbreviation	Term/Phrase/Name
LA	Louisiana
LiDAR	Light detection and ranging
NASSCO	National Association of Sewer Service Companies
MACP	Manhole Assessment Certification Program
MG	Million gallons
MGD	Million gallons per day
PACP	Pipeline Assessment Certification Program
RMP	Remedial Measures Plan
SSA	Sanitary Sewer Assessment
SSES	Sanitary Sewer Evaluation Surveys
SSO	Sanitary sewer overflow
TM	Technical memorandum
WCTS	Wastewater Collection and Transmission System
WWTP	Wastewater Treatment Plant
Yr	Year

1.0 INTRODUCTION

The City of Shreveport (City) is implementing various utility operational and management programs and a significant Capital Improvement Program (CIP) to address the requirements of a Federal Consent Decree (Case No. 5:13-cv-3065) to reduce the occurrence of sanitary sewer overflows (SSOs). The Consent Decree (CD) became effective on May 13, 2014 and requires the City to address defects that allow infiltration and inflow (I/I) (Section VI. B. ¶ 27 (j), C. ¶ 31, (a and b) and ¶ 33). The City completed sanitary sewer assessment (SSA) activities and developed remedial measures plan (RMP) reports to address the CD requirements. The City then proceeded to make significant investments totaling more than $400 million in its wastewater collection system by completing capital improvement projects focused on I/I reduction through collection system renewal and replacement.

After an evaluation of the City's program was completed in 2020, it became apparent that addressing all defects that allow I/I is not an affordable or cost-effective approach to reducing SSOs. It was also evident that the City needed to complete wastewater and drinking water projects (other than collection system renewal and replacement) to maintain compliance and reliable utility service. As a result, the City identified, developed, and is delivering Critical Projects to mitigate SSOs and maintain compliance and reliable utility service. This report has been developed to document remedial measures undertaken by the City to date, summarize the current projects being delivered, and to outline the path forward for addressing condition-related items in the City's wastewater utility through an adaptive management approach.

1.1 Previous Reports

Sanitary sewer assessment (SSA) activities completed to address the requirements of the Consent Decree were summarized by the City's previous wastewater master planning consultant, Burk-Kleinpeter, Inc. (BKI) in SSA reports previously submitted to EPA. Projects to address collection system defects were identified by BKI in Remediation Measures Plans (RMP) for each Phase. **Table 1-1** and **Table 1-2** provide a summary of the SSA and RMP report submittals developed by BKI on behalf of the City and submitted to EPA, respectively. A summary of these reports is provided in Sections 3 and 4.

Table 1-1: SSA Report Submittals

Phase	Phase Description	Completion Deadline Per Consent Decree	Submittal Date
1	Cedar Grove	7/13/2015	7/8/2015
2	Southside, Queensboro, North Highlands, Westside, and Choctaw Bayou	1/13/2017	9/15/2016
3	Cooper Road, Wallace, and Broadmoor	7/13/2018	11/28/2017
4	Stoner, North Pierre Bayou, Bickham Bayou, Country Club, and LSU Basin	1/13/2020	1/10/2020
5	Princess Park, Texas Pierre, Boggy Bayou, Agurs, Highland, Springfield, Gilmer Bayou, Shorewood, Flournoy Bayou, Page Bayou, Cross Bayou, Lower Cross Lake, and Lakeview	7/13/2021	In Progress – 55% Complete

Table 1-2: RMP Report Submittals

Phase	Phase Description	Completion Deadline Per Consent Decree	Submittal Date
1	Cedar Grove	9/13/2015	9/9/2015
2	Southside, Queensboro, North Highlands, Westside, and Choctaw Bayou	3/13/2017	9/20/2016
3	Cooper Road, Wallace, and Broadmoor	9/13/2018	12/5/2017
4	Stoner, North Pierre Bayou, Bickham Bayou, Country Club, and LSU Basin	3/13/2020	3/12/2020
5	Princess Park, Texas Pierre, Boggy Bayou, Agurs, Highland, Springfield, Gilmer Bayou, Shorewood, Flournoy Bayou, Page Bayou, Cross Bayou, Lower Cross Lake, and Lakeview	9/13/2021	In Progress (See Discussion Below)

In addition, the City's Critical Projects have been previously summarized in the Year 6 Annual Report, the Year 7 Annual Report, the Year 8 Annual Report and other submittals to EPA. This report provides a summary of these projects in Section 5.

1.2 Focus and Intent of this Report

This report is one of the stages in the City's multi-stage effort to improve the condition of its wastewater utility infrastructure. The initial stage included the first six years of the City's Consent Decree program, during which the City completed remedial measures in the Phase 1 and Phase 2 areas. The next stage, which began in 2020, includes identification, development, and delivery of the City's Critical Projects described

in Section 5. Future stages include continuing to improve the performance of the City's wastewater utility infrastructure through an adaptive management approach.

Accordingly, this Condition Remedial Measures Plan Report (CORMP) has been developed to summarize the previously completed Sanitary Sewer Assessment (SSA) and Remedial Measures Plan (RMP) reports. SSA work completed by the City is described in Section 3. The remedial measure work completed by the City since the effective date of the Consent Decree is documented in Section 4. This report also summarizes the City's Critical Projects in Section 5. Lastly, this report outlines the process which will be used to continue identifying, developing, and delivering projects focused on addressing significant defects that cause or contribute to SSOs in Section 6.

2.0 WASTEWATER SYSTEM OVERVIEW

The City owns, operates, and maintains the Wastewater Collection and Transmission System (WCTS), which is comprised of the physical infrastructure (gravity sewer pipes, manholes, lift stations and forcemains, and wastewater treatment facilities) that provides wastewater service to the residents and businesses throughout the City of Shreveport, Louisiana. This Section provides an overview of the major system components of the WCTS.

2.1 Wastewater Collection and Transmission System Overview

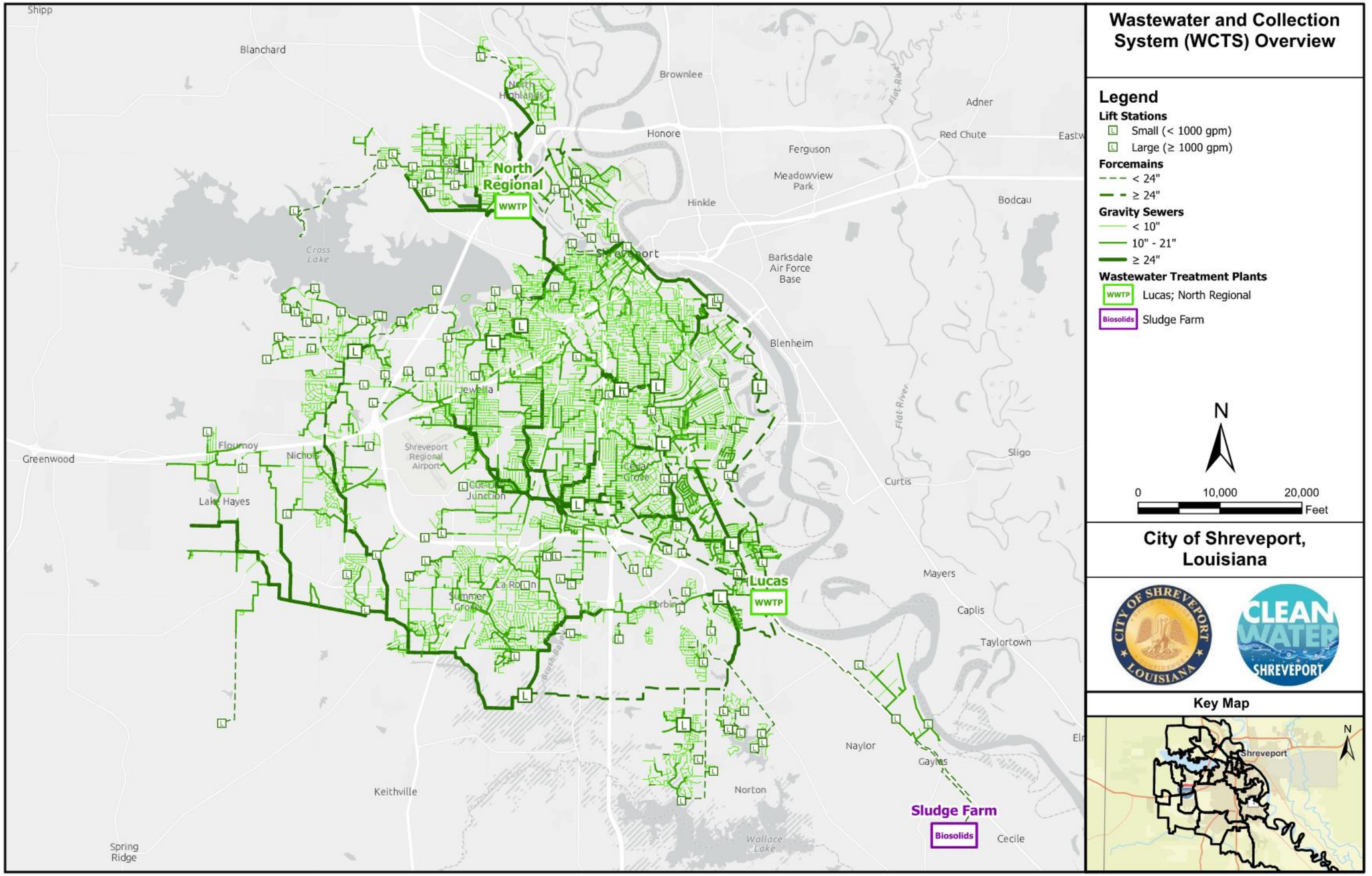
The WCTS is comprised of approximately 1,025 miles of gravity sewers with pipe diameters ranging between 4-inch and 60-inch, 92 miles of forcemain pipe with pipe diameters ranging between 2-inch and 60-inch, 131 lift stations, two (2) wastewater treatment plants, and one (1) biosolids processing facility. **Figure 2-1**, on the following page**,** illustrates the limits of the WCTS, which includes a sanitary sewer service area extending more than 247 square miles. **Table 2-1** below provides an inventory summary of the major components of the WCTS.

Table 2-1: WCTS Inventory Summary

Feature	Count	Length (Miles)
Manholes	17,083	-
Small Diameter Gravity Sewer (< 10 inches in diameter)[1]	13,266	692.5
Medium Diameter Gravity Sewer (10 – 21 inches in diameter)	5,300	269.1
Large Diameter Gravity Sewer (> 21 inches in diameter)	1,013	63.5
Forcemain Pipes	157	92
Lift Stations	131	-
WWTPs	2	-
Biosolids Processing Facility	1	-

Note 1: For both count and length (miles), all existing unknown pipe diameters were included in the less than 10-inch diameter category.

Figure 2-1: City of Shreveport WCTS Overview



2.2 Wastewater Treatment Plants and Biosolids Processing

The City owns and operates two (2) wastewater treatment plants (WWTPs): the Lucas WWTP and the North Regional WWTP. The Lucas WWTP services approximately 127,110 acres, approximately 81% of the overall WCTS in the City of Shreveport, whereas the North Regional WWTP services approximately 30,707 acres or approximately 19% of the WCTS. **Figure 2-2**, on the following page, shows the service areas of each WWTP. In addition, the City owns and operates a biosolids processing facility (sometimes referred to as the 'Sludge Farm') where biosolids generated from each WWTP are dewatered, processed and prepared for land application or disposal.

2.2.1 Lucas WWTP

The Lucas WWTP is operating based on the requirements of LPDES permit LA0041394. The treatment plant has a capacity of treating 30 million gallon per day (MGD) average wastewater flow and a peak flow of 80 MGD for a short duration (24 hours or less). The Lucas WWTP has a total peak wet weather storage volume of 20 MG. However, one of the three (3) equalization basins is not operational due to a structural failure and therefore only 11.9 MG of storage is currently available.

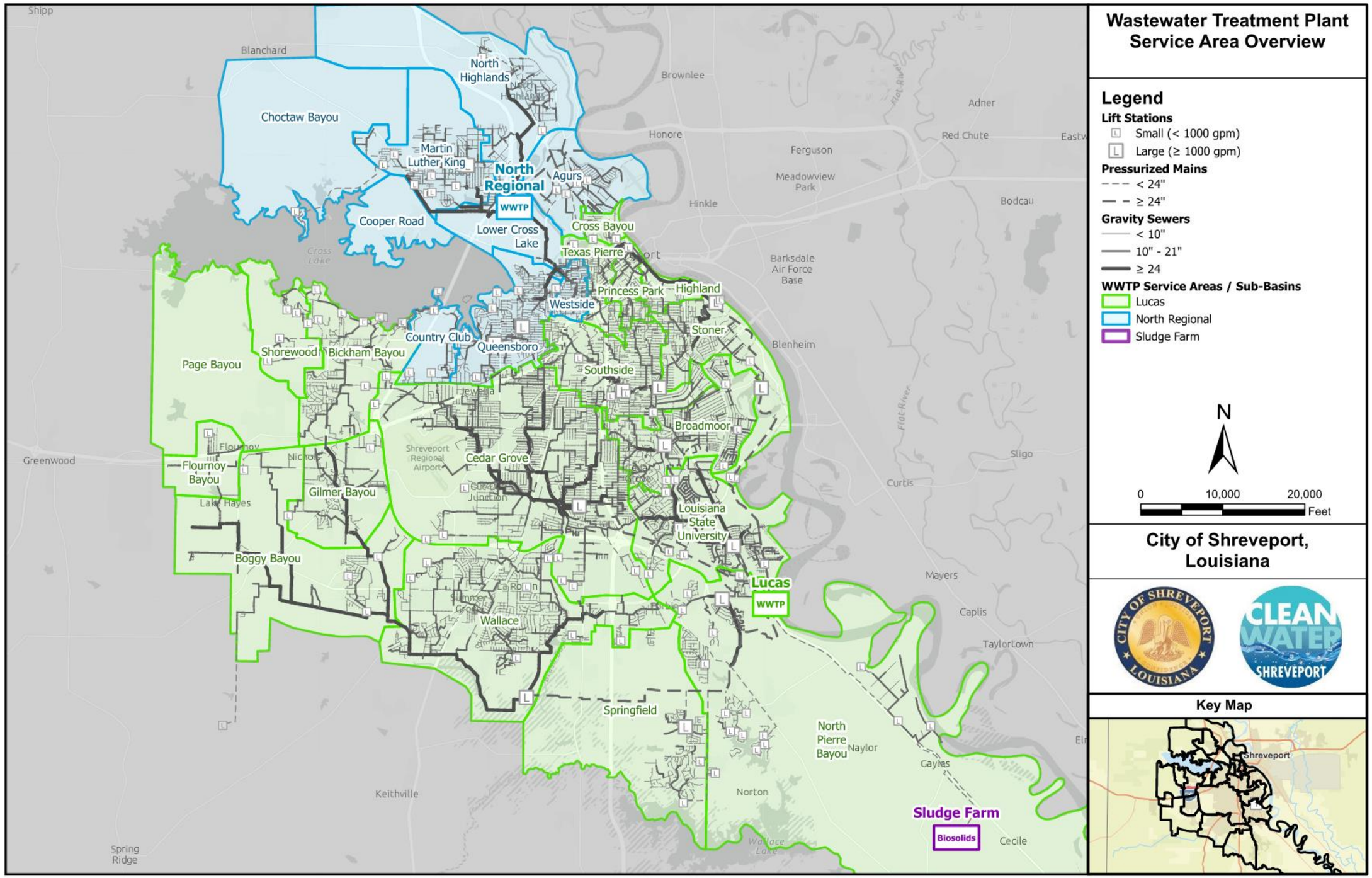
2.2.2 North Regional WWTP

The North Regional WWTP is operating based on the requirements of LPDES permit LA0042188. The treatment plant has a capacity of treating 7 MGD average wastewater flow and a peak flow of 16 MGD during wet weather. The North Regional WWTP has a total wet weather equalization storage of 10 MG. However, existing structural issues with the flow equalization basins reduce the current available storage to 6.9 MG.

2.2.3 Biosolids Processing Facility

The Biosolids Processing Facility (Sludge Farm) is operating based on the requirements of LPDES bio-solids permit LAJ101884. The Sludge Farm has two (2) 800,000 sludge holding tanks and a sludge holding pond on site.

Figure 2-2: Wastewater Treatment Plant Service Area Overview



2.3 Gravity Sewer & Manhole Summary

The City's WCTS is comprised of approximately 1,025 miles of gravity sewer collection system with pipe diameters ranging between 4-inch and 60-inch. **Table 2-2** provides a current inventory summary of the gravity sewer collection assets.

Table 2-2: Gravity Sewer Summary

Pipe Diameter	Count	Length (Feet)	% of Total
Unknown	174	38,081	0.7
Less than 8"	1,385	345,901	6.4
8"	11,707	3,272,645	60.5
10"	2,317	624,229	11.5
12"	1,658	444,944	8.2
14"	5	1,330	0.0
15"	734	196,032	3.6
16"	43	14,539	0.3
18"	300	78,674	1.5
20"	14	2,143	0.0
21"	229	59,036	1.1
24"	306	80,086	1.5
27"	77	22,290	0.4
30"	222	55,340	1.0
36"	206	69,213	1.3
39"	13	7,491	0.1
42"	82	42,059	0.8
48"	46	22,462	0.4
54"	44	27,830	0.5
60"	17	8,439	0.2
Total	**19,579**	**5,412,764**	**100.0**

2.4 Lift Station & Forcemain Summary

There are approximately 131 lift stations in the WCTS that are owned and operated by the City. **Table 2-3** provides an inventory summary of the forcemain assets.

