Report for

City of Eufaula

Sanitary Sewer System Capital Improvements Investigation and Plan

April 2021

prepared by:

COWAN GROUP ENGINEERING

CITY OF EUFAULA, OKLAHOMA

SANITARY SEWER SYSTEM CAPITAL IMPROVEMENTS INVESTIGATION AND PLAN

Prepared By:

Cowan Group Engineering, LLC

7100 N Classen, Suite 500

Oklahoma City, OK 73116

405.463.3369

LICENSED PROFESSIONAL ENGINEER
MICHAEL
TAYLOR
4/28/21
27655
OKLAHOMA

____

Michael Taylor, P.E.

OK PE #27655

Concurred by the Council and signed by the Mayor of the City of Eufaula this ______ day of

__________________________, 2021.

________________________________ ________________________________

City Clerk Mayor

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The City of Eufaula has identified a need to evaluate the wastewater collection system for recommendation for improvements. The City and Cowan Group Engineering (CGE) teamed to pursue funding through the Oklahoma Water Resources Board and was awarded a principal forgiveness loan to complete the evaluation, recommendation, and report for wastewater collection and treatment system improvements.

The general scope of the project includes the planning, mapping, evaluation and recommendation of improvements for the City's wastewater collection system and treatment plant.

The CGE team recommends the City consider three categories of improvements/needs: critical (immediate), short-term (1 to 5 years), and long-term (10+ years). Recommendations for critical and short term are outlined below and concludes with a Capital Improvements Plan (CIP) describing the improvements by category, year of improvement and estimated construction cost.

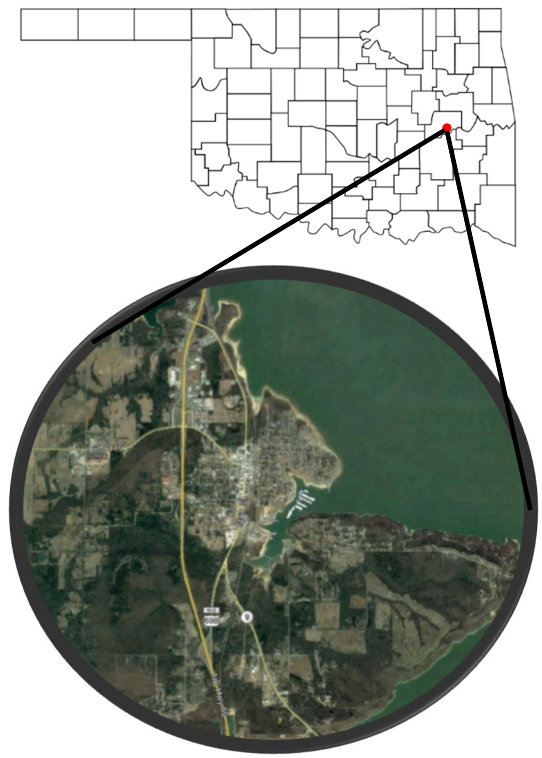
Capital Improvement Plan

Category	Area	Year	Project	Conceptual Cost ($)[1]
Critical	Collection	2021	Package D1, D2, E, F1	2,566,394
	Collection	2022	Package A, B, C	242,418
	Collection	2022	Package D3	219,389
	Collection	2022	Package F2	786,089
	Collection	2022	Package H	765,053
	Collection	2022	Lift Station Maintenance[2]	100,000
	WWTP	2022	Spill Containment and Chemical Pumps	70,875
	WWTP	2022	Oxidation Ditch Sludge Removal and Shaft Replacement	478,125
			Subtotal	3,228,343
			Contingency (20%)	645,669
			Total for Critical Improvements	3,874,012

Short-Term	Collection	2023	Cleaning	75,000
	Collection	2023	Bench and Trough Improvements	50,000
	Collection	2023	Lift Station Maintenance[2]	100,000
	WWTP	2023	Oxidation Ditch Aeration Improvements	650,000
	WWTP	2025	Clarifier Improvements	450,000
	WWTP	2025	Generator	150,000
			Subtotal	1,475,000
			Contingency (20%)	295,000
			Total for Short Term Improvements	1,770,000

CGE recommends the City begin replacement of approximately 25,411 linear feet of new sanitary sewer, sixty-seven (67) new manholes and rehabilitation of twenty-eight (28) manholes with cementitious coating for a cost of $2,566,394 utilizing the Clean Water State Revolving Fund administered by the Oklahoma Water Resources Board.

I. INTRODUCTION



The City of Eufaula (City) owns and operates a wastewater collection system and treatment facility currently serving approximately 3,034 citizens located in McIntosh County, Oklahoma. Portions of the City's wastewater collection system are nearing, or have surpassed, its design life making it an excellent candidate for rehabilitation. As part of this project, the entire collection system for the City of Eufaula was surveyed, and an investigation was conducted to determine its overall condition. Data was gathered in the field and used to create a Geographic Information System (GIS) map book of the system to replace the older, less accurate system map. The scope for the following report is to discuss the planning, mapping, evaluation and recommendation for the City's wastewater collection and treatment system.

