WASTEWATER SYSTEM ANALYSIS AND CAPITAL IMPROVEMENTS

for

City of Sanger
(Denton County, Texas)

TCEQ Wastewater Treatment Plant Permit No.
WQ0014375001.

KSA Project Number SNG.004

Revision	Description	By	Date
0	Final Report	Danny Hays, P.E. Shriram Manivannan, P.E. Emily Avery, E.I.T.	8/3/2022

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1. Introduction

1.1 Scope of work

The City of Sanger authorized KSA Engineers to update the 2010 Master Plan for the water and sanitary sewer systems. The scope included modeling of the existing sanitary sewer systems, projecting future growth, modeling the future systems, identifying the improvements necessary to accommodate future growth, and analysis of wastewater collection system capacity.

To assist in navigation through this report, the following is a brief guide to the information contained within each chapter.

1. Chapter 2 provides a summary of City's existing wastewater collection system infrastructure and facilities.
2. Chapter 3 outlines the evaluation of the City's present wastewater lift station capacities against existing and future requirements.
3. Chapter 4 provides projected growth for the City of Sanger (5, 10 and 20 year) based on NCTCOG growth data and the evaluation of City's wastewater lift stations.
4. Chapter 5 contains a discussion concerning the findings of the modeling of the existing and future wastewater collection system.
5. Chapter 6 is a summary containing a discussion centering on the recommended capital improvements including estimated costs of the recommended improvements.
   Appendix I contains distribution modeling basis and assumptions as well as a brief information to basic hydraulic terminology and fundamentals. This chapter will provide insight to many of the terms used throughout the report. Appendix II contain several graphical exhibits that are referenced in the report. These exhibits show various maps of the wastewater collection system.

1.2 General Work Plan

The general description of the work shall be to prepare an Engineering Report containing the following:

1. Conduct a review of existing information related to the City of Sanger's wastewater collection and treatment history including the following:
   1. 2010 Wastewater Collection System mapping;
   2. Customer Meter Reading and Billing Data (2020-2021); and,
   3. Lift station information (provided by the City).
4. Create a SewerGEMs computer model of the collection system using all line sizes 6-inches and larger. Model will be office calibrated, no field calibration of the model will be conducted.
5. Conduct static model simulations for average day and peak hour flows. The peak hour flow is based on four times the average flows.
6. Identify areas of surcharging within the collection system on the basis of the modeled simulations.
7. Develop new wastewater system infrastructure improvements to address modeled deficiencies; and,
8. Prioritize improvement projects based on city needs and population projections through to year 2040.

1.3 Limitations

References in this report to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the City of Sanger, KSA or other individuals or entities specifically mentioned in this report.

The projected growth rates shown in this report are estimates based upon NCTCOG growth data or from growth patterns in nearby, similar sized cities. Actual growth rates could be higher or lower based upon a number of factors that are beyond the scope of this study.

The design basis for the information presented in this report is preliminary in nature and therefore is subject to change. The facilities and components discussed should be confirmed with more specific data as design development of the capital improvements proceeds.

Any project costs shown are opinions of probable construction cost only and are based upon standard construction practices, materials and installation. Costs are reflective of present day prices and are on the basis of conceptual schematics and alignments. Opinions presented do not include costs arising from property and/or easement acquisition, primary electrical service, etc.

1.4 Acknowledgement

The cooperation and assistance of City of Sanger staff is gratefully acknowledged.

2. Wastewater Collection System Background

2.1 Existing Sanitary Collection System

The City of Sanger Wastewater Collection currently provides service to approximately 3,386 properties. The wastewater is conveyed to the Sanger WWTP where the water is treated and discharged to Ranger Branch, upstream of Lewisville Lake in Segment No. 0823 of the Trinity River Basin.

2.2 Existing Lift Stations

There are seven lift stations in Sanger, including the one at the wastewater treatment plant located on Jones Street in the southeast part of the city. Two lift stations are located west of I-35 (Holt Road and Duck Creek) and feed into the South Bottom lift station at the most southern part of the city before going to the WWTP lift station. The three other lift stations (Marion, Lakeridge, and Quail Run) all feed directly into the WWTP lift station. A map of the lift station locations is shown in Figure 2.1 on the next page.