Table 2-3: Forcemain Summary

Pipe Diameter	Count	Length (Feet)	% of Total
Unknown	4	16,386	3.4
Less than 4”	20	16,495	3.4
4”	42	54,567	11.2
6”	27	71,554	14.7
8”	21	70,057	14.4
10”	4	9,833	2.0
12”	8	5,369	1.1
14”	2	24,532	5.0
16”	2	9,187	1.9
18”	3	29,015	6.0
20”	2	9,441	1.9
24”	4	24,094	5.0
30”	2	14,883	3.1
36”	6	120,638	24.8
42”	2	290	0.1
48”	4	8,904	1.8
54”	1	102	0.0
60”	2	180	0.0
70”	1	482	0.1
Total	**157**	**486,009**	**100.0**

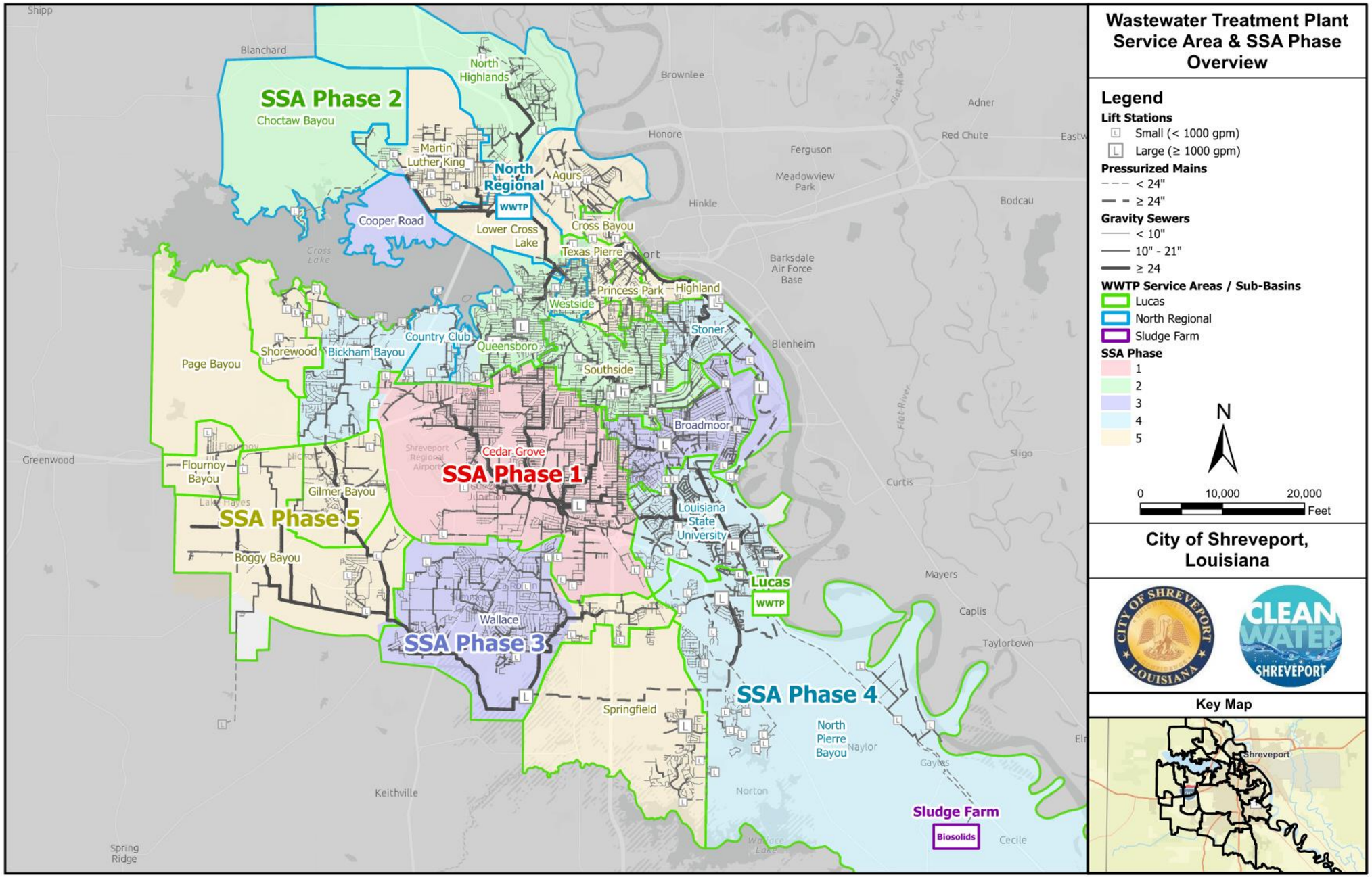
3.0 SANITARY SEWER ASSESSMENT (SSA) OVERVIEW

As part of the CD efforts, the City developed a Sanitary Sewer Assessment (SSA) program to inspect and assess the condition of the assets in the WCTS. The prioritization of sub-basins and schedule for completing SSA activities was identified in the CD. The sub-basins included in each SSA Phase are presented in **Table 3-1**. See Error! Reference source not found. for an illustration of the location of the SSA Phases.

Table 3-1: Summary of Sub-Basin SSA Phasing

SSA Phase	Sub-Basin
Phase 1 SSA	Cedar Grove
Phase 2 SSA	Queensboro Westside North Highlands Choctaw Bayou Southside
Phase 3 SSA	Broadmoor Wallace Cooper Road
Phase 4 SSA	North Pierre Bayou Country Club Stoner Bickham Bayou LSU
Phase 5 SSA	Agurs Boggy Bayou Shorewood Flournoy Bayou Lower Cross Lake Gilmer Bayou Princess Park Highland Martin Luther King Springfield Page Bayou Cross Bayou Texas Pierre

Figure 3-1: Sanitary Sewer Assessment (SSA) Boundaries



3.1 SSA Field Inspections

The City contracted with its previous wastewater master planning consultant and other contractors to complete SSA field inspections. A general description of activities completed is described below.

3.1.1 Manhole Inspections

Manhole inspections were conducted following the National Association of Sanitary Sewer Companies (NASSCO) Manhole Assessment Certification Program (MACP) format. When possible, three-dimensional (3D) manhole assessments were completed. When 3D inspections could not be completed, pole-mounted camera inspections were completed.

3.1.2 Smoke Testing of Gravity Sewers

The City chose to smoke test all gravity sewers, where feasible, within SSA Phase 1 through Phase 5. This approach exceeds the compliance requirements of the CD which only required smoke testing for gravity sewers 15-inches in diameter and smaller. This represents a significant commitment from the City to identify defects contributing I/I into the wastewater collection system.

3.1.3 CCTV Inspections of Gravity Sewer Lines

The City chose to complete CCTV inspections of all the gravity sewers, where feasible, for work completed for SSA Phase 1 through Phase 5. This represents a major commitment to clean and inspect significantly more sewers than is required in the CD. CCTV data was collected in accordance with the NAASCO compliant Pipeline Assessment and Certification Program (PACP). In some larger diameter sewers, sonar inspection was completed in lieu of CCTV.

3.1.4 Lift Station & Forcemain Condition Assessment

Lift stations owned by the City were assessed in each SSA Phase area. The evaluation included a review of the capacity of the lift station. In addition, the assessment included review of critical response time, station condition, design and equipment, the ability of maintenance personnel to take corrective action, critical equipment, and the adequacy of backup power.

Forcemain assessments were conducted based on direct inspection where information was available or if it was feasible to collect it. When not feasible, forcemain condition was determined from the condition and performance of similar forcemains or as-built information. This information, combined with known

information such as age, capacity, and material, was used to identify the condition of the existing forcemains in the WCTS.

3.2 Summary of the Technical Approach Used to Complete the SSAs

The City's previous wastewater master planning consultant developed and implemented a SSA approach which is described within the "*Guideline for Assessment and Recommendations*" (See Appendix A). This guideline describes the approach for both the assessment and rehabilitation of sanitary gravity mains and manholes for SSA Phases 1 through 4. Some modifications made between each SSA phase refined the process but did not make any significant changes to the overall approach. A summary of the SSA approach is provided in the following sections.

3.2.1 Smoke Testing Assessment – Gravity Sewers

Assessment of smoke testing data included reviewing the results of the investigation and assigning an assessment rating. Defects were generally assigned private source versus public source based on a 20-foot buffer from the wastewater collection system. Ratings were generally based on visual assessment of the volume of smoke produced for the defects assigned to be public source. Significant private source defects were addressed through issuance of 10-day letters. Assessment ratings were as follows:

- **0**: Smoke Testing not performed
- **1**: No Smoke observed
- **2**: Light Smoke observed
- **3**: Medium Smoke observed
- **4**: Heavy Smoke observed
- **5**: Significant issue – Immediate action needed (Dye Testing typically requested)

3.2.2 Dye Testing – Gravity Sewers

Dye testing was used as an additional inspection technique to support other field investigations typically involving a potential stormwater cross connection. If a positive connection was found on the private source side, a 10-day letter was issued. If a positive connection was found on the public side, either an emergency repair was issued, or the defect would be addressed as part of future rehabilitation work. No formal assessment criteria were provided other than confirming the connection status.

3.2.3 CCTV Inspections – Gravity Sewers

The NASSCO PACP data recorded during CCTV inspections were evaluated to develop both an overall assessment rating and propose remedial measures. The assessment criteria defined by the City's previous wastewater master planning consultant used the following questions and clarifying conditions to establish a CCTV assessment rating:

- 0: Is the gravity sewer line included for administrative purposes only?
- 1: Is the gravity sewer line in pristine condition and not some variation of clay or concrete pipe?
- 2: Does the gravity sewer line have some minor defects that are not likely to get significantly worse within the next 6 to 10 years?
- 3: Does the gravity sewer line have defects that do need to be addressed but can wait three to five years?
- 4: Does the gravity sewer line have major defects that need to be mitigated in the next two years?
- 5: Does the gravity sewer line have major defects that represent immediate public safety hazards?

Refer to Appendix A for specific criteria used to define these ratings.

3.2.4 Composite Assessment – Gravity Sewers

The composite assessment compared the information from smoke testing and CCTV and adopted the highest rated value.

3.2.5 Spatial Assessment – Gravity Sewers

The spatial assessment included mapping of the composite assessment and evaluating abnormalities in the ratings. The spatial assessment was reviewed specifically to determine if there were outliers in the assessment ratings that should be reviewed. No additional field service inspections were considered during this assessment.

3.2.6 Capacity Assessment – Gravity Sewers

The capacity assessment included consideration of the hydraulic model and the ability for the asset to convey the historical 2-year storm. The capacity assessment included the following ratings:

1. No capacity improvements noted by the original model
4. Capacity improvements necessary and pipe diameter increase is proposed.

3.2.7 Comprehensive Assessment – Gravity Sewers

The final comprehensive assessment considered the Composite, Spatial and Capacity assessment and adopted the highest rating as the Comprehensive Rating.

3.2.8 Smoke Testing Assessment - Manholes

The Smoke Testing assessment for manholes followed a similar approach to the gravity sewers. Each record was reviewed, and manhole specific defect observations were evaluated and ranked based on the following:

- **1**: Manhole that has no smoke leaks attributed
- **2**: Light Smoke is observed
- **3**: Medium Smoke is observed
- **4**: Heavy Smoke is observed
- **5**: Smoke testing gives reason to take immediate action (typically reserved for cross connects or constructed overflows)

3.2.9 Manhole Inspection Assessment

The NASSCO MACP data recorded during manhole inspections were reviewed and defects were evaluated based on each of the major manhole components (Cover/Frame, Chimney, Cone, Wall, Bench, Channel). Each component was evaluated and rated based on the following criteria:

- 0: Is the manhole included for administrative purposes only?
- 1: Is this section of the manhole in good condition with no significant defects noted?
- 2: Does this section of the manhole have some minor defects that are not likely to get significantly worse within the next 6 to 10 years?
- 3: Does this section of the manhole have defects that do not need to be addressed immediately, but can be mitigated in the next 3 to 5 years?
- 4: Does this section of the manhole have major defects that need to be mitigated in the next two years
- 5: Does this section of the manhole have major defects that represent an immediate public safety hazard?

Refer to Appendix A for specific criteria used to define these ratings.

3.2.10 Composite Assessment - Manhole

The assessment rating for each section of the manhole is compared to the smoke test assessment rating and the highest value becomes the Composite Assessment rating.

3.2.11 Lift Station Assessments

Individual lift station assessments were included as part of the previously issued SSA reports. Each station included a summary report that evaluated and provided overall assessment ratings of the major structural, mechanical, and structural components. The SSA report appendices included a more detailed overview including field survey summary, capacity analysis and recommended improvements. Inflow & Infiltration Assessment

As part of the Consent Decree, the City was required to estimate the amount of I/I from defects identified in gravity sewer lines, manholes and laterals within each phase SSA phase. Through the first four (4) SSA phases, the previous wastewater master planning consultant utilized the SSA collected data, the 2012 flow monitoring data, and the previous hydraulic model to support this effort.

The previous wastewater master planning consultant used a process that has been referred to as Actual and Potential I/I Source (APIIS) to complete this effort which is discussed in each of the issued SSA reports. In summary, the observed defects from CCTV and manhole inspections, along with smoke testing data as supplemental information, was used to identify an I/I assessment rating ranging from one to four (high, medium, low and minimal) for public assets (gravity mains and manholes) and one to three (heavy, medium and light) for private sanitary laterals.

Next, the hydraulic model was used, based on the 2012 flow monitoring calibration and the 2-year historical design storm, to estimate the I/I volume in the SSA phase and each of the monitoring boundaries. Based on the smoke testing quantities of private source defects versus public source defects and further engineering judgement, a percentage was allocated to private versus public source I/I. Once the percentage allocation of public versus private source I/I was established, distribution factors were established to allocate I/I to individual assets based on the I/I assessment ratings. A best fit approach of applying the distribution factors to each of the I/I assessment ratings was used so that I/I volume predicted by the model was allocated to each individual asset based on each assets I/I assessment rating.

3.3 Review of the Previous SSA Assessment Approach

The SSA assessment approach that was developed and implemented by the previous master planning consultant for SSA Phases 1-4 was consistently applied with minor refinements between each phase. The approach assigned a score to each asset based on review of various defect types (I/I, structural, sags, and O&M) observed through multiple analyses and evaluations. A Comprehensive Rating was assigned to the asset considering the worst rating from each of the individual assessments. The Comprehensive Rating was used to select assets for rehabilitation.

During the City's review of the program in 2020, it became evident that the rehabilitation work completed by the City prior to that time had addressed a significant number of defects noted in the sewer collection system during the SSAs. It was also apparent that there were significant opportunities to improve the effectiveness of mitigating or reducing the occurrence of sanitary sewer overflows through future projects by adjusting the approach taken to completing SSAs and remedial measures projects. As a result, the City implemented a more agile decision-making framework to maximize environmental benefits, specifically target mitigation of sanitary sewer overflows, and use the City's limited financial resources more effectively. This Adaptive Management approach is discussed in more detail in Section 6.

3.4 SSA Investigations Completed by Phase

A summary of the SSA asset investigations completed for each SSA Phase is provided in the following sections.

3.4.1 Phase 1 SSA

The Cedar Grove sub-basin (in the Cedar Grove model subgroups) is the only sub-basin the Phase 1 SSA area. Investigations were completed for the Phase 1 SSA between November 2012 and May 2015. A comprehensive summary of the SSA for Phase 1 was included in the *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 1 Report* submitted to EPA in July 2015. A summary of the inspections that were completed on manholes and gravity sewers is provided in **Table 3-8**.

Table 3-2: Phase 1 SSA Summary of Asset Investigations

Investigation Type	No. of Assets Inspected	Total Length Inspected (LF)
Manholes	2,396 of 2,413	N/A
Gravity Mains – CCTV	---	1,034,190 of 1,050,649
Gravity Mains – Smoke Testing	---	1,010,360 of 1,050,649

A lift station and forcemain condition assessment was also completed for the facilities in the Phase 1 SSA. The lift stations that were assessed are:

- Brushy Bayou
- Cargill Park
- Cedar Grove
- Hickory Ridge
- Jefferson Paige
- Kennie Road
- Meadow Parkway
- Mt. Zion
- Slack

Results from this assessment can be found in **Results from this assessment can be found in Error! Not a valid bookmark self-reference.. Table 3-9.**

Table 3-3: Phase 1 SSA Summary of Lift Station Assessments

Lift Station Condition Assessment	Count
Good	2
Fair	4
Poor	3
N/A*	0
Total**	9

* No condition rating due to recent rehab or rehabilitation.
** There is one (1) privately owned lift station in the Phase 1 SSA that was not inspected.

3.4.2 Phase 2 SSA

The sub-basins (and model subgroups) included in the Phase 2 SSA area are:

- Southside
- Queensboro
- North Highlands
- Westside
- Choctaw Bayou

Investigations were completed for the Phase 2 SSA between January 2016 and May 2016. A comprehensive summary of the SSA for Phase 2 was included in the *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 2 Report* submitted to EPA in September 2016. A summary of the inspections that were completed on manholes and gravity sewers is provided in **Table 3-8**.

Table 3-4: Phase 2 SSA Summary of Asset Investigations

Investigation Type	No. of Assets Inspected	Total Length Inspected (LF)
Manholes	2,618 of 2,767	---
Gravity Mains – CCTV	---	1,050,554 of 1,076,569
Gravity Mains – Smoke Testing	---	1,056,169 of 1,076,569

A lift station and forcemain condition assessment was also completed for the facilities in the Phase 2 SSA. The lift stations that were assessed are:

- Alabama
- Betty Virginia Park
- Darien
- Delaware
- Fire Station No. 4
- Glen Avenue
- Hardy
- Hawkins
- Looney
- Majorie
- North Arnov
- North Caddo
- Patzman Park
- Pinehill Estates
- Pinehill Road
- Querbes
- Richmond
- South Highlands
- Squirrel Point
- Streets & Drainage (Mansfield Rd)
- Sunset
- Victory

Results from this assessment can be found in **Results from this assessment can be found in Error! Not a valid bookmark self-reference.. Table 3-9.**

Table 3-5: Phase 2 SSA Summary of Lift Station Assessments

Lift Station Condition Assessment	Count
Good	6
Fair	5
Poor	11
N/A*	0
Total**	22

* No condition rating due to recent rehab or rehabilitation.

** There is one (1) privately owned lift station in the Phase 2 SSA that was not inspected.

Following submittal of the Phase 2 SSA report in September 2016, additional inspections have been completed in the Phase 2 SSA area. These inspections include CCTV inspections as part of the "Hot Spot" Sewer Cleaning and CCTV program, additional lift station assessments as part of the ongoing Critical Projects and hydraulic model development, and on-going manhole assessments to identify potential for inflow.

3.4.3 Phase 3 SSA

The sub-basins (and model subgroups) included in the Phase 3 SSA area are:

- Broadmoor
- Wallace
- Cooper Road

Investigations were completed for the Phase 3 SSA between March 2016 and October 2017. A comprehensive summary of the SSA for Phase 3 was included in the *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 3 Report* submitted to EPA in November 2017. A summary of the inspections that were completed on manholes and gravity sewer is provided in **Table 3-8**.

Table 3-6: Phase 3 SSA Summary of Asset Investigations

Investigation Type	No. of Assets Inspected	Total Length Inspected (LF)
Manholes	2,575 of 2,589	---
Gravity Mains – CCTV	---	934,091 of 942,031
Gravity Mains – Smoke Testing	---	897,985 of 942,031

A lift station and forcemain condition assessment was also completed for the facilities in Phase 3 SSA. The lift stations that were assessed are:

- Burgundy Ridge
- Cedar Creek
- Champion Lake
- Dixie Garden
- Elgin
- Knight Street
- Knight Street
- Mackey Lane
- Reunion
- Shreve Island
- Southern Hills Rec Center
- Spring Lake

- Mackey Lane

Results from this assessment can be found in

Results **from this assessment can be found in Error! Not a valid bookmark self-reference.. Table 3-9**.

Table 3-7: Phase 3 SSA Summary of Lift Station Assessments

Lift Station Condition Assessment	Count
Good	2
Fair	6
Poor	5
N/A*	0
Total**	13

* No condition rating due to recent rehab or rehabilitation.
** There are four (4) privately owned lift stations in the Phase 3 SSA that were not inspected.

3.4.4 Phase 4 SSA

Phase 4 SSA was divided into two sub-phases: Phase 4A SSA and Phase 4B SSA. The sub-basins (and model subgroups) included in the Phase 4A SSA area are:

- Bickham Bayou
- Stoner
- Country Club

The sub-basins (and model subgroups) included in Phase 4B SSA area are:

- North Pierre Bayou
- LSU

Investigations were completed for the Phase 4A SSA between August 2017 and December 2018 and for the Phase 4B SSA between March 2018 and May 2019. A comprehensive summary of the SSA for Phase 4 was included in the *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 4 Report* submitted in January 2020. A summary of the inspections that were completed on manholes and gravity sewer is provided in **Table 3-8**.