The City has identified a need to evaluate the wastewater collection system for recommendation for improvements. The City and Cowan Group Engineering teamed to pursue funding through the Oklahoma Water Resources Board and was awarded a principal forgiveness loan to complete the evaluation, recommendation, and report for wastewater collection and treatment system improvements.

The benefits of having a safe and efficient wastewater system range from the general health of the public that it serves, to a significant financial savings for the City. A substandard wastewater collection system poses a serious health risk to the community. Sewage can escape into groundwater sources, or back up into homes effectively exposing the public to harmful bacteria. Constructing a more efficient wastewater collection system will have a large financial benefit for the City due to reduced lift station run times, less frequent repair, and the capacity to generate revenue through additional service connections, along with providing a safe place to live, play and work for the public.

II. PROJECT SCOPE

The City owns and operates the wastewater collection system and treatment facility. The wastewater collection system consists of approximately 120,000 linear feet of gravity sewer, three (3) lift station and 350 manholes. A large portion of the existing wastewater collection lines consist of clay sewer pipe near or past their design life. Many of the manholes are of brick construction which is no longer allowed by Oklahoma Department of Environmental Quality (ODEQ) Standard Regulations.

The general scope of the project includes the planning, mapping, evaluation and recommendation for the City's wastewater collection system and treatment plant. The following is a breakdown of the associated tasks and specific scope of services.

A. Task One - Location Survey and Planning Area

- Scope includes entire wastewater collection system
- Coordinate kick-off review meeting with Owner
- Gather information from the City for existing and proposed developments in the area
- Survey, location, elevation, verification, coordination, and mapping of manholes and wastewater collection lines
- Field land survey shall be according to Oklahoma State Plane coordinate system
- Prepare preliminary manhole map in geographic information system (GIS) platform
- Deliver one (1) hard copy maps (24x36) and electronic PDF format for review
- Attend one (1) review meeting with Owner (as required)

B. Task Two - Manhole and Collection System Investigation

- Scope includes entire wastewater collection system
- Incorporate comments into final map
- Field investigation and data collection of manhole attributes shall be collected
- Manhole attributes collected shall include, but are not limited to the following:
  - Invert depth
  - Pipe sizes
  - Pipe type
  - Manhole type
  - Infiltration present
  - Condition
- Smoke testing to be provided on targeted sewer main trunk lines, not to exceed 10 manhole locations
- Provide all attributes in GIS system mapping
- Deliver one (1) hard copy drawing (24x36) and electronic PDF format for review
- Attend one (1) review meeting with Owner (as required)

C. Task Three – System Modeling

- Attend and coordinate one (1) kick-off review meeting with City staff responsible for revenue and non-revenue customers
- Verification of sewer collection system data from mapping and survey
- Set up and develop Hydraulic Modeling Method
- Field verification on selected manholes and lift stations
- Import GIS maps into InfoSwim Software
- Attend meeting with City for initial findings
- Evaluate historical and projected population and determine peaking factors
- Define existing collection system facilities and basins
- Coordinate with City for review and verification of existing mapping and infrastructure for modeling
- Input existing infrastructure facility data into InfoSwim software including main collection system transmission lines, manholes, lift stations, and outfall at plant. Note: Only larger diameter transmission lines (8-inch and greater and selected 6-inch) will be modeled as part of this agreement. Smaller diameter lines will be considered only if they are integral to the overall hydraulic conditions of the system
- Calibrate software model with field mapping, pumping data, DMR information, and overflow information from the City
- Create hydraulic analysis model under multiple conditions (steady state, extended period, and rain event)
- Prepare recommendations for collection system improvements, as identified within the model and provide in the report

D. Task Four - Mapping and Map Books

- Scope includes entire sanitary sewer system
- Finalize manhole attributes, line size, and line direction into one final document
- Verification of all attributes and line drawings in the map
- Provide GIS and KMZ (Google Earth) files
- Deliver one (1) hard copy drawing (24x36) and electronic PDF format for review
- Create and produce two (2) map books for City staff

E. Task Five – Treatment Plant Inspection

- Scope includes inspection of one (1) treatment plant facility
- Field inspect flow equalization basin
- Field inspect headworks
- Field inspect clarifiers (3)
- Field inspect oxidation ditch
- Field inspect digestor
- Field inspect sludge drying beds
- Provide condition report in final report

F. Task Six – Report and Recommendations

- Scope includes entire sanitary sewer system
- Prepare recommendation for improvements and present to the City for approval
- Incorporate approved concepts into a Report for the collection system

- Prepare report
- Prepare one preliminary construction cost estimate for the collection system and recommended long-term improvements
- Deliver three (3) hard copy Reports and in electronic PDF format
- Attend review meeting with Owner (as required)