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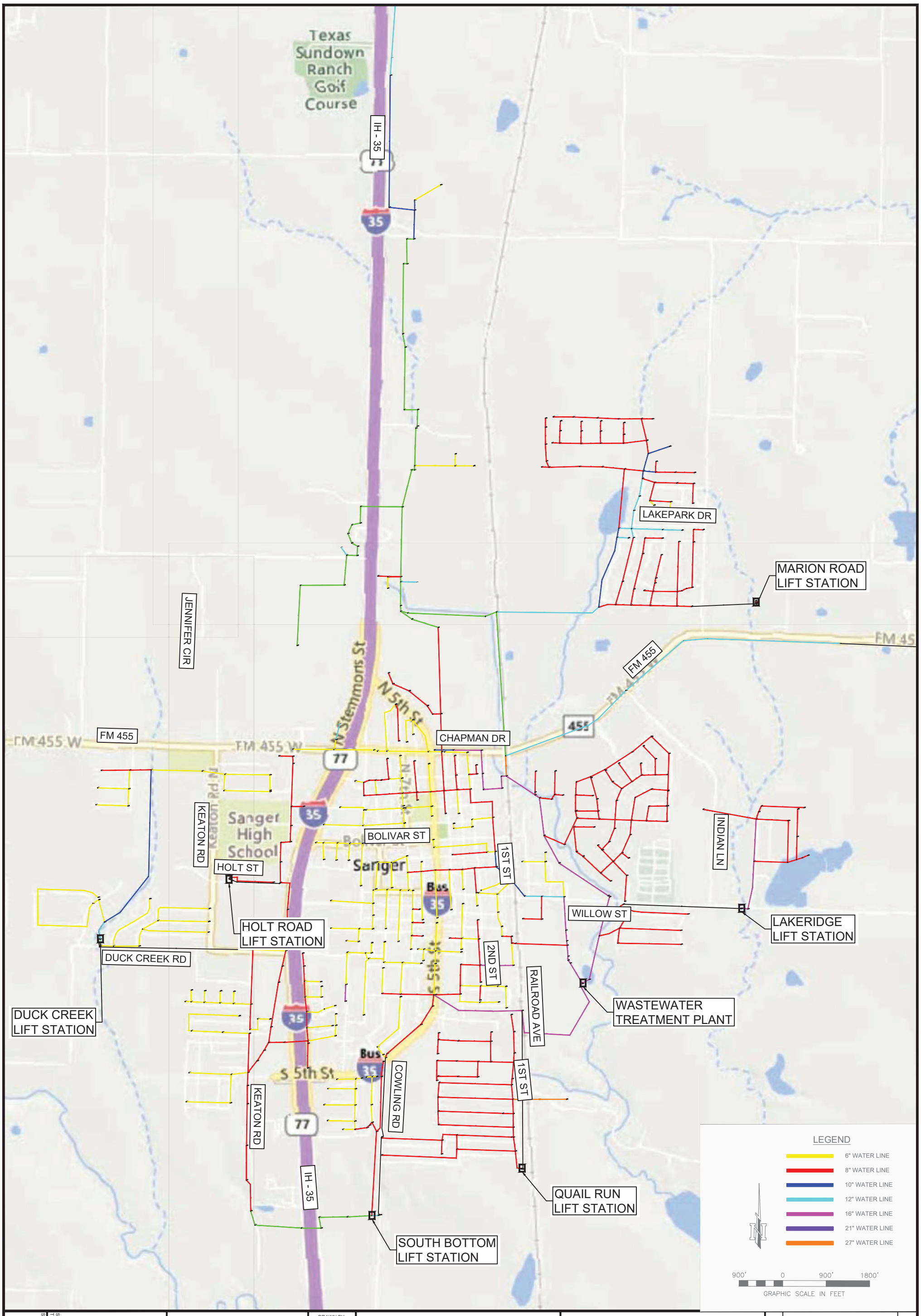

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EXISTING WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

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2.3 Existing Wastewater Treatment Facility

The City of Sanger is currently served by the wastewater treatment plant (WWTP) located at 300 Jones Street, Sanger, Denton County, TX 76266. The treatment plant is permitted for 0.98 MGD average daily flow and a 2-hour peak of 2,917 gallons per minute under permit no. WQ0014375001. The WWTP currently receives flow from the collection system into the treatment plant lift station through 18-inch lines and treats the water through a series of treatment processes before discharging the treated effluent to Ranger Branch.