Table 3-8: Phase 4 SSA Summary of Asset Investigations

Investigation Type	No. of Assets Inspected	Total Length Inspected (LF)

Manholes	3,341 of 3,419	--
Gravity Mains – CCTV	--	1,013,486 of 1,070,271
Gravity Mains – Smoke Testing	--	1,054,253 of 1,070,271

A lift station and forcemain condition assessment was also completed for the facilities in Phase 4 SSA. The lift stations that were assessed are:

- Abbie-Glen
- Acadiana
- Ashley Ridge
- Attaway
- Azalea Gardens
- Benteler
- Bickham Bayou
- Capilano
- Chardonnay Circle
- Country Club
- Country Club Hills
- Creswell
- Cross Creek
- Cross Lake Patrol
- Esplanade
- Fern
- Fire Station No. 20
- Flournoy-Lucas
- Forbing Glen
- Gorton Road
- Hidden Trace
- Hutchinson
- Lakeside
- Lakeside Boat
- Land O' Trees
- Long Lake
- Long Lake Dr. (Swamp)
- Lucas Outfall
- Maintenance Bldg
- Maywood
- Mirador No. 1
- Morris and Dickson
- Norris Ferry
- North Pierre
- North Pointe
- Port
- Professional Plaza
- Public Landing
- Riverwalk I
- Riverwalk II
- Rountree
- Sand Beach
- Sludge Farm
- Stoner
- Stoner Boat Launch
- Stratmore
- West Pointe
- Willow Point 1
- Willow Point II
- Yacht Club
- Youree Drive

Results from this assessment can be found in Error! Not a valid bookmark self-reference..

Table 3-9: Phase 4 SSA Summary of Lift Station Assessments

Lift Station Condition Assessment	Count
Good	7
Fair	22
Poor	18
N/A*	4

Lift Station Condition Assessment	Count
Total**	51

* No condition rating due to recent rehab or rehabilitation.
** There are six (6) privately owned lift stations in the Phase 4 SSA that were not inspected.

Following submittal of the Phase 4 SSA Report in January 2020, additional inspections have been completed in the Phase 4 SSA area. These inspections include CCTV inspections as part of the "Hot Spot" Sewer Cleaning and CCTV program, additional lift station assessments as part of the ongoing Critical Projects and hydraulic model development, and on-going manhole assessments to identify potential for inflow.

3.4.5 Phase 5 SSA

The Phase 5 SSA was divided into two (2) sub-phases: Phase 5A SSA and Phase 5B SSA. The sub-basins included in the Phase 5A SSA include:

- Boggy Bayou
- Springfield
- Gilmer Bayou
- Shorewood
- Flournoy Bayou
- Page Bayou

The sub-basins included in the Phase 5B SSA include:

- Princess Park
- Texas Pierre
- Agurs
- Highland
- Cross Bayou
- Lower Cross Lake
- Lakeview

Investigations for the Phase 5A SSA area began in January 2019 and were completed in December 2019. In March 2020, remaining field investigations in Phase 5 were suspended. **Table 3-10** below presents a summary of findings prior to suspension of the investigations.

Table 3-10: Phase 5 SSA Summary of Asset Investigations

Investigation Type	No. of Assets Inspected	Total Length Inspected (LF)
Manholes	1,850 of 3,863	N/A
Gravity Mains – CCTV	-	670,404 of 1,259,303
Gravity Mains – Smoke Testing	-	489,526 of 1,259,303

Lift station and forcemain condition assessments in Phase 5 were completed as part of the *Lift Station Condition Assessment* in March 2015. The lift stations in Phase 5 SSA that were assessed in that effort include:

- Oak Forest
- Hattie
- Linear
- Havanna
- Legardy
- David Raines Rec Center
- Round Grove (David Raines)
- Agurs
- Fullerton Street
- West Algonquin
- Cherokee
- North Hearne
- Blind Bayou
- Cadillac
- Central Fire Station
- Fannin
- Cottage Ridge
- LaCaze
- Provenance
- Hidden Trace
- St. Charles Pl
- Southern Trace
- New Castle
- West Shreveport
- Huntington
- Bethlehem
- AMI
- Broadacres
- Rockwell Road
- Woolworth Rd. No. 1
- Pinecrest
- Tammer Lane
- Tou-Don
- Risinger
- Long Timber
- Shorewood
- Timber Knoll
- Wonderland

Results from this assessment can be found in

Results from this assessment can be found in Error! Not a valid bookmark self-reference..

Table 3-9.

Table 3-11: Phase 5 SSA Summary of Lift Station Assessments

Lift Station Condition Assessment	Count
Good	10
Fair	13
Poor	15

Lift Station Condition Assessment	Count
N/A*	0
Total**	38

* No condition rating due to recent rehab or rehabilitation.
** There are privately owned and operated lift stations that were not inspected.

The City submitted a plan to continue SSA inspections in Phase 5 to EPA in January 2022. The City has restarted SSA activities, including CCTV and MACP inspections, during 2022. A summary of the activities planned as part of the 2022 Annual Sewer Cleaning Program is provided in **Table 3-12**. Ongoing SSA activities will continue to be reported in annual reports.

Table 3-12: Phase 5 SSA Summary (2022)

Investigation Type	No. of Assets to be Inspected	Total Length to be Inspected (LF)
Manholes	447	N/A
Gravity Mains – CCTV	---	134,177

3.4.6 Summary of SSA Investigations by Phase

A summary of the assessments and investigations completed as part of the SSAs is provided in **Table 3-13.**

Table 3-13: Summary of SSA Investigations by Phase

SSA Phase	Lift Stations Assessed	Manholes Inspected	Gravity Sewers Smoke Tested	Gravity Sewers CCTV'd
SSA Phase 1	9	2,396	1,010,360	1,034,190
SSA Phase 2	22	2,618	1,056,169	1,050,554
SSA Phase 3	13	2,575	897,985	934,091
SSA Phase 4	51	3,341	1,054,253	1,013,486
SSA Phase 5	38	2,297	489,526	804,581

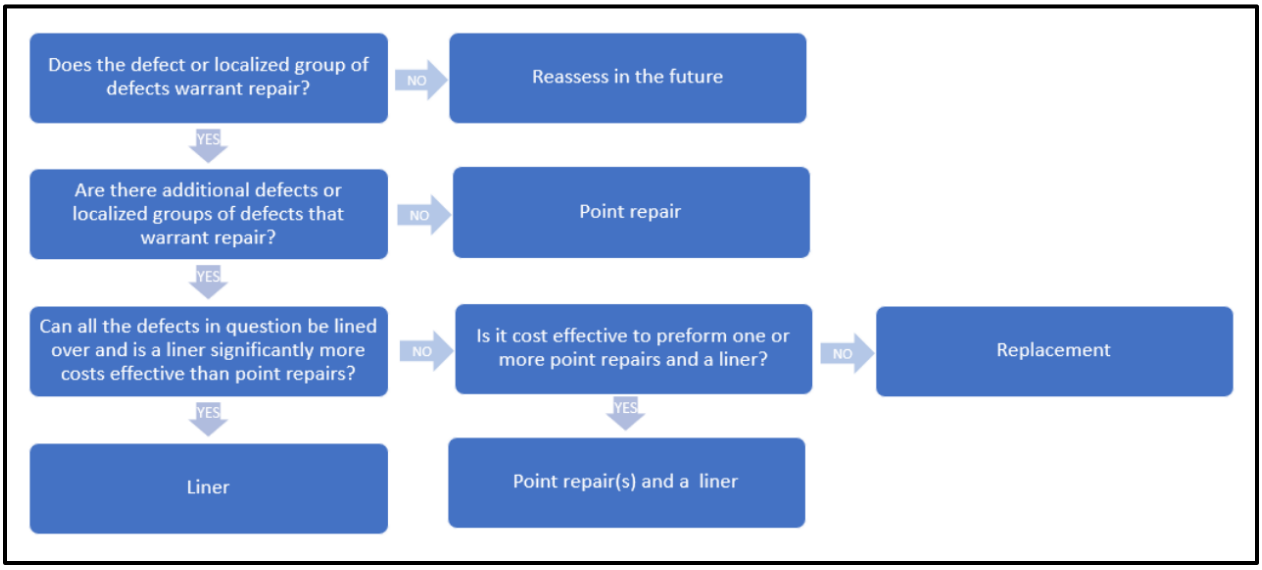
4.0 REMEDIATION MEASURES PLAN (RMP) OVERVIEW

Following submittal of each respective SSA report, the City's previous wastewater master planning consultant, BKI, prepared and submitted an RMP report to EPA. The RMP reports summarize the assessments completed in each SSA phase and the process by which these assessments were analyzed. Recommendations for remedial measures to be taken on each asset (gravity sewer line, manholes, lift stations, and forcemain) were provided as well as project identification to group assets based on geographic proximity. Each RMP report presents anticipated construction methods and scheduling to correct deficiencies identified within the WCTS.

4.1 Summary of the Technical Approach Used to Develop the RMP Reports

The SSA assessment approach developed and implemented by the previous master planning consultant ranked or prioritized each asset on a 5 point scale based on the SSA assessment approach summarized in Section 3. Based on the SSA assessment, each defect was evaluated for rehabilitation recommendation (type of construction). **Figure 4-1** was taken from the "*Guideline for Assessment and Recommendations*", which was included as an attachment to previously issued RMP reports and demonstrates the decision-making logic applied to selection of gravity sewer rehabilitation methods.

Figure 4-1: Original Rehabilitation Selection Approach



A summary from the rehabilitation methods described within the "*Guideline for Assessment and Recommendations*" is as follows:

- **Reassess in Future**: No evidence to suggest a repair is necessary. Add to preventative maintenance scheduled.

- **Install Terminal Manhole:** Install when a repair is warranted on a dead-end line. Include if one or more blind tee's are present.

- **Point Repairs:** Point repairs considered in 20-feet increments. Considered against cost of other more aggressive rehabilitation approaches.

- **Liner:** Recommended with deemed cost effective. Used when liner is non-capacity restricted, structurally intact, and which acceptable grade (less than 15%). Can be used in conjunction with point repairs.

- **Pipe Burst:** Recommended only in rare instances. Used when point repair and liner is not cost effective and directed by previous program manager.

- **Replace:** Used when there are multiple defects that cover a long section that cannot be addressed with a liner and that would make point repairing impractical. Often the case when CCTV inspection had to be abandoned. All 4 or 6-inch pipes upsized to 8-inches.

Selection of manhole rehabilitation methods was completed similarly. The following types of construction were identified based on the SSA data:

- Reassess in Future

- Rehabilitation (Selective)

- Rehabilitation (Entire)

- Replacement

As part of the rehabilitation selection, spatial assessment was completed to confirm that manhole rehabilitation and gravity sewer rehabilitation was aligned to not create issues with varying construction technologies.

Following the final selection of rehabilitation, RMP projects were developed for each SSA phase. These projects were organized based on need of the remediation and physical location. In addition, a timeline of implementation for each project was developed.

4.2 Review of Previous RMP Rehabilitation Selection Methodology

The Phase 1 through 4 RMP reports were developed with a consistent approach. SSA data was reviewed and used to make decisions regarding assets designated for rehabilitation and replacement. Selection of rehabilitation or replacement was based on consideration of the condition assessment data, available construction technologies and cost opinions.

During the City's review of the program in 2020, it became evident that assets selected for rehabilitation or replacement were not being selected based on a direct correlation to historical SSOs. Rather, assets were selected based on addressing defects noted during the SSAs. This approach led to a significant number of defects being addressed but it had limited impact on the number of sanitary sewer overflows that were occurring. It was apparent that there were opportunities to improve mitigation or reduction of sanitary sewer overflows by considering the root cause of historical SSOs and selecting remedial measures appropriate to the cause. In many cases, overflows were caused by buildup of fats, oils, and grease or debris in the sewers. There were opportunities to address these types of overflows through focused operation and maintenance initiatives such as targeted sewer cleaning program rather than repair or replacement of the asset to address defects. As a result, a more agile decision-making framework has been implemented to maximize environmental benefits, specifically target mitigation of sanitary sewer overflows, and use the City's limited financial resources more effectively. This Adaptive Management approach is discussed in more detail in Section 6.

4.3 Remediation Measures Plans Completed by Phase

A summary of the RMP reports completed for each SSA Phase is provided in the following sections.

4.3.1 Phase 1 RMP

The RMP report for Phase 1 can be found in the *Task 700 – Remediation Measures Plan (RMP) – Phase 1 Report* from September 2015. A total of 5,510 manhole defects and 60,511 gravity sewer line defects were identified in the Phase 1 RMP. Error! Reference source not found. provides a summary of these defects. The recommendations to address manhole and gravity sewer defects are presented in **Table 4-1**.

Table 4-1: Manhole Remedial Measures Recommendations in Phase 1

Recommendation	Number of Manholes
Reassess in Future	492
Selective Rehab	222
Entire Rehab	306
Replace Manhole	1,393
Install Terminal Manhole	166
Total	2,579

Table 4-2: Gravity Sewer Remedial Measures Recommendations in Phase 1

Recommendation	Number of Pipes	Total Linear Feet (ft)
Reassess in the Future	585	153,334
Point Repair (Only Linear Feet Being Repaired)	31	680
Rehab with Liner	160	52,156
Rehab with Pipe Bursting	2	665
Replace Gravity Sewer Line	2,154	790,116
Total	2,932	996,951

Following identification of defects, projects were identified based on need of remediation and location in the Phase 1 area. A total of 80 replacement projects were developed which include replacement or point repairs to gravity sewer lines and rehabilitation, addition, or replacement of manholes. In addition, three (3) linear rehabilitation projects to gravity sewer lines were developed. The work in the Phase 1 area begin in August 2016 and reached final completion for all projects in November 2019.

The original value of the 80 collection system improvement projects was estimated at approximately $131,427,000 (2016 Dollars). During design, these 80 projects were consolidated into a collection of 30 bid packages for construction. Following the completion of all Phase 1 RMP projects, the actual costs spent on construction of the Phase 1 RMP projects was approximately $190,270,000. This is a 45% increase in the estimated costs of the Phase 1 RMP projects. **Table 4-3** provides a summary of the projects.

Table 4-3: Summary of Phase 1 RMP Projects

Project Name	Functional Completion	Final Completion*
101.124.125.147 – Dowdell St. & Fairfield Ave.	8/3/2017	11/28/2017
102 – Wyngate Blvd. & W. 84th Street	9/2/2017	11/15/2017

Project Name	Functional Completion	Final Completion*
103 – Garden Valley Subdivision Unit 2 Valley View Dr. & Timberview Rd.	N/A	8/11/2017
103.106.109.110 – West Canal & Valley View	11/27/2017	2/23/2018
104.119.142 – Union & Wallace Ave.	4/19/2017	12/20/2017
105.108 – Cedar Grove Trunkmain	N/A	9/28/2017
106.107.114 – Hollywood Ditch & W. 70th Street	2/28/2018	9/20/2018
109.110.113.129.130.132.135.152.153.154 Sunset Acres & Cargill Park Area (Hickory Ridge LS)	3/27/2018	5/4/2018
111 – Garden Valley Unit 1 Louise St. & W. Canal Blvd.	10/6/2017	5/15/2018
112 – Karen & Dollarway Street	N/A	7/7/2017
114 – Joe Louis & Evers Drive	8/10/2017	3/2/2018
115.120.127.128.151 – Wyngate Blvd. & Wallace Ave.	9/1/2017	6/22/2018
116.117.118.139 – Hollywood & Kennedy Ave.	10/11/2017	12/22/2017
121.122.123.143.144.145.146 Linwood & Fairfield Ave.	4/7/2018	11/30/2018
126.148.149.150.166.167.168 Linwood & Line Ave.	1/12/2018	4/17/2019
131 – Standard Oil & Wisteria St.	N/A	12/1/2016 **
133 – Monkhouse & Interstate Drive	N/A	11/7/2016 **
134 – Greenwood Rd. & Junior Place	N/A	12/1/2016 **
136.137.157 – Hollywood Ave. & Singletary Street	9/29/2017	5/7/2018
138.140.156.169 – Henry & Kennedy Street	10/31/2018	10/29/2019
141.161.171.175.176.178.180 Hearne & Hollywood Trunk Main	2/19/2018	2/24/2019
158.159.160.170 – Jewella Ave. & Clarke Blvd.	1/23/2018	7/16/2018
162.163.164.165.172.173.174 – Mansfield Rd. & Corbitt St.	1/5/2018	11/14/2018
175.177.178.179 – Jewella Ave. & Greenwood Rd.	12/30/2017	6/12/2020
201 CIPPL Package 1	12/8/2017	9/20/2019
202 CIPPL Package 2	4/11/2018	7/24/2019
203 CIPPL Package 3	12/7/2017	1/24/2020
204 CIPPL Package 4	4/11/2018	11/10/2019
STO-03 – Meadow Parkway Lift Station Rehab	N/A	10/6/2017

Project Name	Functional Completion	Final Completion*
STO-04 – Cedar Grove & Slack Lift Station Rehab	N/A	10/18/2017

*Some entries are marked "Not Applicable (N/A)". This is because the City and/or previous Program Manager did not recognize Functional Completion as a contract milestone until after some of the Phase 1 projects had been completed.

** A Final Completion letter was not issued by City. Indicates the date of the Partial Completion letter that is filed at the Courthouse. As shown above, all Phase 1 projects reached Functional Completion by October 31, 2018. All Phase 1 projects reached Final Completion by June 12, 2020.

Following completion of the work, a flow monitoring program was completed in 2018 and 2019 and a hydraulic model update was completed to assess the effectiveness of the proposed RMP projects and determine what reduction of I/I was achieved. Results from this effort indicate that the I/I reduction goals as outlined in the Phase 1 RMP Report were not achieved. A description of this effort can be found in the technical memorandum *Task 652 – Cedar Grove Post Rehabilitation Monitoring, Analysis, and Modeling* from November 2019.

4.3.2 Phase 2 RMP

The RMP report for Phase 2 can be found in the *Task 700 – Remediation Measures Plan (RMP) – Phase 2 Report* from September 2016. A total of 8,694 manhole defects and 83,006 gravity sewer line defects were identified. The recommendations to address manhole and gravity sewer defects are presented in **Table 4-4** and **Table 4-5**.

Table 4-4: Manhole Remedial Measures Recommendations in Phase 2

Recommendation	Number of Manholes
Reassess in Future	931
Selective Rehab	412
Entire Rehab	48
Replace Manhole	1,376
Install Terminal Manhole	213
Total	2,980

Table 4-5: Gravity Sewer Remedial Measures Recommendations in Phase 2

Recommendation	Number of Pipes	Total Linear Feet (ft)
Reassess in the Future	908	186,582
Point Repair (Only Linear Feet Being Repaired)	137	40,359
Rehab with Liner	311	81,823
Rehab with Pipe Bursting	1	316
Replace Gravity Sewer Line	2,323	738,793
Total	3,680	1,047,873

Following identification of defects, projects were identified based on need of remediation and location in the Phase 2 area. A total of 26 replacement projects were developed which include replacement or point repairs to gravity sewer lines and rehabilitation, addition, or replacement of manholes. In addition, three (3) linear rehabilitation projects to gravity sewer lines and one (1) manhole rehabilitation project were developed. The work in the Phase 2 area begin in January 2018 and reached final completion for all projects in May 2021.

The original value of the 29 Phase 2 RMP collection system improvement projects was estimated at approximately $199,337,000 (2017 Dollars). During design, these 29 projects were consolidated and a collection of 17 bid packages for construction were created. Following the completion of all Phase 2 RMP projects, the actual construction cost of the Phase 2 RMP projects was approximately $110,000,000. **Table 4-66** provides a summary of the projects included in the Phase 2 RMP..