G. Task Seven - Final Design

- Scope to include design of up to 30,000 linear feet of sewer line replacement and 100 manhole rehabilitations or replacements
- Incorporate Comments and Prepare Final Construction Drawings
- Construction drawings shall include, but not limited to the final construction drawing sheets:
    - Cover Sheet
    - Pay Quantities and Notes
    - Survey Data
    - Summary Sheets
    - Plan and Profiles
    - Standard Details
    - Special Details
    - Erosion Control
- Prepare contract documents and specifications for one (1) base bid per all CWSRF and CDBG requirements
- Prepare final construction cost estimate
- Prepare engineering report form per ODEQ and submit ODEQ permits and applications
- Deliver three (3) hard copy drawings (11x17) and contract documents, and electronic PDF format
- Attend one (1) review meeting with Owner

H. Task Eight – Bidding and Construction Administration (To be determined)

I. Task Nine – Construction Inspection (To be determined)

III. PROJECT PLANNING AREA

A. Location, Maps, Photographs, and Sketches

Eufaula is a City located in McIntosh County, Oklahoma near the intersection of State Highways 69 and 9. The City boundaries encompass about 6.6 square miles and are shown in APPENDIX A – City Boundary Map.

B. Population Trends

Historical populations were gathered from the U.S. Census Bureau. The 2010 U.S Census Bureau indicated the population of Eufaula was 2,813 citizens with an expected population growth in McIntosh County of 0.88%. Based on the historical information, the population growth is estimated to be 0.64% for the City using the method outlined in the FACT guidelines. Table 1 shows the projected populations.

Table 1 Population Projections

Population Projections	
Year	**POPULATION[1]**
2010	2,813
2020	3,034
2030	3,234
2040	3,447
2050	3,674

[1]*Calculated using the FACT Method*

C. Current and Projected Wastewater Flows

Current and future wastewater flows will be estimated using the following parameters:

Table 2 Current and Future Projections by User Designation

Current and Future Flow Projections by User Designation				
2020	**User Total**	**Flow Rate**	**Average Daily Flow**	**Peak Daily Flow**
Residential Customers	3,034	140 gpcd[1]	0.42 MGD	1.24 MGD
Commercial Customers	94	700 gpcd	0.06 MGD	0.18 MGD
Total			**0.48 MGD**	**1.42 MGD**[2]
2050				
Residential Customers	3,674	140 gpcd[1]	0.51 MGD	1.50 MGD
Commercial Customers	120	700 gpcd	0.08 MGD	0.24 MGD
Total			**0.59 MGD**	**1.74 MGD**[2]

[1]Higher flow rate is used so that the Total Average Daily Flow matches what is recorded at the WWTP.
[2]Peaking factor of 2.95 based on historic DMR information.

In search of a more accurate estimate for wastewater flow, the area was broken down into sub basins shown in APPENDIX B – Sewer Basin Map. A daily flow rate was then determined for each sub basin based upon the number of residential, commercial, or other (e.g., school) customers within that sub basin. Using this method, the total estimated average daily wastewater flow for the entire system is 386,810 gallons per day. A table showing the estimated sewer flow for each sub-basin can be found in APPENDIX C – Basin and Flow Calculations. This number is used in the modeling as outlined in Section V.

D. Inflow and Infiltration

Inflow and Infiltration (I&I) are described as a fluid "other" than wastewater entering the wastewater collection and treatment system. Infiltration occurs when ground water enters the wastewater collection system through cracks in the sewer main, faulty joint connections, root penetration, or an unsealed manhole interior. Inflow occurs when rainwater enters the wastewater collection system directly through roof drain connections, uncapped or broken clean outs, faulty manhole frames or covers, and many other avenues of entry into the sewer main. The most likely sources of infiltration in Eufaula's wastewater collection system include the presence of brick manholes and vitrified clay pipe (VCP) sewer mains. Inflow into Eufaula's wastewater system can be attributed to a combination of broken cleanouts on service laterals and faulty manhole frames and covers. Excess water from inflow and infiltration entering the wastewater system during a storm event drives greater operating costs in the form of increased volume of water that must be treated at the plant and an increase in upkeep for the system.

IV. EXISTING FACILITIES AND NEED FOR PROJECT

A. Location and Layout

The wastewater collection system is bounded to the east by Eufaula Lake. The system's southern extent reaches the intersection of Highway 9 and Business 69B. The western boundary is located just west of US Highway 69 and includes development near US Highway 9 and N4160 Rd. The entire collection system flows south to the wastewater treatment plant located south of E1210 Rd. A map of the wastewater collection system is found in Appendix D – Detailed Wastewater System Map.

B. Condition of Existing Facilities

1. Wastewater Collection System:

Eufaula's wastewater collection system is comprised of roughly 120,000 linear feet of gravity sewer, 350 manholes, and thirteen lift station. The collected wastewater flows south to the treatment plant. Of the approximately 350 manholes, 37 were uninvestigated as they could not be located.