Figure 2.1 – Existing Wastewater Treatment Facility

3. Lift Station Capacity Assessment

3.1 Lift Station Service Areas

The City of Sanger operates 7 sanitary sewer lift stations within their wastewater treatment system to serve a population of approximately 9,080 persons. The locations of all lift stations are shown in Figure 3.1 titled, “Lift Station Map”. The service areas of all lift stations and flow directions are shown in Figure 3.2 titled, “Lift Station Service Area Map & Flow Directions”. Both maps are shown on the following pages.

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LIFT STATION LOCATIONS
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LAKEPARK DR

MARION ROAD
LIFT STATION

JENNIFER CIR

FM 455

FM 455

CHAPMAN DR

KEATON RD

BOLIVAR ST

1ST ST

INDIAN LN

HOLT ST

HOLT ROAD
LIFT STATION

WILLOW ST

LAKERIDGE
LIFT STATION

DUCK CREEK RD

2ND ST

RAILROAD AVE

WASTEWATER
TREATMENT PLANT

DUCK CREEK
LIFT STATION

COWLING RD

1ST ST

KEATON RD

IH - 35

QUAIL RUN
LIFT STATION

SOUTH BOTTOM
LIFT STATION

LEGEND

- DUCK CREEK
- HOLT ROAD
- SOUTH BOTTOM
- QUAIL RUN
- LAKERIDGE
- MARION ROAD
- WASTEWATER TREATMENT PLANT

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EXISTING LIFT STATION SERVICE AREA MAP
SANGER, TEXAS

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3.2 Lift Station Service Areas

Table 3.1 – Lift Stations

Sub-basin	Lift Station Location	Number of Pumps	Pump Capacity (GPM)
Duck Creek	Duck Creek & Rising Star	1 duty, 1 standby	700
Holt Rd	Holt & Keaton	1 duty, 1 standby	50
Lake Ridge	Lake Ridge & McReynolds	1 duty, 1 standby	350
Marion Rd	East of Marion & North of FM455	1 duty, 1 standby	300
Quail Run	S. 1st St.	1 duty, 1 standby	350
South Bottom	Cowling Rd.	1 duty, 1 standby	500
WWTP	Jones St.	2 duty, 2 standby	4,540
Total Capacity			**6,790**

3.3 System Flows

The City of Sanger provides wastewater service to approximately 3,386 properties. The collection system flows were determined from analysis of city wastewater flow records and used in development of the SewerGEMS computer model of the collection system. The following flow rates are of particular interest in analysis of a system.

1. Average Annual Flow: The average amount of water used each day during a calendar year, i.e., annual water usage / 365 days (provided by City staff).
2. Peak Hourly Flow: The peak hourly flow is assumed to be four times the average flow, as specified in the scope of work.

3.4 Lift Station Capacity Evaluation

Lift stations were evaluated based on their rated capacity, which by TCEQ regulation is the firm capacity of the pumps. Firm capacity is defined as the sum of pumping capacity with the largest pump out of service. Firm capacity of the lift station pumps were provided by the City. The capacity was then compared to the estimated peak flow of the service areas. The lift station desktop capacity assessment is based on the model and data provided by the City. No inspections or field studies were done.

Table 3.3

Lift Station	Firm Capacity of the Lift Station (MGD)	Estimated Current Peak Flow (MGD)	Allowable Growth (MGD)	Allowable Growth (Population)[1]
South Bottom	0.72	0.78	-.06	0
Quail Run	0.504	0.309	0.2	401
Lakeridge	0.504	0.103	0.4	826
Marion Rd	0.432	0.005	0.43	879
Holt Rd	0.072	0.01	0.06	128

Duck Creek	1.008	0.28	0.73	1499
WWTP	6.537	3.118	3.42	7040

1: Estimated using 70% of the allowable growth in MGD and with the current average and peak usage of roughly 85 gal/person/day and 350 gal/person/day, respectively.

As the South Bottom lift station is over the firm capacity, the City should consider either upgrading the lift station with new pumps or installing another lift station.

The permitted daily average flow of effluent for the wastewater treatment plant is 0.98 MGD and for any two-hour period (2-hour peak) 2,917 GPM. The table below compares the current estimated flows to the permitted flows.