Table 4-6: Summary of Phase 2 RMP Projects

Project ID – Project Description	Achievement of Full Operation	Final Completion
2-SH1 South Highlands East Rehab	4/12/2021	5/3/2021
2-SH2 South Highlands West CIPP	12/31/2019	9/10/2020
2-SH3 South Highlands Sewer Replacement	11/27/2019	6/12/2020
2-SH4 Mansfield & Claiborne Area Replacement	6/4/2019	7/31/2019
2-QR1 North Querbes CIPP	12/31/2019	4/5/2021
2-QR2 South Querbes CIPP	6/3/2020	4/6/2021
2-QR3 North Querbes Sewer Replacement	11/27/2019	6/10/2020
2-QR4 South Querbes Sewer Replacement	6/1/2020	11/6/2020
2-QB1 N Queensboro CIPP	12/15/2019	5/3/2021
2-QB2 S Queensboro Rehab	11/27/2019	9/28/2020
2-QB3 Choctaw Bayou & Queensboro Sewer Replacement	4/12/2019	1/24/2020
2-NH1 North Highlands Interceptor	3/19/2019	10/30/2019

Project ID – Project Description	Achievement of Full Operation	Final Completion
2-NH2 N Highlands, Choctaw & Queensboro CIPP	12/30/2019	12/2/2020
2-NH3 North Highlands Sewer Replacement	N/A **	10/30/2019
2-LS1 Lift Stations / Force Main Condition	4/30/2019	2/4/2020
2-WS1 Westside CIPP	11/27/2019	10/1/2020
2-WS3 Westside Sewer Replacement	4/3/2019	8/19/2019

** Unknown – Functional Completion Certificate Not Issued.

4.3.3 Phase 3 RMP

The RMP report for Phase 3 can be found in the *Task 700 – Remediation Measures Plan (RMP) – Phase 3 Report* from December 2017. A total of 7,168 manhole defects and 48,284 gravity sewer line defects were identified. The recommendations to address manhole and gravity sewer defects are presented in **Table 4-4** and **Table 4-5**.

Table 4-7: Manhole Remedial Measures Recommendations in Phase 3

Recommendation	Number of Manholes
Reassess in Future	1,182
Selective Rehab	19
Entire Rehab	675
Replace Manhole	713
Install Terminal Manhole	550
Total	3,139

Table 4-8: Gravity Sewer Remedial Measures Recommendations in Phase 3

Recommendation	Number of Pipes	Total Linear Feet (ft)
Install Terminal Manhole	195	31,686
Point Repair (Only Linear Feet Being Repaired)	126	39,250
Reassess in the Future	1,095	265,935
Rehab with Liner	519	191,181
Rehab with Pipe Bursting	1	767
Replace Gravity Sewer Line	1,226	413,212
Total	3,162	942,031

Following identification of defects, projects were identified based on need of remediation and location in the Phase 3 area. A total of 14 projects were developed based on the Phase 3 RMP. Each of these projects

have advanced through engineering design. One (1) project, "3-115 Wallace Interceptor Improvement" began construction and achieved functional completion on January 31, 2020. Bid solicitation and construction of other remaining Phase 3 projects have been placed on hold due to the City's limited financial resources, inability to fully fund all Phase 3 without additional rate increases, and concerns about the hydraulic model used to develop the scopes of the Phase 3 projects. In addition, the City's current approach of implementing targeted initiatives to address SSOs has been demonstrated to be effective at mitigating SSOs than the approach used to identify and develop the Phase 3 and Phase 4 RMP projects.

The total estimated cost for the gravity sewer and manhole rehabilitation work in the Phase 3 area was $172,930,000 (as included in the Phase 3 RMP Report and adjusted for 2022 dollars). **Table 4-9** provides a summary of the projects including design status and construction status.

Table 4-9: Summary of Phase 3 RMP Projects

Project ID – Project Description	Design Status	Construction Status
3-113 - Wallace Interceptor Sanitary Sewer Improvements	100%	Not Started
3-115 - Wallace Interceptor Sewer Rehab	100%	Completed 8/27/2020
3-116 - Southern Hills Interceptor (Segment B) Sanitary Sewer Improvements (See Note 2)	90%	Not Started
3-117 - Southern Hills Interceptor Phase 2 Sanitary Sewer Improvements (See Note 2)	90%	Not Started
3-LS1 - Lift Station Condition (See Note 1)	100%	(1) Completed (6) In Design
3-NE1 - Northeast Sewer Replacement (See Note 3)	100%	Not Started
3-NER1 - Northeast Sewer Rehab 1	100%	Not Started
3-NER2 - Northeast Sewer Rehab 2	100%	Not Started
3-NER3 - Northeast Sewer Rehab 3	100%	Not Started
3-NS1 - Pierremont Rd & Boggy Bayou Areas Rehab	100%	Not Started
3-SW1 - Southern Hills Sewer Rehab	100%	Not Started
3-SW2 - South West Sewer Replacement 2	100%	Not Started
3-SW3 - South West Sewer Replacement 3	100%	Not Started
3-SW4 - South West Rehab 4	100%	Not Started

Note 1: 3-LS1 Lift Station Condition Improvements: Construction of improvements to the Cedar Creek Lift Station was completed on January 21, 2022. Design for the remaining six (6) lift stations began in March 2022 and are included within the critical wastewater projects program.

Note 2: 3-116: Southern Hills Interceptor (Segment B) and 3-117: Southern Hills Interceptor (Segment A)**:** Replacement of the Southern Hills Interceptor, including the 3-116 and 3- 117 projects, have been identified as wastewater critical projects. These designs will be updated based on the results of current hydraulic

modeling and engineering evaluation. It is anticipated that construction will occur after completion of the design updates depending upon available funding. Design updates are expected to be completed in 2024.
Note 3: Two critical wastewater projects, CWP-63 Brookemeade and Querbes SSO mitigation and CWP-117 Pierremont Park Sewer Improvements, are targeted wet weather SSO mitigation projects. These projects were originally part of the 3-NE1 Northeast Sewer Replacement project scope of work but have been broken into separate projects and are both advancing through the critical wastewater projects program. The Pierremont Park Project is in construction. The Brookemeade and Querbes Project has been bid with contact award expected by March 2023.

4.3.4 Phase 4 RMP

The RMP report for Phase 4 can be found in the *Task 700 – Remediation Measures Plan (RMP) – Phase 4 Report* from March 2020. A total of 10,732 manhole defects and 50,176 gravity sewer line defects were identified. The recommendations to address manhole and gravity sewer defects are presented in **Table 4-4** and **Table 4-5**.

Table 4-10: Manhole Remedial Measures Recommendations in Phase 4

Recommendation	Number of Manholes
Reassess in Future	1,889
Selective Rehab	140
Entire Rehab	1,016
Replace Manhole	365
Not Complete	9
Total	3,419

Table 4-11: Gravity Sewer Remedial Measures Recommendations in Phase 4

Recommendation	Number of Pipes	Total Linear Feet (ft)
Point Repair (Only Linear Feet Being Repaired)	397	10,200
Reassess in the Future	2,427	583,803
Rehab with Liner	259	79,871
Rehab with Pipe Bursting	0	0
Replace Gravity Sewer Line	677	216,492
Not Complete	26	3,713
Total	3,786	894,079

Following identification of defects, projects were identified based on need of remediation and location in the Phase 4 area. A total of 14 replacement projects were developed. The total estimated cost for the gravity sewer and manhole rehabilitation work in the Phase 4 area was estimated at approximately $93,500,000 (as included in the Phase 4 RMP Report). Design of Phase 4 remediation measures has not yet begun due to the City's limited financial resources, inability to fund construction of all Phase 4 improvements without additional rate increases, and concerns about the hydraulic model used to develop the scopes of the Phase 4 projects. In addition, the City's current approach of implementing targeted initiatives to address SSOs has been demonstrated to be more effective at mitigating SSOs than the approach used to identify and develop the Phase 3 and Phase 4 RMP projects.

4.3.5 Phase 5 RMP

Preparation of the Phase 5 RMP will be delayed due to suspension of the Phase 5 SSA activities. SSA activities for Phase 5 are approximately 55% complete. Remaining Phase 5 SSA work, valued at approximately $12 million, was suspended by the City in March 2020 due to inadequate funding for implementation of Phase 5 projects.

4.3.6 Summary of RMPs by Phase

Table 4-12 provides a summary of the remedial measures identified in the RMP reports and work completed by the City through October 31, 2022.

Table 4-12: Summary of Remedial Measure Plans

Consent Decree Phase	Assets Identified in Remedial Measures Plans				Assets Rehabilitated or Replaced During Previously Completed Projects				
	Manholes (Each)	Gravity Mains (Feet)	Lift Stations (Each)	Force Mains (Feet)	Manholes (Each)	Gravity Mains (Feet)	Lift Stations (Each)	Force Mains (Feet) *	Wastewater Treatment (Projects) **
Phase 1	1,921	843,617	4	3,472	2,736	823,997	5	5,836	N/A
Phase 2	1,836	861,291	22	3,180	3,026	798,130	16	18,763	N/A
Phase 3	1,407	644,410	9	10,700	44	34,991	2	10,700	N/A
Phase 4	1,521	310,276	33	14,509	18	11,062	6	1,600	3
Phase 5	N/A	N/A	N/A	N/A	21	14,948	6	0	1

* The City has completed 9 point repairs on force mains (1 in Phase 1, 2 in Phase 2, 4 in Phase 4, and 2 in Phase 5) which are in addition to the lengths presented in the table.

** The previous RMP reports did not identify work to be completed at wastewater treatment or sludge processing facilities, as the Consent Decree did not require it. The City has completed some projects at these facilities.

5.0 CRITICAL PROJECTS PROGRAM

The City continues to deliver the current portfolio of Critical Projects, as described herein, that were selected to mitigate SSOs and maintain reliable utility service by addressing known facility and operational issues within the City's wastewater and water utilities. The City may continue scoping and developing additional Critical Projects through continued capital planning activities which will focus projects on SSO mitigation, compliance, and maintaining reliable wastewater and water utility systems.

5.1 Wastewater Critical Projects

The City plans to complete the activities summarized in **Table 5-1** during the period of 2022 to 2024. The activities are associated with delivery of Critical Projects to mitigate SSOs, address regulatory compliance, and maintain reliable utility service. **Table 5-2** (below) summarizes high-priority wastewater critical projects which have been identified and will be implemented pending the availability of funding. The City will use an Adaptive Management Approach to select projects listed in **Table 5-2** (below), or others identified through subsequent planning efforts, to be implemented that will provide benefit to public health using the City's available funding. **Figure 5-1**(below) provides an illustration of the location of the City's Wastewater Critical Projects. **Table 5-3** (below) provides an overview of the assets that have been rehabilitated or replaced as part of previous RMP and included or planned within the current Critical Projects Program.

Table 5-1: Wastewater Critical Projects

Wastewater Critical Projects			
Project	**Project Description**	**Status**	**Anticipated Completion**
CWP-01 MSA 3 STO 2 Wallace Interceptor at Boggy Bayou	Design (complete) and construction of demolition/abandonment of approximately 1,350 linear feet of 54-inch diameter Sanitary Sewer Pipe to be replaced on an independent alignment with approximately 1,100 linear feet of 54-inch diameter Gravity Sanitary Sewer with 4 new sanitary sewer manholes and one rehabilitated manhole.	Construction	June 2023 (Achievement of Full Operation)
CWP-08 City Wide Sewer Repair	Construction of on-demand and/or emergency improvements to repair sanitary sewer gravity mains and forcemains, specifically known locations of sewer pipe collapses, sink holes, SSOs, and forcemain and water main breaks. This contract is used to address emergency and high-priority issues in a timely and efficient manner. The City will expand the capacity of the current contract and implement additional contracts to expand its ability to respond to on-demand and emergency issues.	Construction	No Anticipated Completion Date – Ongoing Annually
CWP-09 Lucas & North Regional UV Disinfection Improvements	Design (complete) and construction of replacement of UV disinfection equipment at both the Lucas and North Regional WWTPs. This project will support compliance with the City's LPDES permits.	Bid & Award	July 2024 (Achievement of Full Operation)
CWP-11 Stratmore Lift Station Improvements	Construction for rehabilitation of existing lift station along with the associated piping.	Bid & Award	December 2023 (Achievement of Full Operation)
CWP-12 Lift Station Rehabilitation	Rehabilitation of lift stations that are on bypass, at risk of going on bypass, and/or have contributed to SSOs. This project has been packaged into sub-projects described below.	See below.	See below.
CWP-12B Maywood Lift Station Rehabilitation	Construction of rehabilitation of lift station that went on bypass in April 2019.	Construction	December 2023 (Achievement of Full Operation)
CWP-12C Land O' Trees Lift Station Rehabilitation	Construction of rehabilitation of lift station that is at risk of going on bypass.	Construction	December 2023 (Achievement of Full Operation)
CWP-12D Cherokee, Long Timbers, and Forbing Glen Lift Station Rehabilitation	Construction of rehabilitation of lift stations that are on bypass or at risk of going on bypass. Cherokee Lift Station went on bypass in April 2017. Long Timber and Forbing Glen Lift Stations are at risk of going on bypass.	Bid & Award	December 2023 (Achievement of Full Operation)
CWP-12E Agurs and Glen Avenue Lift Station Rehabilitation	Design and construction of rehabilitation of lift stations that are currently on bypass. Agurs Lift Station went on bypass in December 2018 and Glen Avenue Lift Station went on bypass in June 2019.	Bid & Award	April 2024 (Achievement of Full Operation)
CWP-12F Lakeside Boat, Woolworth Road No. 1, and Pinecrest Lift Station Rehabilitation	Construction of rehabilitation of lift stations that are on bypass. Lakeside Boat Lift Station went on bypass in June 2018. Woolworth Road No. 1 went on bypass in February 2018. Pinecrest Lift Station went on bypass in February 2019.	Bid & Award	April 2024 (Achievement of Full Operation)
CWP-17 Exposed Sewer Mains in Bayou Pierre	Study & Report (complete), design and construction for rehabilitation of existing 20-inch diameter and 24-inch diameter sewer crossing of Bayou Pierre exposed due to erosion of existing concrete encasement built within the flowline of concrete ditch.	Design	April 2023 (Design) May 2024 (Achievement of Full Operation)
CWP-36 Manhole Rehabilitation and I/I Reduction	Rehabilitation of high-priority manholes to address structural condition and infiltration and inflow (I/I) issues. The City will rehabilitate approximately twenty (20) manholes annually from 2022-2024.	Construction	No Anticipated Completion Date – Ongoing Annually

Wastewater Critical Projects			
Project	**Project Description**	**Status**	**Anticipated Completion**
CWP-56 Dilg League SSO Mitigation	Study & Report (complete), design and construction of improvements to address reoccurring SSOs at Dilg League Drive area.	Design	March 2023 (Design) December 2024 (Achievement of Full Operation)
CWP-63 Brookmeade & Querbes SSO Mitigation	Construction of improvements to address reoccurring SSOs in the Brookmeade & Querbes area. Approximately 9,000 feet of 10- to 30-inch-diameter gravity sewer is anticipated to be installed.	Bid & Award	December 2024 (Achievement of Full Operation)
Lift Station Rehabilitation Package	Study & Report and Design of rehabilitation of approximately twenty-five (25) lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. The City intends to complete only Study & Report and Design activities at this time. Implementation of improvements to follow design pending available funding.	See below (CWP-79, CWP-80, CWP-81, CWP-82)	See below
CWP-79 LS Improvements - Darien, Hardy, Meadow Parkway, Patzman Park, Alabama, Pinehill Road, North Caddo, Marjorie, Hawkins, and Pinehill Estates Lift Stations	Design of rehabilitation of lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. The City intends to complete only Design activities at this time. Construction of improvements to follow pending available funding.	Design	June 2023 (Design) To be determined. (Achievement of Full Operation)
CWP-80 LS Improvements - Havanna, Country Club, Fern, Cadillac, Risinger, Cross Creek, and Elgin Lift Stations	Design of rehabilitation of lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. The City intends to complete only Design activities at this time. Construction of improvements to follow pending available funding.	Design	June 2023 (Design) To be determined. (Achievement of Full Operation)
CWP-81 LS Improvements – Azalea Gardens, Attaway, Fannin, Bickham Bayou, North Hearne, North Pierre, and Linear Lift Stations	Design of rehabilitation of lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. The City intends to complete only Design activities at this time. Construction of improvements to follow pending available funding.	Design	June 2023 (Design) To be determined. (Achievement of Full Operation)
CWP-82 LS Improvements – Wallace, Dixie Garden, Shreve Island, Knight Street, and Mackey Lane Lift Stations	Design of rehabilitation of lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. The City intends to complete only Design activities at this time. Construction of improvements to follow pending available funding.	Design	December 2024 (Design) To be determined. (Achievement of Full Operation)
CWP-61 Gravity Sewer Main Improvements Package (Broadmoor & Querbes Area – Sewer Installation for Lines Under Homes)	Design of improvements to address high-priority condition issues based on NASSCO PACP ratings, known SSO locations, and work order records. The City intends to complete only Study & Report and Design activities at this time. Construction of improvements to follow pending available funding.	Design	December 2024 (Design) To be determined (Achievement of Full Operation)
CWP-83 Wallace Force Main Improvements	Study & Report to evaluate alternatives for rehabilitation or replacement of select portions of approximately 45,000 feet of 36-inch diameter ductile iron pipe (DIP) force main that is approximately 40 years old. The City intends to complete only Study & Report activities at this time. Design and construction of improvements to follow pending available funding.	Design	December 2023 (Study & Report) To be determined (Design) To be determined (Achievement of Full Operation)

Wastewater Critical Projects			
Project	**Project Description**	**Status**	**Anticipated Completion**
CWP-85 Stoner Force Main Improvements	Study & Report to evaluate alternatives for rehabilitation or replacement of select portions of approximately 46,000 feet of 36-inch diameter pre-stressed concrete forcemain that is approximately 45 years old. The City intends to complete only Study & Report activities at this time. Design and construction of improvements to follow pending available funding.	Design	December 2023 (Study & Report) To be determined (Design) To be determined (Achievement of Full Operation)
CWP-84 Cedar Grove Force Main Improvements	Study & Report to evaluate alternatives for rehabilitation or replacement of select portions of approximately 28,000 feet of 36-inch-diameter pre-stressed concrete forcemain that is approximately 45 years old. The City intends to complete only Study & Report activities at this time. Design and construction of improvements to follow pending available funding.	Design	December 2023 (Study & Report) To be determined (Design) To be determined (Achievement of Full Operation)
CWP-102 Southern Hills Interceptor Improvements	Study & Report to evaluate alternatives for rehabilitation of approximately 24,000 feet of 8- to 42-inch diameter concrete gravity sewer. Updated hydraulic modeling results indicate that the project as previously designed needs to be evaluated. The City will complete only Study & Report activities at this time. Design and construction of improvements to follow pending available funding.	Study & Report	December 2023 (Study & Report) To be determined (Design) To be determined (Achievement of Full Operation)
CWP-42 SCADA Master Plan and Implementation	Study & Report to evaluate improvements to address deficiencies in the supervisory control and data acquisition (SCADA) systems being utilized to operate the City's wastewater and water facilities. Planning for an upgrade is needed considering that the systems are nearing the end of their useful life. The City is currently challenged to fully understand the real-time operating conditions of its collection system and facilities because monitoring and control capabilities the current systems are limited, resulting in significant manual operation of the City's facilities and remote sites, including its wastewater lift stations. In addition, obtaining hardware compatible with the dated operating system and software is becoming increasingly difficult. The Master Plan will identify needed improvements with costs and a timeline associated with implementing upgrades. Design and construction of improvements to follow pending available funding.	Study & Report	September 2023 (Study & Report) To be determined (Design) To be determined (Achievement of Full Operation)
CWP-88 Sludge Farm Facility Improvements Phase II	Study & Report and design improvements at the sludge processing facility including cleaning and rehabilitation of the existing sludge storage lagoon and rehabilitation or replacement of sludge drying equipment that are necessary to either address regulatory compliance or maintain utility service. The City will complete only Study & Report and design activities at this time. Construction of improvements to follow pending available funding.	Study & Report	December 2022 (Study & Report) December 2023 (Design) To be determined (Achievement of Full Operation)
CWP-60 Stoner Force Main Improvements & Champion Lake Lift Station	Construction of new 8- and 12-inch diameter gravity sewer, installation of approximately 3 miles of 36-inch diameter forcemain and construction of new Champion Lake Lift Station. Project included abandonment of existing gravity sewer, forcemain and the old Champion Lake Lift Station.	Construction	October 2022 (Achievement of Full Operation)