Of the investigated manholes, 61 were found to be constructed of brick. Brick manholes do not meet approval of ODEQ regulation OAC 252:656-5-3(d), which states: "Brick and/or concrete blocks will not be approved for manhole construction". Therefore, brick manholes are a priority when discussing rehabilitation.

Manhole number F247 and D106, shown in Figure 1 and Figure 2 below, have some notable deficiencies related to its brick construction. Loose bricks, missing bricks, and deteriorated grout are all common issues associated with brick manholes. Manholes like these should be replaced to increase the efficiency of the sewer system.

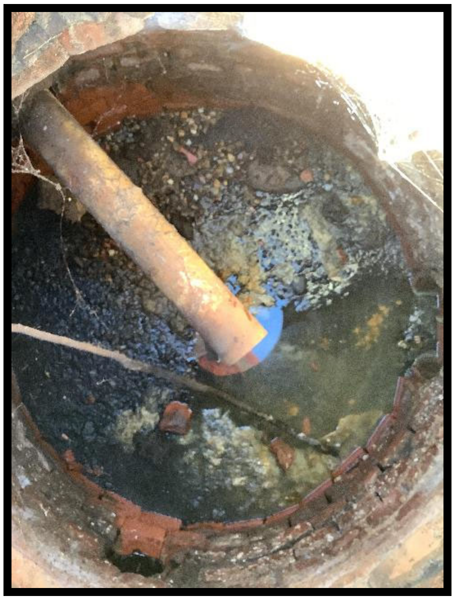


Figure 1 Brick Manhole No. F247

Figure 2 Brick Manhole No. D106

2. Lift Stations

The wastewater collection system for the City utilizes thirteen lift stations. There is little historical information available at the time of the report. Table 3 lists the available attributes for each of the lift stations. It is recommended to complete a full evaluation of each lift station.

Table 3 Lift Station Attributes

LIFT STATION ATTRIBUTES													
Location	Bunny Creek Rd.	Industrial Rd.	Buck St.	Buck St. and N4160	Overflow Lagoon	Braum's	High School	Lakeshore	Diesel	McKinley	Simpson	Simpson and Duffee	WTP
Sub-Basin	A	B	C	C	D	E	E	F	F	H	H	H	I
Pump Capacity (gpm)	2 @ 100	2 @ 100	2 @ 30	2@250	2 @ 750	2 @ 250	2 @ 35	2 @ 500	2 @ 750	2 @ 250	2 @ 100	2 @ 100	2 @ 250
Head (ft.)	70	49	106	20	68	80	15	22	25	51	15	10	25
Length of Force Main (ft.)	3,354	3,125	749	7,580	13,125	145	210	53	1,648	1,200	776	160	5,050

3. Treatment Plant

After collection, all the City's wastewater is conveyed to the wastewater treatment plant. The wastewater treatment plant consists of headworks, flow equalization basin, three (3) clarifiers, one (1) oxidation ditch, one (1) digestor, one (1) disinfection basin, and three (3) sludge drying beds.

In an Engineering Report dated March 2019, an evaluation of the treatment units at the wastewater treatment facility was performed. The treatment unit capacities with proposed improvements were compared to the projected flows expected in the year 2040. For the year 2040, the treatment units with proposed improvements meet or exceed construction standards. The design conditions for the year 2040 can be found in APPENDIX E – Proposed Design Conditions. The design conditions do not consider the useful life of the existing equipment but merely capacities. The condition of the wastewater treatment plant is discussed in Section VI.

V. METHODOLOGY AND INSPECTION FOR SEWER SYSTEMS

A. Collection System

1. Wastewater Collection Lines

The initial stage of mapping the wastewater collection system involved a site visit by the survey crew to locate and gather GPS coordinates on each manhole. As the manholes were surveyed, a numbering system was established to identify each structure. The GPS coordinates for each manhole were integrated with sewer line attributes gathered from the inspection to generate the GIS map.

2. Manholes

A visual inspection was conducted, and data was gathered on each manhole. Below is an example of some of the data that was collected.

- Manhole Material (i.e. Brick, Pre-Cast, etc.)
- Flow Direction
- Pipe Size
- Pipe Direction and Type
- Invert Depths
- Manhole Location (i.e. Grass, Asphalt, Gravel)
- Subjection to High Flow or Sewer Gas

Using the data gathered from the field inspection, the best strategy for rehabilitation of each manhole is determined.

B. Modeling

A sanitary sewer system is a network of all service connections, wastewater lines, lift stations, equalization basins and manholes. All of these rely on the pressure created by either the height of the water in feet or the head of a pump created by force. CGE utilizes the software Innovzye InfoSWMM, a fully GIS integrated sanitary sewer system modeling and management software application. Because of this functionality, information gathered during the wastewater collection system inspection is directly imported to create the model.