Table 3.4

	Estimated Current Flows	WWTP Permit (2016)	Percentage of Capacity
Average Daily Flow (MGD)	0.78	0.98	79%
2-Hour Peak Flow (GPM)	2,166	2,917	74%

The current flows are near 80% of the permitted capacity. As the wastewater treatment plant flows have reached greater than 75% of the permitted capacity, this will trigger TCEQ Rule 305.126 summarized below.

TCEQ Rule - 305.126:

- Whenever flow measurements for any sewage treatment plant facility in the state reaches 75% of the permitted average daily or annual average flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the wastewater treatment and/or collection facilities.
- Whenever the average daily or annual average flow reaches 90% of the permitted average daily flow for three consecutive months, the permittee shall obtain necessary authorization from the commission to commence construction of the necessary additional treatment and/or collection facilities.
- In the case of a wastewater treatment facility which reaches 75% of the permitted average flow for three consecutive months, and the planned population to be served or the quantity of waste produced is not expected to exceed the design limitations of the treatment facility, the permittee will submit an engineering report supporting this claim to the executive director. If in the judgment of the executive director the population to be served will not cause permit noncompliance, then the requirements of this section may be waived. To be effective, any waiver must be in writing and signed by the director of the enforcement division of the commission, and such waiver of these requirements will be reviewed upon expiration of the existing permit; however, any such waiver shall not be interpreted as condoning or excusing any violation of any permit parameter.

It is understood the City is in process of obtaining approval to increase the average daily permitted effluent flow to 1.2 MGD and plan for future developments and population growth.

4. Projected Population and Capacity Requirements

4.1 Projected Population

The City of Sanger service area consists of the incorporated area of Sanger, Texas in Denton County. In order to develop future population growth for the city, the NCTCOG population projection growth rate of 3.2% CAGR was used to estimate the future population. This data can be seen in Table 5.1.

Table 4.1 –Population Projections

Year	Sanger, Texas Population
2019	8,800
2020	9,080
2025	10,629
2030	12,442
2040	17,048

Using the projected population for the City of Sanger, shown above in Table 4.1, a projected number of water system connections can be developed. A ratio of 1:1 water service connections to sewer service connections was used to estimate the approximate number of sewer connections for each year.

In order to establish the number of future connections the ratio of persons per connection must be calculated. For the purposes of this study the projected population values have been divided by 2.68, the estimated number of person per household per the City's 2019 population and number of customer meters.

Table 4.2 –Connection Projections

Year	Population	Total Connections (Calculated per Ratio)
2020 (current)	9,080	3,386
2025	10,629	3,966
2030	12,442	4,643
2040	17,048	6,361

4.2 Development of Future Sewer Flows and Growth Areas

Sewer flow projections for future conditions (ie. 5-year, 10-year and 20-year projections) were developed using detailed comprehensive plan (supplied by City staff) and historical sewer flow information. Figure 4.1 shows the location of the future developments per city comprehensive plan.