Wastewater Critical Projects			
Project	**Project Description**	**Status**	**Anticipated Completion**
CWP-117 Pierremont Park Sewer Improvements	Design and construction of improvements to replace of existing 24-inch diameter gravity sewer with a larger new 30-inch. Note: This was originally a subproject of the CWP-63 Brookemeade & Querbes SSO Mitigation project. The City has expedited this project to construction.	Construction	To be determined (Achievement of Full Operation)

Table 5-2: Other Wastewater Critical Projects

Other Wastewater Critical Projects		
Project	**Project Description**	**Current Status**
CWP-79,80,81,82 Lift Station Rehabilitation Packages	Construction of rehabilitation of approximately twenty-five (25) lift stations to address current mechanical, electrical, hydraulic, and operational issues contributing to observed SSOs or reliability issues that, if not addressed, have a high likelihood of causing future SSOs. Completion of these activities is pending available funding.	Design
CWP-61 Gravity Sewer Main Improvements Package (Broadmoor & Querbes Area – Sewer Installation for Lines Under Homes)	Design and construction of improvements to address high-priority condition issues based on NASSCO PACP ratings, known SSO locations, and work order records. Completion of these activities pending available funding.	Design
CWP-64,65,66,67 Gravity Sewer Main Improvements Packages	Study & Report, design, and construction of improvements to address high-priority condition issues based on NASSCO PACP ratings, known SSO locations, and work order records. Completion of these activities is pending available funding.	Planning
CWP-83 Wallace Forcemain Improvements	Design and construction of rehabilitation or replacement of select portions of approximately 45,000 feet of 36-inch diameter ductile iron pipe (DIP) forcemain that is approximately 40 years old. Completion of these activities is pending available funding.	Planning
CWP-85 Stoner Forcemain Improvements	Design and construction of rehabilitation or replacement of select portions of approximately 46,000 feet of 36-inch diameter pre-stressed concrete forcemain that is approximately 45 years old. Completion of these activities is pending available funding.	Planning
CWP-84 Cedar Grove Forcemain Improvements	Design and construction of rehabilitation or replacement of select portions of approximately 28,000 feet of 36-inch-diameter pre-stressed concrete forcemain that is approximately 45 years old. Completion of these activities is pending available funding.	Planning
CWP-102 Southern Hills Interceptor	Design and construction of rehabilitation of concrete gravity sewer that is approximately 40 years old. Completion of these activities is pending available funding.	Design
CWP-42 SCADA Master Plan and Implementation	Design, construction, and/or implementation of improvements identified in an upcoming SCADA Master Plan. Completion of these activities is pending available funding.	Planning

Other Wastewater Critical Projects		
Project	**Project Description**	**Current Status**
CWP-88 Sludge Farm Facility Improvements Phase II	Construction of improvements necessary to address regulatory compliance or maintain reliable utility service. Completion of these activities is pending available funding.	Study & Report
Lucas and North Regional WWTP Improvements	Study & Report, design, and construction of improvements necessary to address regulatory compliance or maintain reliable utility service. Completion of these activities is pending available funding.	Planning
CWP-124 Cedar Grove Lift Station Improvements	Study & Report, design, and construction of improvements to the Cedar Grove Lift Station.	Planning
CWP-129 Chemical Feed Room Repairs at Lucas WWTP	Design of repairs for concrete floor and stairs in the chemical feed room at Lucas WWTP.	Design

Figure 5-1: Critical Wastewater Project Locations

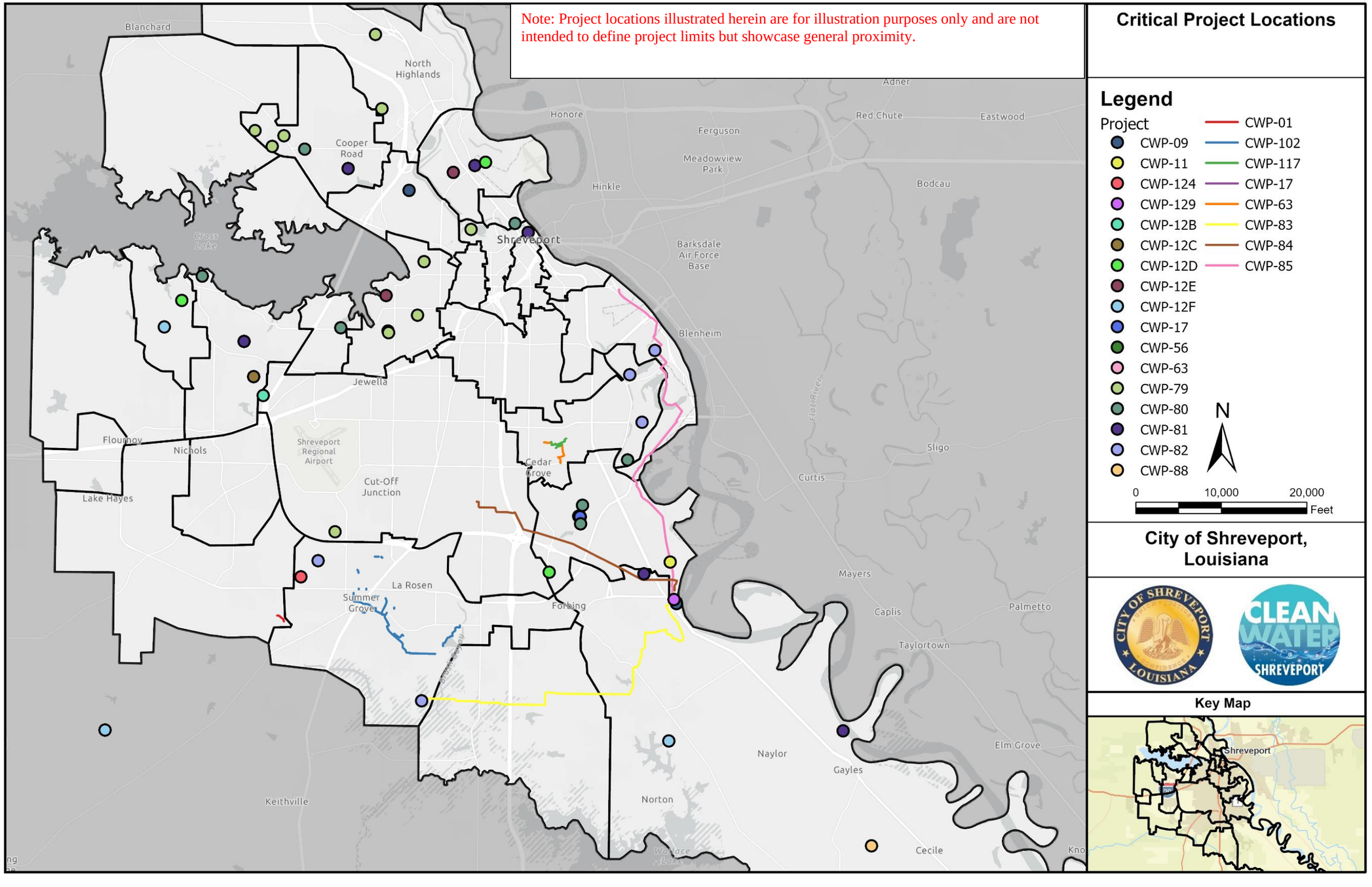


Table 5-3: WCTS Summary of Asset Rehabilitation and Replacements

Consent Decree Phase	Assets Identified in Remedial Measures Plans				Assets Rehabilitated or Replaced During Previously Completed Projects					Assets Included in Critical Projects Currently Being Planned, Designed or Constructed				
	Manholes (Each)	Gravity Mains (Feet)	Lift Stations (Each)	Force Mains (Feet)	Manholes (Each)	Gravity Mains (Feet)	Lift Stations (Each)	Force Mains (Feet) *	Wastewater Treatment (Projects) **	Manholes (Each)	Gravity Mains (Feet)	Lift Stations (Each)	Force Mains (Feet)	Wastewater Treatment (Projects) **
Phase 1	1,921	843,617	4	3,472	2,736	823,997	5	5,836	N/A	1	0	1	28,157	N/A
Phase 2	1,836	861,291	22	3,180	3,026	798,130	16	18,763	N/A	1	0	11	0	N/A
Phase 3	1,407	644,410	9	10,700	44	34,991	2	10,700	N/A	159	47,004	5	34,012	N/A
Phase 4	1,521	310,276	33	14,509	18	11,062	6	1,600	3	5	0	12	24,000	2
Phase 5	N/A	N/A	N/A	N/A	21	14,948	6	0	1	4	0	11	0	1

* The City has completed 9 point repairs on forcemains (1 in Phase 1, 2 in Phase 2, 4 in Phase 4, and 2 in Phase 5) which are in addition to the lengths presented in the table.

** The previous RMP reports did not identify work to be completed at wastewater treatment or sludge processing facilities, as the Consent Decree did not require it. The City has completed some projects at these facilities.

6.0 ADAPTIVE MANAGEMENT

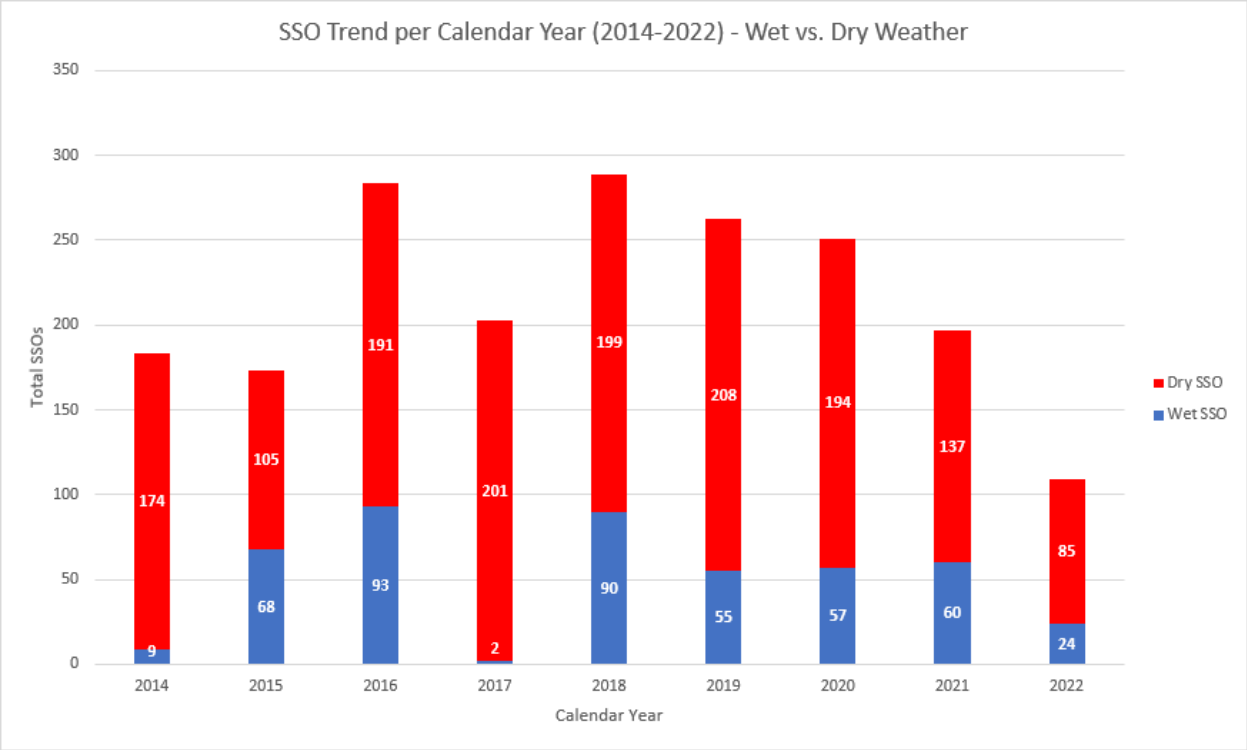
After an evaluation of the City's program was completed in 2020, it became apparent that addressing all defects that allow I/I is not an affordable or cost-effective approach to reducing SSOs. It was also evident that the City needed to complete wastewater and drinking water projects (other than collection system renewal and replacement) to maintain compliance and reliable utility service. As a result, the City identified, developed, and is delivering Critical Projects to mitigate SSOs and maintain compliance and reliable utility service.

This is an example of an adaptive management approach to implementing the City's Consent Decree program. Adaptive management is an intentional approach to making decisions and adjusting initiatives in response to new information or circumstances that change in the assumptions or criteria used to develop previous plans. This approach provides for learning and agile decision-making during program implementation to improve effectiveness and impact. Since 2020, the City has used adaptive management to focus its projects on addressing significant defects that cause or contribute to SSOs. This approach has proven to be successful by reducing SSOs and will continue to be used going forward. This section summarizes progress made since adaptive management began to be used, outlines the processes and tools which will be used to support adaptive management, and identifies a structured approach for evaluating progress.

6.1 Summary of Progress To-date

The number of sanitary sewer overflows which occur is the most important key performance indicator being used to measure the progress and success of the City's Consent Decree program. **Figure 6-1** illustrates the total number of SSO occurrences per calendar year since the City's Consent Decree program began in May 2014. The 5-year rolling average for the total number of SSO occurrences was 240.6 SSOs per year for 2017-2021. The 5-year rolling average for the number of dry-weather SSO occurrences was 187.8 per year for 2017-2021. The trend of total and dry weather SSO occurrences has decreased dramatically since 2020 when the City's adaptive management approach was implemented, with a 55% reduction achieved in 2022 compared to the previous 5-year rolling average. The results strongly support the success of the approach to strategically focus efforts on understanding the causes of SSOs in its system and implementing capital and maintenance programs designed to specifically mitigate those causes.

Figure 6-1: Sanitary Sewer Overflows by Year (2014-2022)



6.2 Assessment Programs

A summary of the assessment programs that the City will use to monitor progress and implement adaptive management solutions to address challenges being experienced by its wastewater utility is provided below.

6.2.1 Lift Station Assessment Program

The City has recently assessed s approximately 131 lift stations to identify those currently on bypass, at risk of requiring bypass pumping, and those in which equipment or power failure may have contributed to SSOs. As a result of these efforts, the City has been delivering Critical Projects to rehabilitate approximately twenty-five (25) lift stations (see Table 5-1). The City will continue to routinely assess its lift stations to determine if other remedial actions are required.

6.2.2 Force Main Assessment Program

The City completed assessments of its forcemains by walking forcemain alignments, identifying air release valves (ARV), and confirming force main discharge locations. Three (3) 36-inch diameter, aging force

mains have been identified as Other Wastewater Critical Projects (see Table 5-2). The City will routinely assess its forcemains by developing and maintaining a database of information regarding forcemain pipe condition data, including when a pipe is tapped or replaced, to identify trends or patterns indicating increased risk of failure. Forcemains will be assessed by reviewing forcemain failures to identify patterns indicating potential risk of failure. The City will also investigate opportunities to improve its forcemain assessment techniques, to include periodic surveys of new technologies and implementation of those techniques which are reliable and cost-effective.

6.2.3 Collection System Assessment Program

The City will continue to evaluate available collection system condition assessment data collected through Sewer System Assessment (SSA) activities previously completed according to the requirements of the original Consent Decree in SSA Phases (3, 4 and approximately half of 5). Gravity sewer mains and manholes inspected during SSA activities completed in these phases will be characterized using industry-accepted condition rating systems and the City's professional engineering judgment. The characterization will be utilized to develop the scope and timeline of sewer rehabilitation projects focused on addressing major structural defects in the collection system that restrict flow conveyance and cause SSOs as well as continue to identify necessary assets for inclusion in the Hot Spot Cleaning and Annual Sewer Cleaning programs.

The most practical and cost-effective solutions for resolving significant defects and the timetable for implementing these solutions will be based on consideration of the long-term performance of the assets and the consequence of failure. In addition, the City is implementing a risk assessment initiative to define Likelihood of Failure (LoF) and Consequence of Failure (CoF) for inspected sanitary sewer assets within the wastewater collection system and is integrating these into the City's data management systems.

6.2.4 Wastewater Treatment Plant (WWTP) Assessment Program

The City is currently completing a Critical Projects to replace aging UV disinfection equipment at the Lucas Wastewater Treatment Plant (WWTP) and North Regional WWTP. The City recently completed a project to increase sludge storage capacity at the Sludge Farm biosolids processing facility. The City has recently reviewed its Wastewater Master Plan and performed assessments of the Lucas WWTP, North Regional WWTP, and Sludge Farm to confirm the condition of equipment and processes and to identify additional projects necessary to reliably treat wastewater and process residuals in accordance with its LPDES permit requirements. The City will continue to routinely assess its wastewater treatment and residuals facilities to

determine if previously identified projects, or others identified in subsequent assessments, require action to maintain reliable operations or compliance with the City's LPDES permits. The City will also develop a Supervisory Control and Data Acquisition (SCADA) Master Plan to identify needed improvements along with costs and a timeline associated with implementing SCADA upgrades.

6.3 Ongoing Evaluation of Progress

As part of its adaptive management approach, the City will prepare and submit to EPA an interim evaluation report of progress by December 31, 2025, 2030, and 2035. These reports will evaluate the effectiveness of the City's program efforts and identify additional/alternative remedial measures work that may be required to improve the City's wastewater utility by supporting compliance with the Clean Water Act and reducing SSOs.

7.0 REFERENCES

Burk-Kleinpeter, Inc. and Black & Veatch. (July 2015). *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 1 Report*.

Burk-Kleinpeter, Inc. and Black & Veatch. (September 2015). *Task 700 – Remediation Measures Plan (RMP) – Phase 1 Report*.

Burk-Kleinpeter, Inc. and Black & Veatch. (September 2016). *Task 700 – Remediation Measures Plan (RMP) – Phase 2 Report*.

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Burk-Kleinpeter, Inc. and Black & Veatch. (November 2017). *Task 700 – Sanitary Sewer Assessment (SSA) – Phase 3 Report*.

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Burns & McDonnell (July 2022). Capacity Assessment Report

Burns & McDonnell (January 2023). Capacity Assessment Remedial Measures Plan

APPENDIX A : GUIDELINE FOR ASSESSMENT AND REHABILIATION

GUIDELINES FOR ASSESSMENT AND RECOMMENDATIONS

Updated 7/8/2019

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Introduction to the SSA Program

The City of Shreveport (City) is in the process of conducting a Sanitary Sewer Assessment (SSA) Program of its Wastewater Collection & Transmission System (WCTS). The SSA Program is being undertaken as part of a Consent Decree (CD) agreement with Environmental Protection Agency (EPA) and Department of Justice (DOJ) (Case No. 5:13-cv-3065) and is comprised of five phases.