The conditions analyzed by simulating the dynamics of the system under steady-state and extended period simulations. These simulation methods are described in detail below:

<u>Steady-State Simulation</u>

A steady-state simulation computes the state of the system assuming that the hydraulic demands and boundary conditions do not change with respect to time. This simulation can be used for many different conditions such as average day demand, maximum day demand, peak hour demand. It is used to determine the very basic distribution system issues with respect to pressure and/or flow. A steady-state simulation is used to calibrate and validate the model using actual flows collected.

<u>Extended Period Simulation</u>

Extended period simulation determines the dynamic behavior of the system over a period of time, computing the system as a series of steady-state simulations with hydraulic demands and boundary conditions changing with respect to time. This simulation is used once the steady-state performance calibration is completed. The extended period simulation analyzes the effects of changing wastewater flows over time, fill and drain cycles of equalization basins, and response of lift stations to system changes. The model will also effectively analyze both dry-weather and wet-weather flow conditions.

The extended period simulation is typically run at multiples of 24 hour time simulations. The changing water flows are modeled using a Demand Pattern. When normal wastewater flows are observed with minimal infiltration, the wastewater curves resemble water consumption curves, but with a lag depending on the storage size of the collection system. A first flowrate peak may be seen in the late morning when wastewater from the peak morning water use reaches the plant and the second flowrate peak in the early evening.

C. Lift Stations

The inspection of Eufaula's thirteen lift stations involved a site visit by the team's professional engineer. Thorough examinations were performed on the vital components: structure, pumps, valves and piping, and controls.

D. Wastewater Treatment Plant

The inspection of Eufaula's wastewater treatment plant involved a site visit by the team's professional engineer. Thorough examinations were performed on the vital components at the plant, including headworks, flow equalization basin, clarifiers, oxidation ditch, digestor, and sludge drying beds.

VI. RESULTS

A. Collection System Inspection Summary

1. Wastewater Collection Lines

It can be assumed that clay pipe is no longer an effective means to convey wastewater and should be replaced. The investigation discovered around 42,939 feet of VCP, which is likely creating a medium for inflow and infiltration into the system. A summary of the wastewater collection system attributes can be found in Table 4.

Table 4 Wastewater Collection Line Summary

Wastewater Collection Line Summary								
Material	Diameter							Total (ft)
	3”	4”	6”	8”	10”	12”	Unknown	
VCP	-	1,675	7,095	32,031	658	-	1,480	42,939
PVC	457	5,409	6,856	26,854	3,295	907	1,101	44,959
CIP	-	575	2,233	1,702	-	700	-	5,210
RCP	-	493	1,962	820	-	-	125	3,400
Unknown	132	481	1,752	2,797	-	284	15,183	20,629
Total (ft)	590	8,713	19,899	64,203	3,953	1,891	17,890	**117,512**

The pipe will be replaced using both trenching and trenchless methods. A common trenchless method to replace brittle sewer lines is pipe bursting. First, a pit is excavated, usually in tandem with replacing a manhole. The machine is then installed in the constructed pit, level with the pipe needing replacement. A rod is then fed through the pipe to the manhole on the other end of the pipe. The bursting head with new pipe is attached to the rod and pulled back through the existing pipe. As the bursting head is pulled the existing pipe is fractured and forced into the surrounding soil. Once the new pipe is installed, the rod and machine are removed, and a manhole is installed in the pit. This is a recommended method of construction given the brittleness of the existing VCP.

2. Manholes

As previously mentioned, brick manholes do not comply with ODEQ regulations, and are susceptible to inflow and infiltration. Additionally, several of the manholes and lift stations are in the FEMA Flood Zone A, which are areas subject to the one (1) percent annual chance flood event. Manholes in this area are at a higher risk for infiltration as they may become submerged. The map attached in APPENDIX F – FEMA Flood Map shows the structures that fall within this flood zone. Reports generated from the field inspection with pictures can be found in APPENDIX G – Manhole Inspection Reports. A summary of the manhole count by material is found in Table 5 below.

Table 5 Wastewater Collection Manhole Summary

Wastewater Collection Manhole Material Summary	
Type	**Count (EA)**
Total Brick MH	61
Total Pre-Cast MH	218
Total Brick/Concrete Combination	29
Total Uninvestigated	37
Total	**345**

The existing manhole will either be replaced or rehabilitated. To fully replace a manhole, a bypass pumping plan is needed. The manhole is then removed by excavating a roughly 100 square foot area around the manhole and cutting the connected pipes. The new manhole is then installed, and the sewer lines are reconnected to the new manhole. The bench and trough are poured, and the cover and lid are also installed. This is a costly process due to the excavation and pumping requirements but will last many decades.