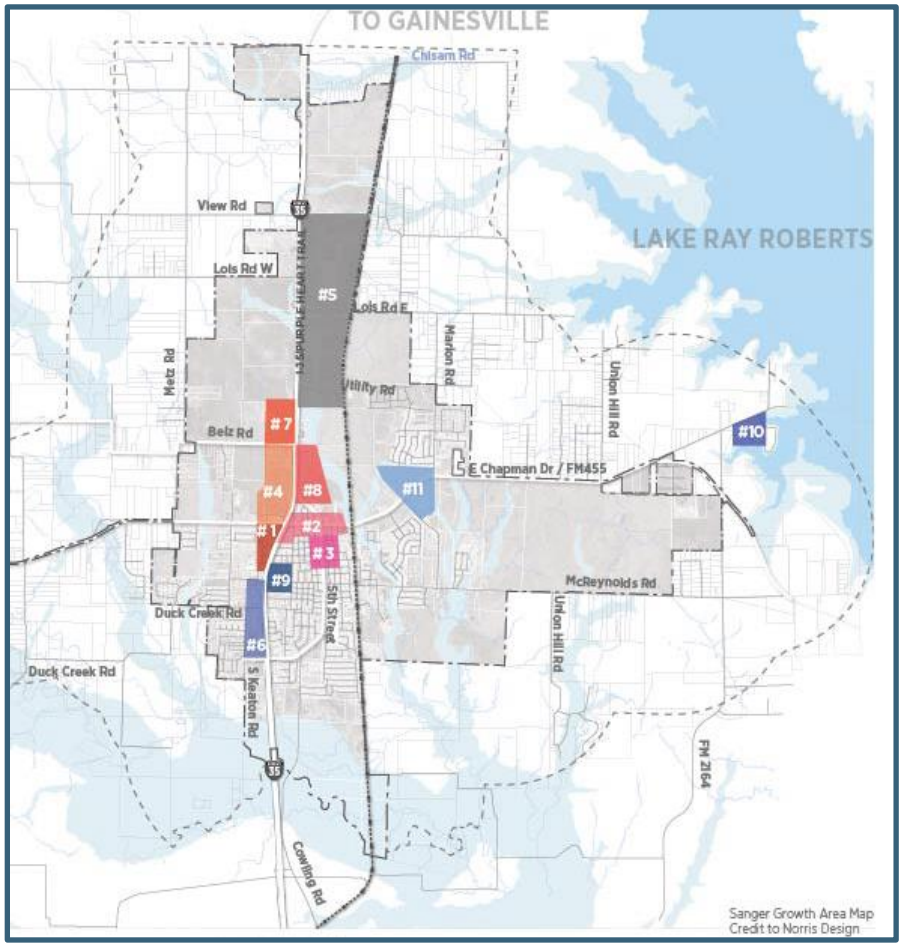

Figure 4.1: Future Development Areas per Comprehensive Plan

Growth Areas identified in the comprehensive plan includes:

#1 – FM 455 & I-35/Southwest Corner

#2 – FM 455 Corridor (East of I-35)

#3 – Downtown Sanger

#4 – FM 455 & I-35/Northwest Corner

#5 – Light Industrial near Walmart Distribution Center

#6 – I-35 Corridor (west of I-35 in Core of Sanger)

#7 – Belz Road & I-35 (Northwest Corner)

#8 – 5th Street Corridor (North of FM 455)

#9 – Linda Tutt Learning Center/SISD Site

#10 – Lake Ray Roberts

#11 – FM 455 & Future Indian Lane Extension

Based on discussions with the city staff with respect to growth projected for the city in the 5-year, 10-year and 20-year scenarios, the following wastewater flows were projected for the future development areas, which were further used in the wastewater collection system modeling analysis.

Table 4.3

Growth Area	2025			2030			2040		
	Number of Additional Connections	Additional Average Day Flow GPM	Additional Peak Hour Flow GPM	Number of Additional Connections	Additional Average Day Flow GPM	Additional Peak Hour Flow GPM	Number of Additional Connections	Additional Average Day Flow GPM	Additional Peak Hour Flow GPM
#1	29	4.64	18.56						
#2	29	4.64	18.56						
#3	29	4.64	18.56						
#4	29	4.64	18.56						
#5	174	27.84	111.36	118	18.93	75.6	301	48.13	192.52
#6	29	4.64	18.56						
#7	232	37.12	148.48	136	21.6	86.52	258	41.26	165.04
#8	29	4.64	18.56						
#9	29	4.64	18.56						
#10				304	48.67	194.68	860	137.52	550.08
#11				118	18.93	75.6	301	48.13	192.52
Total	**580**	**93**	**390**	**679**	**108**	**433**	**1719**	**275**	**1100**

5. Future Development Lift Station Capacity Analysis

The table below shows the lift station capacity analysis for the future lift station service areas. Only the lift stations that receive flows from the new growth areas discussed above are shown with the estimated future flows.

Table 5.1

Year	Lift Station	Estimated Lift Station Capacity (MGD)	Estimated Future Peak Flow (MGD)	Allowable Growth (MGD)	Allowable Growth (Poupulation)
5-Year	South Bottom	0.72	0.81	-0.09	0
	WWTP	6.54	3.65	2.89	5,944
10-Year	WWTP	6.54	4.28	2.26	4,647
20-Year	WWTP	6.54	5.86	0.68	1,394

1: Estimated using 70% of the allowable growth in MGD and with the current average and peak usage of roughly 85 gal/person/day and 350 gal/person/day, respectively.

As noted in section 3.4, the South Bottom lift station has exceeded the firm capacity for the lift station and will either require improvements or a new lift station will need to be installed to allow for the current and future peak flows. Section 7 discusses several options for improvements.