Each of these phases is expected to be compliant with the CD. An easily understood summary of key requirements and milestones of the SSA Program is included here for the convenience of the reader. Managerial decisions should always be based on direct reading of the CD and therefore, citations have been included. The compliance requirements of the CD that are most pertinent to the SSA Program are:

- Visual inspections of all manholes and associated pipes (CD 2014, Page 17 p22)
- Identify physical degradation of the WCTS and quantify Inflow and Infiltration (CD 2014, Page 17 p21).
- Smoke testing of all pipes that are 15 inches in diameter and smaller of the WCTS, including Private Laterals (CD 2014, Page 17 p22).
- CCTV inspection of at least 30% of the applicable portion of the WCTS (including 100% of the pipes that are greater than 15 inches in diameter) in each phase (CD 2014, Page 17 p22).
    - The City has elected to attempt CCTV on 100% of gravity sewer lines.
- Dye testing if appropriate (CD 2014, Page 17 p22)
- Flow isolation if appropriate (CD 2014, Page 17 p22)
- Identify sewers in need of repair, rehabilitation, or replacement (CD 2014, Page 17 p22)

The major milestones specified in the CD that are pertinent to the SSA Program are:

SSA Milestones	Inspection Deadlines	SSA Report Deadlines	RMP Report Deadlines
Phase 1	5/12/2015	7/12/2015	9/12/2015
Phase 2	11/12/2016	1/12/2017	3/12/2017
Phase 3	5/12/2018	7/12/2018	9/12/2018
Phase 4	11/12/2019	1/12/2020	3/12/2020
Phase 5	5/12/2021	7/12/2021	9/12/2021

(CD 2014, Pages17, 21, 25)

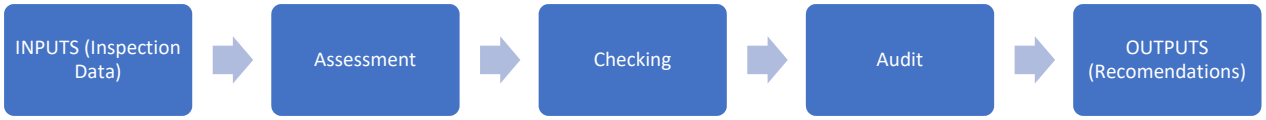
The CD also requires a reassessment of the first three phases. This reassessment shall be started no later than 8 years from the effective date of 5/13/2014 and completed no later than 12 years from the effective date (CD 2014, Page 35 p51(b)). It has not yet been established if these guidelines will apply to the reassessments of the first three phases.

Within this document the line between the SSA program (the inspections) and the RMP program (the recommendations) is often blurred. The remainder of this document provides guidance on how the data from the SSA Program are used for the RMP program to arrive at consistent and repeatable rehabilitation recommendations. While there is a degree of subjective interpretation required in the process, there are logical procedures in place to mitigate as much variability as possible. Checking is an

integral part of the assessment processes and this feedback has resulted in improvements to these procedures over time. Those updates have been incorporated into this document.

Generalized Summary of the Assessment Process

Historically the assessment team has been composed of three-roles: The Assessor, the Checker, and the Auditor (known collectedly as the Assessment Team). In brief, incoming inspection data is processed, and a preliminary assessment rating is assigned. This preliminary rating is used to flag potential public safety hazards. Next, the assessor examines the inspection data associated with each asset and arrives at an assessment rating and type of construction. As the assessments are completed by the Assessor, the Checker examines each inspection and accepts or rejects the assessment rating and the type of construction. The Assessment Team collaborates often throughout these processes and if necessary, corrective action is taken. When all the inspections have been assessed and checked, the recommendations are updated based on recommended capacity improvements and spatial analysis. When all the assets have been updated and a final recommendation has been made, the Auditor performs a final check to ensure procedures have been carried out correctly and consistently.



Gravity sewer lines are inspected using smoke testing, CCTV inspections, and occasionally sonar and/or dye testing. Manholes are inspected with smoke testing and either a 3D Panoramic camera (preferred) or a Pole Camera. In a few isolated instances, CCTV may be used as the means of inspection. These inspections are received incrementally throughout the project, usually on a monthly basis, and are the inputs to the assessment process.

The National Association of Sewer Service Companies (NASSCO) has developed a program for Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP). Defects are coded in accordance to PACP and MACP guidelines. These codes are used heavily through the assessment process and are referenced within this document. Familiarity with PACP and MACP codes and procedures would be helpful to the reader but are certainly not required. PACP and MACP certifications are held and maintained by both the Assessor and the Checker.

While the PACP and MACP codes are standardized, there is considerable variability in the severity of the defect associated with each code. Due to these variabilities, it is necessary to apply selective judgement to the evaluation of individual defects and by extension to the assets. The challenges associated with making a subjective judgement more repeatable are mitigated by collaboration and training over time. Collaboration and training are integral parts of the checking and auditing processes. When differences of opinion do arise, the Assessor and the Checker usually resolve them through discussion. Even if the Assessor and the Checker agree, it is a routine matter to discuss examples with the Auditor. If inconsistencies are discovered, they are discussed until full team consensus is reached and recommendations are adjusted. On rare occasions, special conditions have

warranted discussion with City personnel and the Program Manager, usually during one of the monthly meetings. A recent example was the construction artifacts.

The gravity sewer line assessment process is recorded on a Gravity sewer line assessment form. This form will be referenced several times in the explanation of these procedures. The form is designed to reflect the assessment process. Summary data is located at the top, along with the final rehabilitation recommendation and assessment rating. Emergency repairs, if any, are denoted with relevant information due to their importance. A completed example is available in Appendix 6.

Gravity sewer line Assessment

In general, each gravity sewer line will have two types of inspections: a smoke test and a CCTV inspection. Occasionally, additional or alternate inspection techniques are used (Sonar, Dye test, etc.), and those inspection techniques are discussed when appropriate. The process to evaluate smoke test inspections and CCTV inspections are in the sections that follow. If at any time a defect is encountered that warrants an emergency repair, the emergency repair procedures are initiated.

Emergency Repairs Procedures

Ideally, potential emergency repairs are found in the field by the sub-contractor performing the inspections. Additional emergency repairs are discovered by the Assessor or during the evaluation process. If the subcontractor reports the need for an emergency repair, they submit a flash drive containing photos, videos, and any other relevant information. If the Assessor finds a situation requiring an emergency repair the relevant information is retrieved from the data submittal. In either case, the Assessment Team reviews the defect and determines if an emergency repair is warranted. If so, the repair is officially submitted to the City which has the final say if a repair warrants emergency action. Over time, the definition of “emergency repair” has been refined through conversations with City personnel. This has reduced the number of emergency repairs required.

When the Assessment Team deems a defect does not warrant an emergency repair, a standardized note is added to the emergency repair section of the form stating as much, and the defect is addressed in the standard assessment process.

When the Assessment Team determines the defect warrants an emergency repair (most commonly public safety hazards and utility conflicts), a report is submitted to the City and Program Manager (PGM) via email. The emergency repair report contains the defect description, location, and pictures. The report, videos, and pictures are uploaded to two (2) external hard drives and delivered to the COS Field Operations superintendent and the program management team. The relevant information is added to a tracking spreadsheet where information like descriptions, addresses, work order numbers, and statuses are housed. If a repair is made prior to the end of SSA field work, a post-repair inspection is performed by the sub-contractor and submitted for the updated assessment of the gravity sewer line.

Emergency Repair

EmergencyRepairS	Yes
Date Sent:	2/13/2017
Work Order	107226
Completion Date	7/13/2017

Remarks

Emergency Point Repair required to address Infill Runner (IR) and Infill Gusher (IG) at 284.3 feet and 286 feet from 22MM-49. Nearby pond seems to be contributing to the gusher. Curtis states that City will insert a stainless steel pipe.

Evaluating Smoke Test inspections

Smoke test inspections are conducted by a sub-contractor and the resultant inspection reports are submitted incrementally throughout the project phase. Rehabilitation recommendations (Reassess in the future, Point repair, Liner, Pipe Burst, Replacement, or Install Terminal Manhole) are not determined as a result of assessing the smoke test inspections. Instead, an assessment rating (0 to 5) is assigned for the gravity sewer line, data is recorded for Inflow and Infiltration calculations (I&I), and if necessary, notes are transferred to the associated manhole for inclusion in the assessment of that manhole. The results of smoke testing inspections factor into the rehabilitation recommendations during the process of developing a composite rating.

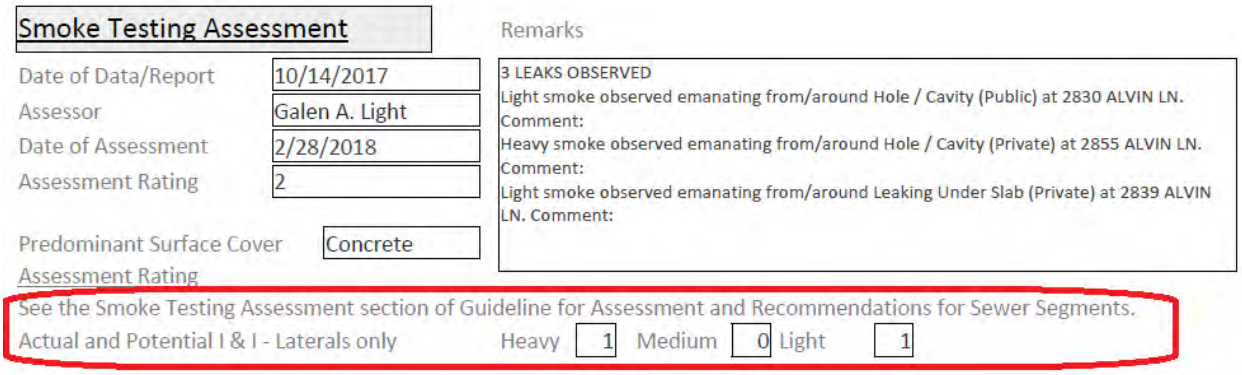
The general source for smoke leak observations are categorical. In other words, the general source for each smoke leak observation falls into one of three possible groups: manholes, private laterals, or the gravity sewer line itself. These general source groups are exclusive. A leak does not belong to more than one of the three possible general source groups. Smoke leak observations from each general source group impacts a different element of the smoke testing assessment.

Smoke leak observation - manholes

An observation of smoke leaking from around a manhole is transferred from the gravity sewer line to the appropriate manhole and does not impact the assessment rating of the gravity sewer line. The only exception would be if the Manhole were private, in which case it would be counted in the I&I summation.

Smoke leak observation - private laterals

An observation of smoke leaking that is greater than 20 feet from the gravity sewer line and is not from an obvious public asset (City Storm Drain, City manhole) would be deemed private. For each smoke test inspection, the number of smoke leak observations that are deemed to be private are summed by volume of smoke (heavy, medium, or light) and recorded in the "Actual and Potential I&I – Laterals only" section of the gravity sewer line assessment form. As the intention of summarizing these leaks from private sources is for use in I&I calculations, a leak observed from a private manhole would be counted as if it were a lateral and a note would be made on the manhole assessment report.



Smoke Testing Assessment

Date of Data/Report	10/14/2017
Assessor	Galen A. Light
Date of Assessment	2/28/2018
Assessment Rating	2
Predominant Surface Cover	Concrete

Remarks

3 LEAKS OBSERVED
Light smoke observed emanating from/around Hole / Cavity (Public) at 2830 ALVIN LN. Comment:
Heavy smoke observed emanating from/around Hole / Cavity (Private) at 2855 ALVIN LN. Comment:
Light smoke observed emanating from/around Leaking Under Slab (Private) at 2839 ALVIN LN. Comment:

Assessment Rating
See the Smoke Testing Assessment section of Guideline for Assessment and Recommendations for Sewer Segments.
Actual and Potential I & I - Laterals only Heavy 1 Medium 0 Light 1

Smoke leak observation - Gravity sewer line

An observation of smoke leaking that is within 20 feet of the gravity sewer line and is not from an obvious private asset (yard drain, broken lateral clean out, missing lateral cleanout cap, roof drain, etc.) is deemed to be "public". These are the smoke leaks that directly impact the assessment rating of the gravity sewer line.

A Gravity sewer line that was not inspected using smoke testing (typically private lines) is given an assessment rating of zero (0). As a reminder, in accordance with the CD, all pipes that are 15 inches in diameter or smaller need to be smoke tested. A rating of zero is unusual and should be an explainable exception. If a smoke leak is observed on a private gravity sewer line it would be counted among the private lateral summation previously covered.

Otherwise, the assessment rating is assigned based on the volume of smoke observed to be leaking from the sanitary sewer line. A Gravity sewer line that has no smoke leaks attributed to it is assigned a smoke test assessment rating of one (1). If light smoke is observed the assessment rating would be upgraded to a two (2). If medium smoke is observed, then the assessment rating would be upgraded to a three (3). If heavy smoke is observed, the assessment rating would be upgraded to a four (4). An assessment rating of five (5) is reserved for cases when the smoke test inspection gives reason to take immediate action. This is usually a direct physical connection between the sanitary sewer collection system and the public storm water collection system (cross connect) or a constructed overflow. In those cases, dye testing is usually conducted to confirm the cross connection. If confirmed, an emergency repair will be performed to rectify the cross connection.

Smoke Testing Assessment

Date of Data/Report	10/14/2017
Assessor	Galen A. Light
Date of Assessment	2/28/2018
Assessment Rating	2
Predominant Surface Cover	Concrete

Remarks

3 LEAKS OBSERVED
Light smoke observed emanating from/around Hole / Cavity (Public) at 2830 ALVIN LN. Comment:
Heavy smoke observed emanating from/around Hole / Cavity (Private) at 2855 ALVIN LN. Comment:
Light smoke observed emanating from/around Leaking Under Slab (Private) at 2839 ALVIN LN. Comment:

Assessment Rating
See the Smoke Testing Assessment section of Guideline for Assessment and Recommendations for Sewer Segments.
Actual and Potential I & I - Laterals only Heavy 1 Medium 0 Light 1

Dye Testing

Dye testing is used as an additional inspection technique and can be used on any major source group (Manhole, Private Lateral, or Gravity sewer line). Dye testing is almost always used to explore the possibility of a direct cross connection with the Storm Water Collection System. When a Smoke Test Inspection suggests a potential cross connection, a dye flood test is performed on the suspected location. This involves placing dye or a dye tablet in the smoke source (ditch, storm drain, yard drain, roof drain, etc.) and supplying water to flood the dye in the system. A CCTV camera is placed in the sewer system to identify where any potential leak or cross connection may be located. Multiple attempts can be made to ensure that all efforts to locate potential leaks are found. If a dye test on a

public source is positive, it is submitted for emergency repair or addressed in the RMP. If a dye test on a private source is positive, a 10-day Notice of Violation letter is sent to the respective property owner.

Evaluating CCTV inspections

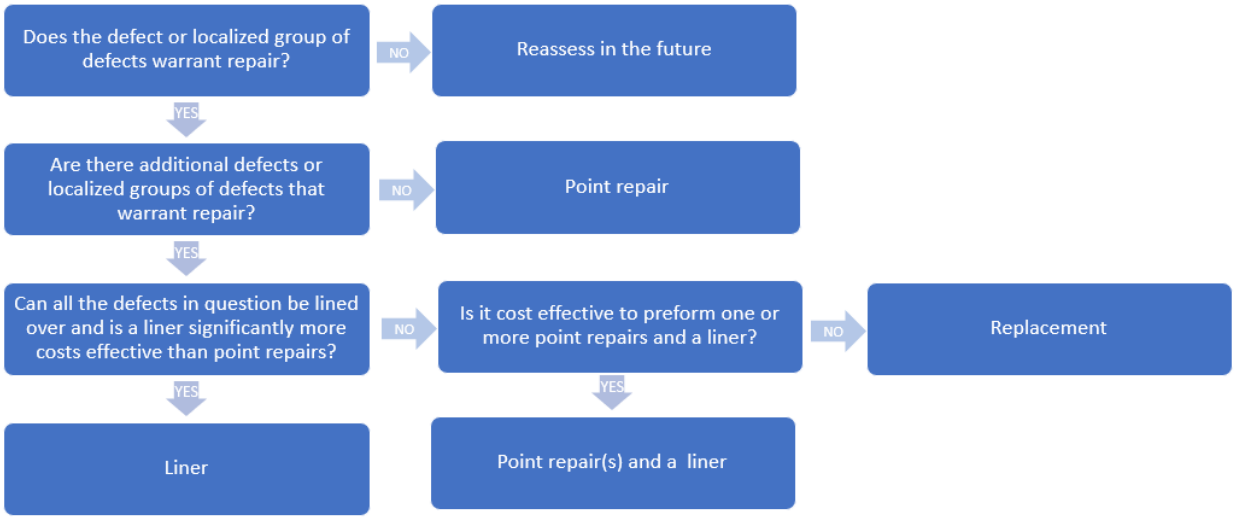
Gravity sewer lines are inspected in accordance with PACP standards and as a result each observation or defect is coded. These codes are assigned an assessment rating from 1 to 5, and the maximum value is applied to the gravity sewer line. These numbers have been refined over time and consider the probability of failure and the consequences of the failure should it occur. The result is a temporary rating that allows for workflow prioritization and is primarily used to locate defects that need to be reviewed for an emergency repair.

	InitialRating	MajorMinor	Distance	ImageLink	Cc	Va	Valı	Vali	Join	
⊞	1	Not Defect	0	AMH					☐	01JJ-51
⊞	1	Not Defect	0	MGP					☐	PIPE DIAMETER
⊞	1	Not Defect	0	MWL				10	☐	
⊞	2	Major	5	FM					☑	
⊞	2	Minor	9.6	FL					☑	
⊞	3	Major	11.6	H					☐	
⊞	2	Minor	16.4	CL					☑	
⊞	2	Minor	16.9	SSS					☑	
⊞	2	Major	16.9	CM					☑	
⊞	3	Major	22.6	B					☑	
⊞	3	Major	28.5	MWLS				15	☐	
⊞	2	Minor	46.4	ISSR				5	☐	
⊞	2	Minor	58.3	ISSR				5	☐	
⊞	2	Major	76.4	FM					☑	
⊞	2	Major	82.5	FM					☑	
⊞	5	Major	100.4	BSV					☑	
⊞	5	Major	106.4	HVV					☐	
⊞	3	Major	112.4	ID					☑	
⊞	3	Major	112.4	B					☑	
⊞	3	Major	119.3	MWLS				20	☐	
⊞	2	Minor	136.6	ISSR				5	☐	
⊞	2	Minor	184.7	FL					☐	
⊞	2	Minor	255.1	TBD		6			☐	DEBRIS
⊞	2	Major	266.7	FM					☑	
⊞	5	Major	267.9	BSV					☑	
⊞	3	Major	274	B					☑	
⊞	5	Major	280.5	HSV					☑	
⊞	3	Major	286.5	B					☑	
⊞	2	Minor	316.4	ISSR				5	☐	
⊞	1	Not Defect	327.1	MCU	S01				☐	
⊞	1	Not Defect	347	MCU	F01				☐	
⊞	1	Not Defect	347	AMH					☐	01JJ-51
✳	0								■	

As there is subjective interpretation inherent in the inspections, subjective interpretation is required in the assessments. The defect codes are examined, and the Assessor uses his or her best judgement to determine if a repair is warranted. The following section explains the methodologies used.

Type of construction

Arriving at an initial rehabilitation recommendation (type of construction) based on the CCTV inspection is a two-part process. First the Assessor must determine if the defect(s) warrant a repair, then the Assessor must determine what repair is most appropriate. An understanding of the repair options and types of construction is needed to determine what repair is warranted. Cost estimates are used to assist in the selection of the appropriate repair.