Rehabilitation of brick manholes is much more cost effective when compared to a full replacement. Instead of removal, a trusted repair method is a spray applicated cementitious layer. This layer is mixed onsite, and a uniform layer is sprayed on the exposed surface inside the manhole. This adds structural integrity to the manhole, as well as prevents ground water infiltration into the manhole via the previously eroded surface. Additionally, there are alternative additives that can be included in the cementitious mixture to address more specific needs.

3. Collection System Inspection Summary by Sub-Basin

a. Sub-Basin A

The manholes in Sub-Basin A are precast and the pipes are primarily PVC. The only noticeable problem in this basin pertains to the first manhole after the nursing and rehabilitation center. There was a large amount of medical supplies and trash in this manhole creating a blockage. Overall, this basin is in good condition.

b. Sub-Basin B

Sub-Basin B is overall in good condition. All but one manhole was precast, with the singular one being plastic. This basin mostly contains PVC pipes. Apart from the plastic manhole, the sanitary sewer in this basin is newer compared to other basins.

c. Sub-Basin C

This basin contains manholes that are all in good condition. All but one are precast with the one being a fiberglass manhole. The piping in this basin is PVC. During the time of the inspection, many of the manholes near the lift station were full of water. Accurate analysis was not possible on many of the manholes near the lift station. Overall, this basin contains seemingly newer manholes and pipe with the main issue being the lift station.

d. Sub-Basin D

Sub-Basin D is the largest basin and contains a fair amount of both brick manholes and clay pipes. During the inspection, most of the manholes had high flows and signs of infiltration. The sanitary sewer system along High Street had newer precast manholes with PVC lines, however this basin also contained a discharging manhole on Locust Street.

e. Sub-Basin E

Many of the manholes in Sub-Basin E are precast. Many of them were observed to have signs of root and water infiltration during the time of the inspection. A majority the manholes also had a large amount of sediment built up in the bench and trough. There are some VCP and RCP in this basin, but it is mostly comprised of PVC pipe.

f. Sub-Basin F

Sub-Basin F contains multiple areas where VCP lines exist. There are also several brick manholes within this basin. There were some newer PVC pipes installed in the western part of the basin but most of the infrastructure is outdated. Since this sub-basin is the closest to the lake there are some added concerns. Multiple manholes near the eastern edge of the basin are within the floodplain and are of concern for infiltration. Many of the manholes near the lake were filled with water, keeping them from being properly evaluated.

g. Sub-Basin G

Sub-Basin G contains precast manholes and PVC piping. Many of the manholes had signs of high flow which may have been caused by an obstruction found in a downstream manhole. Many of the manholes in this sub-basin contain flowlines that had the elevations backwards. The manholes near the creek contained standing water. Overall, the sanitary sewer system in this area is in good condition.

h. Sub-Basin H

A majority Sub-Basin H is comprised of VCP piping. There exists a small portion in the southern part of Sub-Basin H that is newer where the manholes are precast. The manholes in the southern area were clean and have PVC pipe. However, several of the manholes in this sub-basin were next to the lake and had standing water in them. With the remaining ones containing standing water, further evaluation of them was not possible.

i. Sub-Basin I

Sub-Basin I contains one manhole which is located at the water treatment plant. This precast manhole was filled with water making it unavailable for full analysis.

B. Modeling

The sanitary sewer GIS information was directly imported into the software Innovzye InfoSWMM. The steady-state simulation was run to calibrate and validate the imported data and the flow rates. Once the validation was complete, an extended period model was simulated using average daily flows and peak flow. Average daily flows and peak flows were arrived upon by using daily operational reports obtained from the Oklahoma department of environmental quality. Results of the modeling simulations are found in APPENDIX I: Model.

The results of the model show a small portion of the sewer system is overloaded. When a manhole is noted as surcharged it means that the hydraulic grade of the incoming flow is greater than the downstream pipe's crown. Similarly, if a pipe length, or conduit, is noted as having backwater, the pipe is filling with sewage and indicates the pipe capacity is under-sized. Overall, the hydraulic capacity of the system is adequate.

It should be noted that the manholes experiencing surcharging are those manholes where there is a significant elevation change. These manholes will benefit from raising the rim elevation and having a locking lid to prevent overflow.

C. Lift Stations

An above grade visual inspection was performed on November 18, 2020, of the lift stations. The following items were noted:

- Buck St. Lift Station was overgrown with weeds.
- Replacement of Lakeshore Lift Station is schedule at the time of this report.