6. Modeling Results

6.1 SewerGEMs Wastewater Model

An evaluation of the current collection system was performed using a computerized modeling program called SewerGEMS. Information for the computerized model was provided by the City's employees, line lengths were scaled off of existing maps, and invert elevations were determined using minimum slopes required by TCEQ for the various line sizes used. The computer model was used to evaluate the adequacy of existing collection system as well as options for future expansion. The computerized model did not include an inflow and infiltration analysis. Alternatively, peak flow rate of 4 times the average day flow was used to simulate peak conditions.

6.2 Existing Collection System Model

6.2.1 Existing Average Day Sewer Flow Condition

Under the existing average day flows, no surcharging was observed in the model. The model did show several upstream sections (with fewer property connections) of 8-inch line with velocities less than 0.5 ft/second under existing average day flow conditions. Additionally, the 18-inch line on the west side of I-35 near Belz Road and the 12-in line on Chapman Drive show velocities of less than 0.5 ft/second. Future development planned in the I-35 corridor and along FM 455 will help alleviate stagnate velocity issues in the existing large diameter pipelines.

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JENNIFER CIR
FM 455
CHAPMAN DR
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BOLIVAR ST
HOLT ST
1ST ST
INDIAN LN
WILLOW ST
DUCK CREEK RD
2ND ST
RAILROAD AVE
KEATON RD
COWLING RD
1ST ST
IH - 35

LEGEND

- 6" SEWER LINE
- 8" SEWER LINE
- 10" SEWER LINE
- 12" SEWER LINE
- 16" SEWER LINE
- 18" SEWER LINE
- 21" SEWER LINE
- 27" SEWER LINE

BOLD = SURCHARGING

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EXISTING SYSTEM AVERAGE DAY

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6.2.2 Existing Peak Hour Flow Condition

Under the existing peak hour flows (i.e. 4 times the average flow) surcharging occurs most noticeably in the area west of I-35. The model indicates the 8-inch line and associated manholes directly downstream of the Duck Creek lift station force main along Keaton Road exceeds the pipe design capacity by close to 25% to 30%. Due to this surcharge in the pipe along Keaton Road, the model shows the upstream pipes and manholes running north to Chapman Road are backing up and are also surcharging.

Additionally, there are several smaller areas on the east side of I-35 that also show surcharging. The first, along 5th Street north of Cowling Road shows the 8-inch pipe directly downstream of the South Bottom lift station exceeding the pipe design capacity by close to 90%.

The second area showing surcharging, is near 1st St and north of Willow St, in the lines upstream of the 12-in and 16-in lines that flow to the WWTP. The 10-inch line along 1st St and south of Locust St exceeds the pipe design capacity by close to 20%.

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LAKEPARK DR

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FM 455

CHAPMAN DR

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1ST ST

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WILLOW ST

DUCK CREEK RD

2ND ST

RAILROAD AVE

KEATON RD

COWLING RD

1ST ST

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LEGEND

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6.2.3 5-Year Average Day Sewer Flow Condition

Under the 5-year average day flows, no surcharging was observed in the model. The model did show several upstream sections (with fewer property connections) of 8-inch line with velocities less than 0.5 ft/second under existing average day flow conditions. Additionally, the 18-inch line on the west side of I-35 near Belz Road and the 12-in line on Chapman Drive show velocities of less than 0.5 ft/second. Future development planned in the I-35 corridor and along FM 455 will help alleviate stagnate velocity issues in the existing large diameter pipelines.

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RAILROAD AVE
KEATON RD
COWLING RD
1ST ST
IH - 35

LEGEND

- 6" SEWER LINE
- 8" SEWER LINE
- 10" SEWER LINE
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- 16" SEWER LINE
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SANGER, TEXAS

PROJECT NAME:

5-YEAR SYSTEM AVERAGE DAY

SHEET NAME:

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6.2.4 5-Year Peak Hour Sewer Flow Condition

Under the 5-year peak hour flows (i.e. 4 times the average flow) surcharging occurs most noticeably in the area west of I-35. The model indicates the 8-inch line and associated manholes directly downstream of the Duck Creek lift station force main along Keaton Road exceeds the pipe design capacity by close to 25% to 50%. Due to this surcharge in the pipe along Keaton Road, the model shows the upstream pipes and manholes running north to Chapman Road are backing up and are also surcharging.