Reassess in Future

Reassess in the future is used when the gravity sewer line is in good condition and there is no evidence to suggest a repair is necessary. It is recommended that this Gravity sewer line be added to the preventative maintenance schedule.

Install Terminal manhole

Install terminal manhole is recommended if there is a repair warranted on a dead-end line that will be addressed with the addition of a terminal manhole. Gravity sewer lines that have one or more blind tees are also recommended for the installation of a terminal manhole. Otherwise, if a Gravity sewer lines terminates without a manhole (i.e., a dead-end line), is at least 10 feet in length (i.e., not a "stub-out"), and makes it though all other assessment processes (Spatial, Capacity, etc.) without a repair recommended more aggressive than Reassess in the Future, then it will be upgraded to the Install Terminal Manhole type of construction (see Comprehensive Assessment)

CCTV Assessment	
Date of Data/Report	12/18/2017
Assessor	Galen A. Light
Date of Assessment	5/23/2018
Assessment Rating	4
Type of Construction	Install terminal manh
Point Repair Length	0
Surface Type	Natural Ground

Remarks

Crack Longitudinal, Crack Spiral, Hole, Intruding Sealing Other, Joint Offset Medium, Roots Fine Joint, Tap Break-in Intruding, Tap Factory Defective

End of pipe cap is missing. Installing a terminal manhole will address this issue.

Point Repair

Point repairs are considered in 20 feet increments. The cost of a point repair is compared to the cost of other, more aggressive rehabilitation methods (Liner, Pipe Burst, Replace) and a decision is made about which repair will give the greater value. As the cost estimates are rough orders of magnitude at this point, the decision is a value judgement.

Liner Cost	$16,850
Pipe Burst Cost	$73,466
Point Repair Cost/20Ft	$4,360
Replacement Cost	$73,466

CCTV Assessment	
Date of Data/Report	12/4/2017
Assessor	Galen A. Light
Date of Assessment	3/8/2018
Assessment Rating	3
Type of Construction	Point Repair
Point Repair Length	40
Surface Type	

Remarks

Point repair required to address Roots Medium Connection (RMC) at 37.1 and Hole Soil Visible (HSV) at 38.3 feet from 01X-59.

Point repair required to address Roots Medium Connection (RMC) at 173.5 and Hole Soil Visible (HSV) at 174.3 feet from 01X-59.

Deposits Attached Ragging, Fracture Longitudinal, Hole Soil Visible, Roots Medium Connection, Tap Break-in Defective, Tap Factory Defective

Liner

Liners are recommended when deemed cost effective. A liner may be used if a gravity sewer line is non-capacity restricted, structurally intact, and within acceptable grade/alignment (less than fifteen (15) percent). If there are defects that cannot be addressed with a liner alone a point repair might also be called out.

Liner Cost	$16,850
Pipe Burst Cost	$73,466
Point Repair Cost/20Ft	$4,360
Replacement Cost	$73,466

CCTV Assessment	
Date of Data/Report	8/28/2017
Assessor	Galen A. Light
Date of Assessment	10/26/2017
Assessment Rating	3
Type of Construction	Rehab with Liner
Point Repair Length	20
Surface Type	Natural Ground

Remarks

Point repair required to address Roots Medium Connection (RMC) at 272 feet from 01Y-42.

Fracture Longitudinal, Fracture Multiple, Hole, Intruding Sealing Other, Intruding Sealing Ring, Roots Fine Joint, Roots Fine Lateral, Roots Medium Connection, Tap Break-in Defective, Tap Factory Defective, Water Level Sag, Fracture Longitudinal Hinge(3)

Pipe Burst

Pipe bursts are only recommended in rare instances. If a gravity sewer line needs replacement (it is not cost effective to point repair and cannot be lined) then it may be considered for Pipe Bursting. This construction type is not used at the sole discretion of the Assessor, but instead is a directive from the SSA Program Team Leader (traditionally the Auditor).

Replace

Replacement is recommended when there are multiple defects that cover a long section(s) on a gravity sewer line that cannot be addressed with a liner and that would make point repairing impractical. This is often the case when there are defects that have caused the CCTV inspection to be abandoned leaving long sections uninspected or significant sags that are too long for point repairs to be cost effective. The reasoning for replacement is included in the remarks. It should be noted that the City has decreed that any gravity sewer line that is replaced should be at least 8 inches in diameter. In other words, if a 4- or 6-inch gravity sewer line is replaced the replacement gravity main should be at least 8 inches.

CCTV Assessment	
Date of Data/Report	3/21/2018
Assessor	Galen A. Light
Date of Assessment	4/26/2018
Assessment Rating	4
Type of Construction	Replace Segment
Point Repair Length	0
Surface Type	Drainage Channel (Impro

Remarks

Crack Longitudinal, Deformed, Fracture Longitudinal, Fracture Multiple, Fracture Spiral, Hole Soil Visible, Infil Dripper, Roots Fine Joint, Tap Factory Defective, Fracture Longitudinal Hinge(4)

Mulitple defects

CCTV Assessment		Remarks
Date of Data/Report	1/3/2018	Deposits Attached Encrustation, Deposits Attached Grease, Fracture Longitudinal, Fracture Spiral, Hole, Intruding Sealing Other, Surface Corrosion Metal Pipe, Tap Break-in Intruding, Tap Factory Defective, Water Level Sag
Assessor	Galen A. Light	
Date of Assessment	2/22/2018	
Assessment Rating	4	
Type of Construction	Replace Segment	Survey incomplete
Point Repair Length	0	
Surface Type	Major Streets	

CCTV Assessment		Remarks
Date of Data/Report	12/12/2017	Deposits Attached Grease, Water Level Sag
Assessor	Galen A. Light	
Date of Assessment	3/14/2018	Sags over 30% for greater than 10 feet.
Assessment Rating	4	
Type of Construction	Replace Segment	
Point Repair Length	0	
Surface Type	Natural Ground	

CCTV Assessment Ratings

Using the preliminary assessment rating to prioritize work, the assessor examines each gravity sewer line and determines if a repair is necessary. Each defect code is given the attention that is warranted based on its potential severity and impact until a rehab recommendation can be reached. The Assessor accomplishes this by asking themselves a series of questions.

0. **Is the gravity sewer line included for administrative purposes only?**
1. **Is the gravity sewer line in pristine condition and not some variation of clay or concrete gravity sewer line?**
2. **Does the gravity sewer line have some minor defects that are not likely to get significantly worse within the next 6 to 10 years?**
3. **Does the gravity sewer line have defects that do need to be addressed but can wait three to five years?**
4. **Does the gravity sewer line have major defects that need to be dealt within the next two years?**
5. **Does the gravity sewer line have major defects that represent immediate public safety hazard?**

Assessment rating 0

Is the gravity sewer line included in the report for administrative purposes only? If so, the assessor assigns an assessment rating of zero (0). This assessment rating is reserved for gravity sewer lines that are included in the report but not inspected for a logical and preapproved reason. For instance, private gravity sewer lines which are included in the GIS are reported on, but smoke testing is not conducted. Another rare case is when the gravity sewer line is part of a capital replacement project that is already underway, and approval has been given not to assess the gravity sewer line.

Assessment rating 1

Is the gravity sewer line in pristine condition and not some variation of clay or concrete gravity sewer line? If so, the assessor assigns a rating of one (1). In layman's terms, this means the gravity sewer line is "as good as new" and is NOT made of clay or concrete. If you looked at it in ten years, you'd expect it to look the same. Based on present conditions there is no reason to believe any of the defects will cause a Sanitary Sewer Overflow (SSO). This may include the following:

- Gravity sewer line blockages:
  - No evidence of blockages
  - No diminished Gravity sewer line capacity from debris or attached grease
  - Good fluid movement
  - CCTV complete from manhole to manhole
- Infiltration:
  - Presence of infiltration staining
- Gravity sewer line Structure:
  - No cracks in gravity sewer line
  - No disjointed sections
  - Good line and grade (e.g. no sags, bends, etc.)
  - Sound lateral connections
- Gravity sewer line structure:
  - No apparent structural issues
- Corrosion:
  - No visible corrosion
- Roots:
  - No roots in gravity sewer line
- Material:
  - Gravity sewer line is NOT Vitrified Clay (VCP) or any type of Concrete (RCP, CON)

Assessment rating 2

Does the gravity sewer line have some minor defects that are not likely to get significantly worse within the next 6 to 10 years? If so, the assessor assigns a rating of two (2). This means that if you looked at it in ten years, you'd expect it to look very similar. The likelihood of any defect causing an SSO is very low. In layman's terms, the gravity sewer line looks good but isn't perfect. This may include the following:

- Gravity sewer line blockages:
  - Blockages are than 10%
  - Flow restricted only by small amounts of grease or sediment deposits (generally less than 10%)
  - Good fluid movement appears to be maintained
  - Sags are generally less than 35% and do not appear to be otherwise problematic (little if any attached grease, at the terminal end of a Gravity sewer line, only a short distance with adequate scouring likely)
- Infiltration:
  - Presence of an infiltration weeper

- Gravity sewer line structure:
  - Minor fractures in gravity sewer line
  - Liners are in good condition
  - Previous point repairs are in good to fair condition
- Corrosion:
  - Minor corrosion evident in gravity sewer line
- Roots:
  - Fine roots in gravity sewer line
- Material:
  - The best rating any Clay (VCP) or any type of Concrete (RCP, CON) gravity sewer line can get is a two (2).

Assessment rating 3

Does the gravity sewer line have defects that do need to be addressed but can wait three to five years? If so, the assessor assigns a rating of three (3). Failure is not eminent; however, if the repair is not done it will eventually get worse and result in a costlier repair or an SSO. In layman's terms, the repair is needed but can wait. This may include the following:

- Gravity sewer line blockages:
  - Blockages are less than 20% (blockages are not likely to be causing surcharging upstream)
  - Flow restriction is evident leading to large sediment deposits which can be addressed by routine hydraulic cleaning
  - Sags greater than 35% and can be cost effectively repaired with a point repair
- Infiltration:
  - Presence of an infiltration dripper
  - Gravity sewer line structure:
  - Fractures in gravity sewer line
  - Disjointed gravity sewer line sections greater than the wall thickness
  - Liners have moderate deterioration and are beginning to fail
- Gravity sewer line Structure:
- Corrosion:
  - Corrosion is moderate
- Roots:
  - Larger roots penetrating the gravity sewer line

Assessment rating 4

Does the gravity sewer line have major defects that need to be dealt within the next two years? If so, the assessor assigns a rating of 4. Failure is imminent. If the repair is not done soon, it will get considerably worse or is likely to result in an SSO. In layman's terms, this needs to be repaired soon. This may include the following:

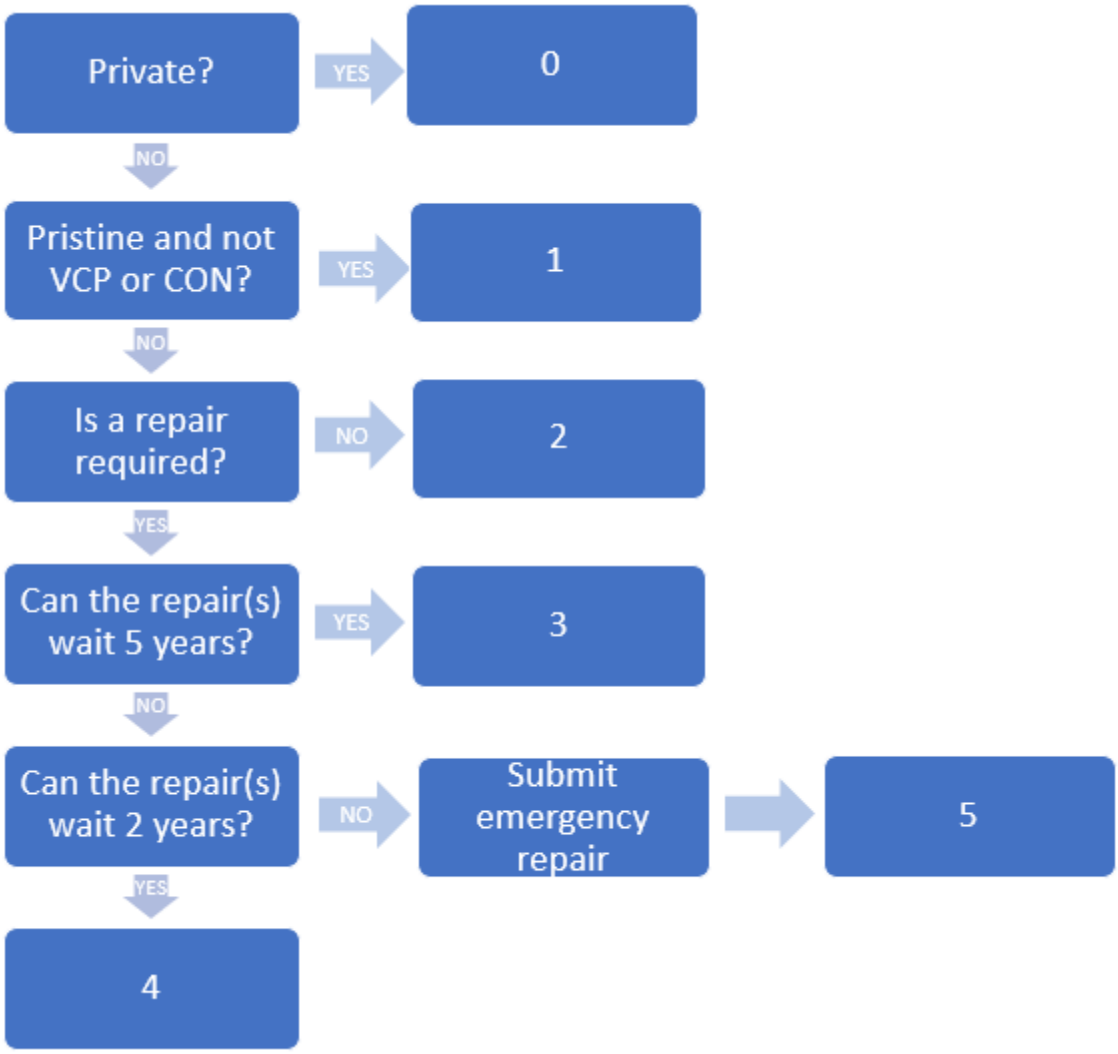
- Gravity sewer line blockages:
  - Blockages are greater than 20%, but there is still flow (blockages are likely causing surcharging conditions upstream)

  - Significant deposits which cannot be addressed by routine hydraulic cleaning
  - CCTV inspection cannot be completed (i.e., the gravity sewer line cannot be adequately inspected).
  - Sags significantly greater than 35% that cannot be cost effectively repaired with a point repair
- Infiltration:
  - Presence of an infiltration runner or a (relatively minor) gusher
- Gravity sewer line structure:
  - Large fractures that are nearly completely collapsed (some flow is still evident)
  - Disjointed Gravity sewer line sections and severe sags lending to further gravity sewer line collapse
  -
  - Structural integrity is compromised
  - Previous rehabilitation efforts have not been effective to reduce I&I or to regain structural integrity
  - Severely deteriorated rehabilitation applications (e.g., slipped or crumpled lining, missing epoxy coatings)
  - Frequent loss of line and grade
- Corrosion:
  - Corrosion is extensive
- Roots:
  - Tap roots and large root masses have penetrated the gravity sewer line

Assessment rating 5

Does the gravity sewer line have major defects that represent immediate public safety hazard? If so, the assessor assigns a rating of 5 and submits the asset as a potential emergency repair. This may include the following:

- Utility Conflicts
  - Utility conflicts (gas mains, water lines, drainage structures, power poles, etc.)
- Gravity sewer line blockages:
  - Complete obstruction of flow
- Infiltration:
  - Catastrophic infiltration (potential busted water main, inflow from water body, etc.)
- Gravity sewer line structure:
  - Missing gravity sewer line joints or gravity sewer lines
  - Complete collapse
  - Large visible voids through holes or breaks in gravity sewer line
- Corrosion:
  - Extensive corrosion resulting in a missing crown (the gravity sewer line is essentially "gone")
- Roots:
  - Massive root penetration (the gravity sewer line is essentially "gone")



Assessment of Inflow & Infiltration

During each SSA phase, dynamic environmental conditions will be encountered which will result in a variation of the amount of observed I&I on similar or the same types of defects. Therefore, the total I&I for each sewer basin will be allocated to each gravity sewer line by using the potential I&I rating. The potential I&I rating will be based on the observed defects during the manhole inspections, smoke testing, and/or CCTV and will use engineering judgment to quantify the amount of potential I&I on each gravity sewer line during saturated conditions. The four (4) potential I&I ratings are as follows:

Minimal – The Gravity sewer line is new or nearly new with no defects coded. This item has little to no potential for I&I.
Low – The Gravity sewer line has shown few to no defects and will remain in use for the foreseeable future (e.g., minor circumferential or longitudinal cracks and or fractures).
Medium – The gravity sewer line (including manholes) shows a moderate risk of I&I by having several minor defects or a potential minor continuous defect (e.g., hinge or multiple fractures).

High – The Gravity sewer line shows a significant risk of major I&I by having multiple defects that are directly related to I&I (e.g., broken soils visible, hole voids visible, collapsed pipe, joint offset).

CCTV Assessment

Date of Data/Report	1/12/2017
Assessor	Galen A. Light
Date of Assessment	2/27/2017
Assessment Rating	3
Type of Construction	Rehab with Liner
Point Repair Length	0
Surface Type	Natural Ground

Remarks

Broken, Broken Soil Visible, Crack Longitudinal, Crack Multiple, Fracture Longitudinal, Fracture Multiple, Hole, Hole Soil Visible, Hole Void Visible, Infil Dripper, Intruding Sealing Ring, Surface Spalling, Tap Break-in Defective, Water Level Sag

Potential I & I Rating

CCTV APIIS	Low	Sags Over 30% for greater than 10 feet	No
CCTV/Smoke Checked B	Amanda Mitchiner	Survey Incomplete	No
CCTV/Smoke Checked B	3/2/2017	Reversal Outstanding	No
Assessment Rating		Taps Reviewed	Yes

See the CCTV Assessment section of Guideline for Assessment and Recommendations for Sewer Segments.

Checking

Once the Assessor has completed CCTV assessment on Gravity sewer line, the Checker can begin review of the initial assessments. The Checker essentially repeats the assessment processes already done by the Assessor and then verifies they agree. If there is a difference in opinion on the type of construction or assessment rating, the Assessment Team discuss the specific details until a unanimous decision is reached.

CCTV Assessment

Date of Data/Report	1/12/2017
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Remarks: Broken, Broken Soil Visible, Crack Longitudinal, Crack Multiple, Fracture Longitudinal, Fracture Multiple, Hole, Hole Soil Visible, Hole Void Visible, Infil Dripper, Intruding Sealing Ring, Surface Spalling, Tap Break-in Defective, Water Level Sag

Potential I & I Rating

CCTV APIIS	Low
CCTV/Smoke Checked B	Amanda Mitchiner
CCTV/Smoke Checked B	3/2/2017
Assessment Rating	

Sags Over 30% for greater than 10 feet	No
Survey Incomplete	No
Reversal Outstanding	No
Taps Reviewed	Yes

See the CCTV Assessment section of Guideline for Assessment and Recommendations for Sewer Segments.

Composite Assessment

The assessment rating from smoke and CCTV inspection assessments are compared, and the highest value is carried forward to composite. The type of construction is carried forward from the CCTV inspection assessment, however it may be updated based on the results of smoke test inspection and potential dye test results.