Basin A

Figure 3 Bunny Creek Lift Station

Basin B

Figure 4 Industrial Rd. Lift Station

Basin C

Figure 5 Buck St. Lift Station

Figure 6 Buck and N4160 Lift Station

Basin D

Figure 7 North Lift Station

Basin E

Figure 8 Braum's Lift Station

Figure 9 High School Lift Station

Basin F

Figure 10 Diesel Lift Station

Figure 11 Lakeshore Lift Station

<u>Basin H</u>

Figure 12 Lift Station #1

Figure 13 Lift Station #2

Figure 14 McKinley Lift Station

Basin I

Figure 15 WTP Lift Station

D. Wastewater Treatment Plant Inspection Results

An inspection of the wastewater treatment plant was completed on November 18, 2020. The plant is overall in good condition. The following items were noted as needing improvements:

- There is significant build-up of sludge in the bottom of the oxidation ditch.
- The internal mechanisms in Clarifier 1 and 2 are nearing the end of their useful life.
- The laboratory and chemical building needs replacement.
- Storage of sodium hydroxide and sodium thiosulfate is inadequate.
- The onsite generator is nearing the end of its useful life.

A site schematic from historical plans can be seen in APPENDIX J – Eufaula WWTP Historical Plans.

Figure 16 Headworks

Figure 17 Oxidation Ditch

Figure 18 Aeration Basin

Figure 19 Blowers

Figure 20 Clarifiers 1 and 2

Figure 21 Clarifier 3

Figure 22 Disinfection Basin

Figure 23 Equalization Basin

Figure 24 Laboratory and Chemical Building

Figure 25 Generator

VII. RECOMMENDED IMPROVEMENTS

After careful consideration and evaluation, the CGE team recommends the City consider three categories of improvements/needs: critical, short-term, and long-term. Recommendations for each category are outlined below and concludes with a Capital Improvements Plan (CIP) describing the improvements by category, year of improvement and estimated construction cost. The three categories are defined as:

- **Critical** – Recommended wastewater system improvements that must be addressed immediately because they are imperative to current operations of the system and/or have exceeded their treatment capacity.

- **Short-Term** – Recommended wastewater system improvements that need to be addressed as soon as possible but are not imperative to the immediate operations of the system and/or are at or near their treatment capacity. These improvements take some planning before implementation or are reliant on the completion of critical category items.

- **Long-Term** – Recommended wastewater system improvements which will take extensive planning and are for the betterment of the system overall and/or are needed to meet projected flows.

A. Wastewater Collection System

1. Critical

The investigation of the wastewater collection system revealed the presence of clay pipe, brick construction manholes, broken cleanouts and other potential sources for I&I. Areas that contain clay pipe and brick manholes will be the highest priority.

The investigation shows that areas of Sub Basin D, E, F, and H contain both a high number of brick manholes and clay pipe. These areas are the most critical and are recommended for replacement. The critical replacement areas are combined into packages for cost-effective construction. Figure shows the replacement packages within each Sub Basin. Packages D1, D2, E, and F1 are recommended for replacement in the first phase.

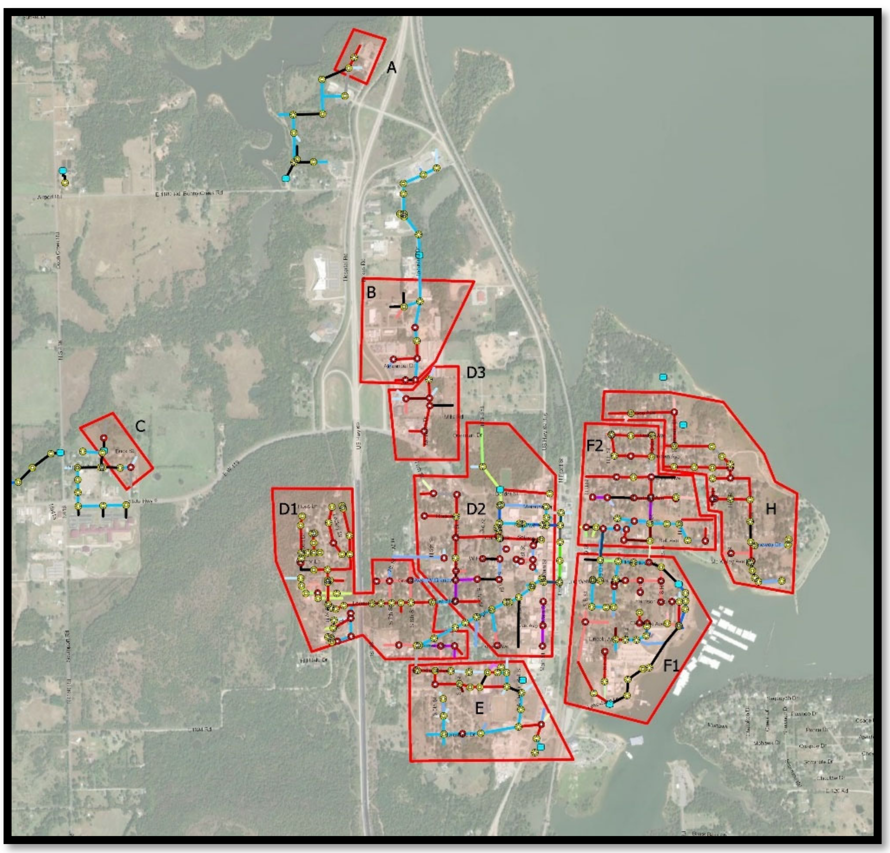


Figure 26 Replacement Packages

Replacement within these packages will result in 25,411 linear feet of new sanitary sewer and sixty-seven (67) new manholes. Rehabilitation of an additional twenty-eight (28) manholes with cementitious coating is also recommended.