Additionally, there are several smaller areas on the east side of I-35 that also show surcharging. The first, along 5th Street north of Cowling Road shows the 8-inch pipe directly downstream of the South Bottom lift station exceeding the pipe design capacity by close to 90%.

The second area showing surcharging, is in the northeast section of the city, between Peach St and Willow St, and in the lines upstream of the 12-in and 16-in lines that flow to the WWTP. The 10-inch line along 1st St and south of Locust St exceeds the pipe design capacity by close to 50%, and is causing the upstream pipes and manholes in this area to back up and also surcharge.

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LAKEPARK DR

JENNIFER CIR

FM 455

FM 455

CHAPMAN DR

KEATON RD

BOLIVAR ST

1ST ST

INDIAN LN

HOLT ST

WILLOW ST

DUCK CREEK RD

2ND ST

RAILROAD AVE

KEATON RD

COWLING RD

1ST ST

IH - 35

LEGEND

6" SEWER LINE
8" SEWER LINE
10" SEWER LINE
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PROJECT NAME: PROPOSED WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

SHEET NAME: 5-YEAR SYSTEM PEAK HOUR

MARK	REVISION	DATE

\\KSA.NET\GATEWAY\PROJECTS\SNG004\MCK\010 MODELS OR RENDERINGS\SEWER SYSTEM\USE THIS MODEL\ SANGER UPDATED SEWER MODEL 2022 - SUBDIVIDED BY LS - FINAL.DWG | LS - RK | 4/19/2022 - 11:32 AM
DRAWING PATHNAME | LAYOUT | PLOT DATE - TIME

PROJECT TITLE: ---- - CITY XX, TEXAS

6.2.5 10-Year Average Day Sewer Flow Condition

Under the 10-year average day flows, no surcharging was observed in the model. The model did show several upstream sections (with fewer property connections) of 8-inch line with velocities less than 0.5 ft/second under existing average day flow conditions. Additionally, the 18-inch lines on the west side of I-35 near Belz Road shows velocities of less than 0.5 ft/second. Future development planned in the I-35 corridor and along FM 455 will help alleviate stagnate velocity issues in the existing large diameter pipelines.

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IH - 35
LAKEPARK DR
JENNIFER CIR
FM 455
CHAPMAN DR
FM 455
KEATON RD
BOLIVAR ST
HOLT ST
1ST ST
INDIAN LN
WILLOW ST
DUCK CREEK RD
2ND ST
RAILROAD AVE
KEATON RD
COWLING RD
1ST ST
IH - 35

LEGEND

- 6" SEWER LINE
- 8" SEWER LINE
- 10" SEWER LINE
- 12" SEWER LINE
- 16" SEWER LINE
- 18" SEWER LINE
- 21" SEWER LINE
- 27" SEWER LINE

BOLD = SURCHARGING

900' 0 900' 1800'

GRAPHIC SCALE IN FEET

SEAL:
TBPE Firm Registration No. F-1356
SHEET NO.

KSA
8866 Synergy Dr.,
McKinney, Texas 75070
T. 972-542-2995 F. 888-224-9418
www.ksaeng.com

DRAWN BY:
DESIGNED BY:
LATEST REVISION:
KSA JOB NO.:
SNG.004

PROPOSED WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

PROJECT NAME:

10-YEAR SYSTEM AVERAGE DAY

SHEET NAME:

MARK	REVISION	DATE

\\KSA.NET\GATEWAY\PROJECTS\SNG004\MCK\010 MODELS OR RENDERINGS\SEWER SYSTEM\USE THIS MODEL\ SANGER UPDATED SEWER MODEL 2022 - SUBDIVIDED BY LS - FINAL.DWG | 10 - AVG | 4/19/2022 - 1:32 PM

DRAWING PATHNAME | LAYOUT | PLOT DATE - TIME

PROJECT TITLE: ---- - CITY XX, TEXAS

6.2.6 10-Year Peak Hour Sewer Flow Condition

Under the 10-year peak hour flows (i.e. 4 times the average flow) surcharging occurs most noticeably in the area west of I-35. The model indicates the 8-inch line and associated manholes directly downstream of the Duck Creek lift station force main along Keaton Road exceeds the pipe design capacity by close to 25% to 55%. Due to this surcharge in the pipe along Keaton Road, the model shows the upstream pipes and manholes running north to Chapman Road are backing up and are also surcharging.