Composite Assessment

Compostie_Rating_Asses	Galen A. Light
Date of Assessment	7/27/2017
Assessment Rating	4
Type of Construction	Rehab with Liner
Depth Category	0-10 Feet
Assessment Rating	

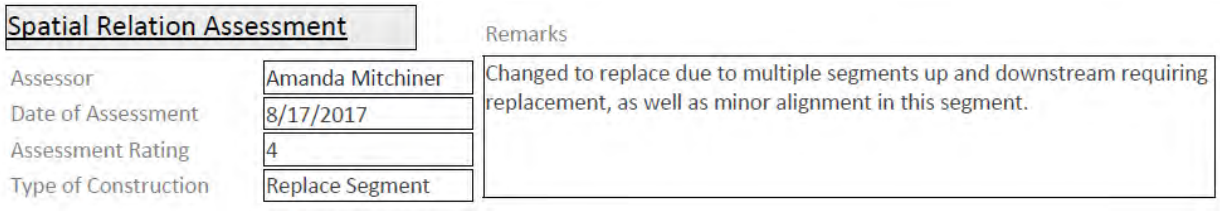
Remarks: Smoke Test Assessment rating was higher than CCTV Assessment rating. Overall Rating increased for severity of smoke shown.

(1) Reassess in ten years. (2) Rehabilite or replace in six to ten years. (3) Rehabilitate or replace in three to five years. (4) Rehabilitate or replace in zero to two years. (5) Rehabilitate or replace immediately.

Spatial Assessment

The rehabilitation recommendation and the assessment rating for each segment are carried forward from the Composite Rating and are displayed graphically in a Geographical Information System (GIS). The assigned team member then looks for patterns that would warrant modification to the assessment rating or type of construction. For instance, if there are interruptions in long runs of connected Gravity sewer lines that are all being recommended for replacement, the intervening Gravity sewer lines would be examined to determine if replacement might a viable rehabilitation strategy. Similarly, if there are runs of Gravity sewer lines with an assessment rating of three (3) and one intervening four (4) breaking the run, the gravity sewer lines would be re-examined to determine if a change would give better value. Additional changes might be made based on service population, location (proximity to bodies of water, homes, businesses, schools, railroad tracks, etc.), the amount of

flow, or other historical information. Changes, if any, are recorded in the Spatial Relation Assessment portion of the gravity sewer line Assessment Form.

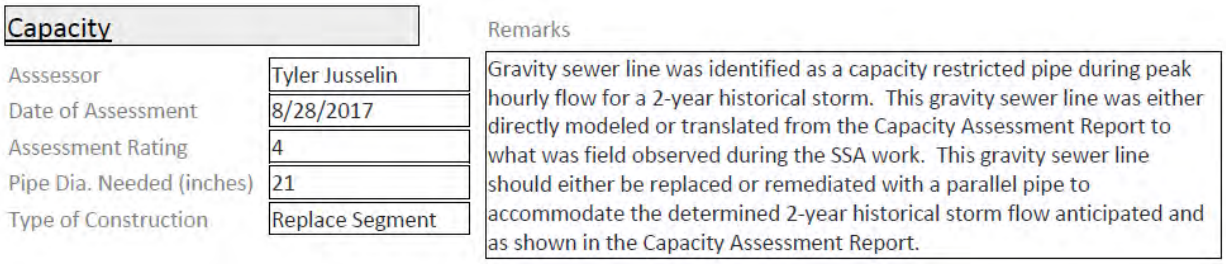


Spatial Relation Assessment		Remarks
Assessor	Amanda Mitchiner	Changed to replace due to multiple segments up and downstream requiring replacement, as well as minor alignment in this segment.
Date of Assessment	8/17/2017	
Assessment Rating	4	
Type of Construction	Replace Segment	

Capacity Assessment

Capacity improvements are based the capacity master plan and model runs done by B&V. As the model was built using the GIS provided by the City at the beginning of the SSA program, and the GIS has been updated based on field data, the capacity improvements must be translated from the original GIS to match the field verified GIS. A translation table is constructed that relates each modeled gravity main to its respective counterpart in the updated GIS.

Each Gravity sewer line that has been assessed in the proceeding processes (i.e. do not have an assessment rating of zero) is initially assigned a capacity assessment rating of one (1) and a type of construction of “reassess in the future”. The required diameter for each gravity sewer line that is in the capacity assessment translation table is compared to the existing diameter (i.e. the size it was found to be). When the required size is greater than the existing size, a capacity improvement is recommended. The assessment rating is changed to a four (4), and the type of construction is changed to “replace segment”. An appropriate note is added to the remarks section, and the “pipe diameter needed” field is populated as appropriate.



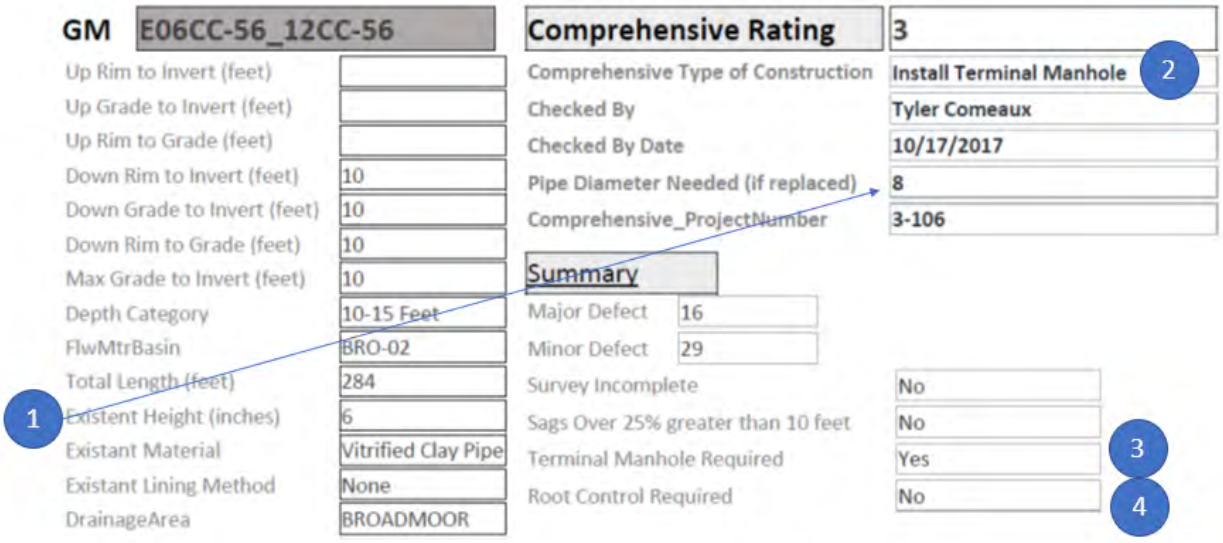
Capacity		Remarks
Asssessor	Tyler Jusselin	Gravity sewer line was identified as a capacity restricted pipe during peak hourly flow for a 2-year historical storm. This gravity sewer line was either directly modeled or translated from the Capacity Assessment Report to what was field observed during the SSA work. This gravity sewer line should either be replaced or remediated with a parallel pipe to accommodate the determined 2-year historical storm flow anticipated and as shown in the Capacity Assessment Report.
Date of Assessment	8/28/2017	
Assessment Rating	4	
Pipe Dia. Needed (inches)	21	
Type of Construction	Replace Segment	

Comprehensive Assessment

The Composite, Spatial, and Capacity assessment ratings and types of construction are all compared, and the highest rating and most aggressive type of construction is moved forward to the comprehensive rating and type of construction. Additional close out operations are performed. These tasks include but are not limited to:

1. Gravity sewer lines that were found to be six inches or less in diameter are noted as needing to be 8 inches if replaced.
2. Dead-end lines that are greater than 10 feet in length that do not already have a more aggressive rehabilitation type recommended are explicitly recommended to have a terminal manhole installed as the type of construction.

3. Any dead-end line that is greater than 10 feet in length, regardless of type of construction is flagged for a terminal manhole required.
4. Root control is flagged for all Gravity sewer lines that had any type of roots.



Final Checking

The Auditor, who has traditionally been the project manager then confirms that assessments are compliant with established procedures. This is accomplished by randomly selecting 10% of the assessed gravity sewer lines and checks them. If the selected set is verified to the satisfaction of the Auditor no additional checking is performed. Otherwise corrections are made, and the audit is repeated on a different randomly selected set of gravity sewer lines.

Manholes Assessment

Each manhole will have a either a 3D Panoramic camera (preferred) or a Pole Camera inspection. In a few isolated instances, manholes have been inspected with CCTV inspection; however, this is not a preferred method of inspection and should only be used as a last resort. When manholes are inspected with CCTV it should be an approved exception and should be appropriately documented. Smoke leak observations associated with manholes are carried over from the gravity sewer line Smoke Test Inspections.

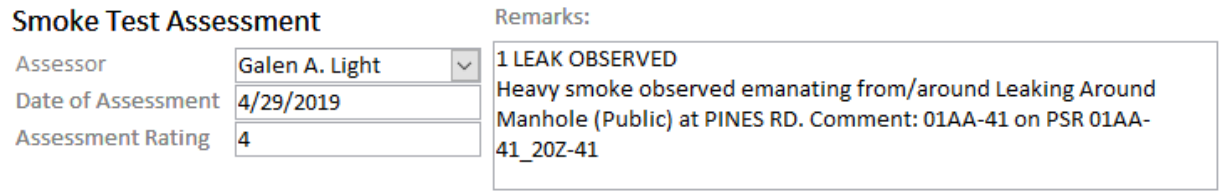
In general, defects found during the 3D/Polecam inspections are reported on in sections (elaborated below). Each section is evaluated for the severity of the defect and flagged for repair if a repair is deemed necessary. The type of construction is determined as part of the Composite Assessment based on what parts of the manhole need rehabilitation and the severity of the noted defects. If defect is encountered that warrants an emergency repair, the emergency repair procedures are initiated.

Emergency Repairs and Procedures

The emergency repair procedures for manholes are the same for Gravity sewer lines, excluding obvious differences (3D/Polecam verses CCTV).

Evaluating Smoke Test inspections

Smoke test inspections are conducted by a sub-contractor and the resultant inspection reports are submitted incrementally throughout the project phase. Smoke test inspections are reported on by gravity main and not by the manhole. An individual leak on a Gravity sewer line might be attributed to a manhole; however, there is no smoke test inspection report for the manhole itself. The smoke leak observed on a Gravity sewer line report is transferred to the appropriate Manhole Assessment Form.



The default smoke test assessment rating for any Manhole is one (1). A Manhole that has no smoke leaks attributed to it remains a one (1). If light smoke is observed, the assessment rating would be upgraded to a two (2). If medium smoke is observed, the assessment rating would be upgraded to a three (3). If heavy smoke is observed, the assessment rating would be upgraded to a four (4). A rating of five (5) is reserved for cases when the smoke test inspection gives reason to take immediate action. This is usually a direct physical connection between the sanitary sewer collection system and the public storm water collection system (cross connect) or a constructed overflow. In those cases, dye testing is usually conducted to confirm the cross connection. If a cross connection is confirmed, an emergency repair is issued (see the applicable sections under Gravity sewer lines).

Evaluating 3D and Pole camera Inspections

Defects recorded in accordance with MACP inspection procedures are reported in six sections based on where in the manhole the defect occurs. Those sections are: 1. Cover and Frame, 2. Chimney (internal and external), 3. Cone (internal and external), 4. Wall, 5. Bench, and 6. Channel. The Assessor examines the defects associated with each section of the manhole, assigns an appropriate assessment rating, and considers if a repair is required. Details on this process are found in the following sections.

The Assessor arrives at an assessment rating by looking at the defects in each section and asking themselves a series of questions.

0. **Is the Manhole included for administrative purposes (i.e., private or capital improvement projects already underway) only?**
1. **Is this section of the Manhole in good condition with no significant defects noted?**
2. **Does this section of the Manhole have some minor defects that are not likely to get significantly worse within the next 6 to 10 years?**
3. **Does this section of the Manhole have defects that do need to be addressed immediately, but can instead wait three to five years?**
4. **Does this section of the Manhole have major defects that need to be dealt within the next two years?**

5. **Does this section of the Manhole have major defects that represent immediate public safety hazard?**

Assessment rating 0

Is the manhole included for administrative purposes only? If so, the assessor assigns a rating of zero (0) and would not flag this section of the manhole for repair. This rating is reserved for manholes that are included in the report because they exist in the GIS but have not inspected because they are private or part of a capital improvement project already underway.

Assessment rating 1

Is this section of the manhole in good condition with no significant defects noted? If so, the assessor assigns a rating of one (1). In layman's terms, this means the manhole section is essentially "as good as new" or nearly so. If you looked at this manhole in ten years, you'd expect it to look the same. There is no reason to believe any of the defects in this section of the manhole will cause a Sanitary Sewer Overflow (SSO). This may include the following:

- New or nearly new
- Cover and frame in good condition, seals and interfaces to manhole tight (very minor corrosion)
- Any previous rehabilitation, such as coatings, is in good to excellent condition
- Original materials for cone wall, bench, and channel are in good condition (e.g., brick and mortar are intact, concrete is sound, no evidence of corrosion or deterioration)
- No visible roots
- No evidence of groundwater leaks in manhole
- Smoke test indicated no smoke sources
- Infiltration stain may be present

Assessment rating 2

Does this section of the manhole have some minor defects that are not likely to get significantly worse within the next 6 to 10 years? If so, the assessor assigns a rating of two (2). This means that if you looked at it in ten years, you'd expect it to look very similar. The likelihood of any defect in this section of the manhole causing an SSO is very low. In layman's terms, the manhole looks good condition, but it isn't perfect. This may include the following:

- Cover and/or frame in fair condition
- Very minor to no structural damage
- Fine roots in manhole
- Manhole grout for cone wall, bench, or channel is largely intact with a few spots missing
- Infiltration drippers or weepers may be present

Assessment rating 3

Does this section of the manhole have no defects that need to be addressed immediately, but can instead wait three to five years? If so, the assessor assigns a rating of three (3). Failure is not eminent, but if the repair is not done it will eventually get worse and result in a costlier repair or an SSO. In layman's terms, the repair is needed, but it can wait. This may include the following:

- Cover and/or frame moderately corroded

- Cover and frame in need of resetting to eliminate a gap or offset with the manhole chimney
- Missing mortar or a missing brick, damaged or deteriorating concrete on the cone, wall, bench, or channel
- CCTV camera unable to access connecting gravity sewer line due to offset entrance
- Manhole is showing moderate structural defects
- Medium root penetrating manhole
- Infiltration runners may be present

Assessment rating 4

Does this section of the manhole have major defects that need to be dealt within the next two years? If so, the assessor assigns a rating of 4. Failure is imminent. If the repair is not done soon it will get considerably worse or is likely to result in an SSO. In layman's terms, the defect needs to be repaired sooner than later. This may include the following:

- Cover and/or frame heavily corroded or heavily damaged
- Missing large amounts of mortar on the cone wall, bench, or channel
- Manhole is showing very significant structural defects such as several missing bricks or large cracks in the structure or is otherwise structurally unstable
- Manhole contains large amounts of debris, restricting flow.
- Manhole grout is missing large sections
- Tap roots and large root masses penetrating manhole
- Infiltration gushers
- Visible corrosion damage
- Manholes that could not be located or opened during the inspection attempts.

Assessment rating 5 (emergency repair)

Does this section of the manhole have major defects that represent immediate public safety hazard? If so, the assessor assigns a rating of 5 and submits the asset as a potential emergency repair. This may include the following:

- Missing cover
- Utility conflicts
- Collapsed/collapsing in such a way that is a hazard to the public
- Confirmed cross connect to storm drain or overflow to body of water that should be repaired immediately
- Immediate replacement required for any other reason

Composite Assessment

The assessment rating for each section of the manhole is compared to the smoke test assessment rating, the highest value becomes the composite assessment rating. The assessor then determines the I&I and the recommended type of construction.

Inflow and Infiltration

During each SSA phase, dynamic environmental conditions will be encountered which will result in a variation of the amount of observed I&I on similar or the same types of defects. Therefore, the total I&I for each sewer basin will be allocated to each manhole by using the potential I&I rating. The

potential I&I rating will be based on the observed defects during the manhole inspections and/or smoke testing. The Assessor will use judgment to quantify the amount of potential I&I on each manhole and record it in the APIIS section of the Manhole Assessment Form. The four potential I&I ratings are as follows:

Minimal – The manhole is new or nearly new with no defects coded. This item has little to no potential for I&I.
Low – The manhole has a low risk of I&I by having few or minor defects and will remain in use for the foreseeable future (e.g., cracks or fractures) and no demonstrated infiltration more severe than staining, weeping or dripping.
Medium – The manhole has a moderate risk of I&I by having several defects with the potential for I&I (e.g., multiple fractures, missing mortar) and no demonstrated infiltration more severe than an infiltration runner.
High – The manhole has significant risk of I&I and has multiple defects that are directly related to I&I (e.g., broken soils visible, hole voids visible, offset joint) or has significant infiltration such as a gusher.

Type of construction

Reassess in Future

Reassess in the future is used when the Manhole is in good condition and there is no evidence to suggest a repair is necessary. It is recommended that this Manhole be added to the preventative maintenance schedule.

Rehabilitation (selective)

Manholes that have defects that warrant repair but are structurally intact are selected for rehabilitation. If Assessment Team deems that the defects are relatively minor and can be addressed without a manhole entry (damage to the frame, cover, external chimney, missing grout, etc.), then selective rehabilitation is selected.

Rehabilitation (entire)

Manholes that have defects that warrant repair but are structurally intact are selected for rehabilitation. If Assessment Team deems that the defects are major and will require considerable expertise to repair or cannot be addressed without a manhole entry (problems in the channel or bench, most defects on the wall, internal defects), then entire rehabilitation is selected.

Replacement

Replacement is recommended when there are multiple defects a manhole that cannot be addressed with an epoxy liner or when explicitly selected during the spatial assessment (see below) as a result of having two or more connecting gravity sewer lines selected for replacement.

Checking

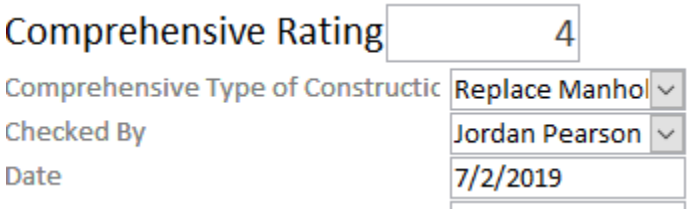
Once the Assessor has completed assessments on the manhole, the Checker can begin review of the initial assessments. The Checker essentially repeats the assessment processes already done by the Assessor and then verifies they agree. If there is a difference in opinion on the type of construction or assessment rating, the Assessment Team discusses the specific details until a unanimous decision is reached.

Spatial Assessment

All manholes are initially assigned a default spatial assessment rating of one (1) and reassess in the future as the type of construction. GIS spatial analysis is used to determine if two or more gravity mains on a given manhole are being recommended for replacement and if so, the assessment rating is changed to four (4) and the type of construction is changed to replacement. As the manhole spatial rating is dependent on the gravity sewer lines' comprehensive type of construction, the gravity main assessment process should be completed first. Otherwise any changes made to the gravity sewer line would have to be rippled into the manhole spatial assessment.

Comprehensive Assessment

The most aggressive values in the manhole composite and spatial assessments are carried forward to the comprehensive rating.



Final Checking

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