The remaining package, Packages A, B, C, D3, F2, and H, are considered a critical need and should be replaced as funding becomes available.

2. Short-Term

The short-term is dedicated to setting aside funds for bench and trough improvements and cleaning of the remaining manholes.

3. Long-Term

For the long-term replacement of sanitary sewer lines, it is recommended to keep records of pipe age and maintenance areas. Those areas with aging pipe that have frequent leaks and/or breaks shall be the considered for replacement.

B. Lift Stations

1. Critical

The first step in determining the needed improvements to the lift stations is to perform an assessment of each lift station. Information for each lift station, as found in Table 3, should be gathered. In addition, equipment that is no longer operable should be replaced to prevent any accidental overflows of the lift stations.

C. Treatment Plant

1. Critical

A new chemical storage area is needed for the sodium hypochlorite and sodium thiosulfate. This includes spill containment and redundant pumping systems for each.

Figure 27 Existing Chemical Storage

Settled solids in the oxidation ditch need to be clean out. In addition, settling in the oxidation ditch needs to be prevented by increasing mixing/velocities in the basin. The oxidation ditch was originally designed with two (2) 30 HP disc aerator shafts. At the time of the site visit, only one (1) disc aerator shaft was installed and operational. The second disc aerator shaft needs to be installed and put back into service. Proper operation and maintenance of the oxidation ditch is critical to obtaining compliance with the discharge permit. The permit to discharge can be found in APPENDIX K – PERMIT TO DISCHARGE.

Figure 28 Oxidation Aerator

2. Short-Term

Replacement of the internal mechanisms in the two of the clarifiers is needed. This includes, at a minimum, the drives, troughs, skimmers, and rakes.

A new generator at the WWTP should be planned for replacement.

3. Long-Term

It is proposed to construct a new office and laboratory building in the future.

VIII. CAPITAL IMPROVEMENTS PLAN

The CIP is used for long-term planning of projects necessary for the overall reliability of the wastewater collection and treatment system. The CIP serves as a tool for decision-making, as projects are prioritized early so that a more deliberate method of planning and distributing financial resources can occur. It is recommended that the CIP be updated every five years.

Table 6 organizes the projects identified in Section VII based on its category. Those projects categorized as critical should be addressed within the next one to two years. Projects listed as Short-Term should be schedule within the next five to ten years, while Long-Term project scheduled 15 years or more.

Table 6 Capital Improvements Plan

City of Eufaula Capital Improvement Plan				
Category	**Area**	**Year**	**Project**	**Conceptual Cost ($)[1]**
Critical	Collection	2021	Package D1, D2, E, F1	2,566,394
	Collection	2022	Package A, B, C	242,418
	Collection	2022	Package D3	219,389
	Collection	2022	Package F2	786,089
	Collection	2022	Package H	765,053
	Collection	2022	Lift Station Maintenance[2]	100,000
	WWTP	2022	Spill Containment and Chemical Pumps	70,875
	WWTP	2022	Oxidation Ditch Sludge Removal and Shaft Replacement	478,125
			Subtotal	3,228,343
			Contingency (20%)	645,669
			Total for Critical Improvements	3,874,012
Short-Term	Collection	2023	Cleaning	75,000
	Collection	2023	Bench and Trough Improvements	50,000
	Collection	2023	Lift Station Maintenance[2]	100,000
	WWTP	2023	Oxidation Ditch Aeration Improvements	650,000
	WWTP	2025	Clarifier Improvements	450,000
	WWTP	2025	Generator	150,000
			Subtotal	1,475,000
			Contingency (20%)	295,000
			Total for Short Term Improvements	1,770,000
Long-Term	Collection	2031	Additional Sewer Replacement	TBD
	WWTP	2031	New Office and Laboratory Building	250,000
	WWTP	2031	WWTP Improv. and Maintenance	TBD

[1]Conceptual Costs include construction costs only. Cost do not include engineering studies, design, right-of-way, survey, land acquisition, legal and financial advisor fees. All costs are based upon 2020 construction costs.

[2]Costs are estimated for annual basis which may vary from year to year.

A detailed cost estimate for each project listed as critical can be found in APPENDIX L – Conceptual Cost Estimates. The City of Eufaula will seek funding through the Oklahoma Water Resources Board (OWRB) and apply for principal forgiveness through the Clean Water State Revolving Fund (CWSRF). Additional funding should be sought through a Community Development Block Grant (CDBG). The remainder of the project funding will come from either the Indian Health Services or the local funding.