Additionally, there are several smaller areas on the east side of I-35 that also show surcharging. The first, along 5th Street north of Cowling Road shows the 8-inch pipe directly downstream of the South Bottom lift station exceeding the pipe design capacity by close to 90%.

The second area showing surcharging, is in the northeast section of the city, between Peach St and Willow St, and in the lines upstream of the 12-in and 16-in lines that flow to the WWTP. The 8-inch and 10-inch lines along 1st St and south of Locust St exceeds the pipe design capacity by close to 50% and 90%, respectively. This is causing the upstream pipes and manholes in this area to back up and also surcharge.

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IH - 35

LAKEPARK DR

JENNIFER CIR

FM 455

CHAPMAN DR

FM 455

KEATON RD

BOLIVAR ST

1ST ST

INDIAN LN

HOLT ST

WILLOW ST

DUCK CREEK RD

2ND ST

RAILROAD AVE

KEATON RD

COWLING RD

1ST ST

IH - 35

LEGEND

6" SEWER LINE
8" SEWER LINE
10" SEWER LINE
12" SEWER LINE
16" SEWER LINE
18" SEWER LINE
21" SEWER LINE
27" SEWER LINE

BOLD = SURCHARGING

900' 0 900' 1800'

GRAPHIC SCALE IN FEET

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LATEST REVISION:
KSA JOB NO.:
SNG.004

PROJECT NAME: PROPOSED WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

SHEET NAME: 10-YEAR SYSTEM PEAK HOUR

MARK	REVISION	DATE

\\KSA.NET\GATEWAY\PROJECTS\SNG004\MCK\010 MODELS OR RENDERINGS\SEWER SYSTEM\USE THIS MODEL\ SANGER UPDATED SEWER MODEL 2022 - SUBDIVIDED BY LS - FINAL.DWG | 10 - PK | 4/19/2022 - 11:38 AM
DRAWING PATHNAME | LAYOUT | PLOT DATE - TIME

PROJECT TITLE: ---- - CITY XX, TEXAS

6.2.7 20-Year Average Day Sewer Flow Condition

Under the 20-year average day flows, no surcharging was observed in the model. The model did show several upstream sections (with fewer property connections) of 8-inch line with velocities less than 0.5 ft/second under existing average day flow conditions. Additionally, the 18-inch line on the west side of I-35 near Belz Road shows velocities of less than 0.5 ft/second. Future development planned in the I-35 corridor and along FM 455 will help alleviate stagnate velocity issues in the existing large diameter pipelines.

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IH - 35
LAKEPARK DR
JENNIFER CIR
FM 455
CHAPMAN DR
FM 455
KEATON RD
BOLIVAR ST
HOLT ST
1ST ST
INDIAN LN
WILLOW ST
DUCK CREEK RD
2ND ST
RAILROAD AVE
KEATON RD
COWLING RD
1ST ST
IH - 35

LEGEND

- 6" SEWER LINE
- 8" SEWER LINE
- 10" SEWER LINE
- 12" SEWER LINE
- 16" SEWER LINE
- 18" SEWER LINE
- 21" SEWER LINE
- 27" SEWER LINE

BOLD = SURCHARGING

900' 0 900' 1800'

GRAPHIC SCALE IN FEET

SEAL:
TBPE Firm Registration No. F-1356
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DESIGNED BY:
LATEST REVISION:
KSA JOB NO.: SNG.004

PROPOSED WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

PROJECT NAME:

20-YEAR SYSTEM AVERAGE DAY

SHEET NAME:

MARK	REVISION	DATE

\\KSA.NET\GATEWAY\PROJECTS\SNG004\MCK\010 MODELS OR RENDERINGS\SEWER SYSTEM\USE THIS MODEL\ SANGER UPDATED SEWER MODEL 2022 - SUBDIVIDED BY LS - FINAL.DWG | 20 - AVG | 4/19/2022 - 11:34 AM

DRAWING PATH/NAME | LAYOUT | PLOT DATE - TIME

PROJECT TITLE: ---- - CITY XX, TEXAS

6.2.8 20-Year Peak Hour Sewer Flow Condition

Under the 10-year peak hour flows (i.e. 4 times the average flow) surcharging occurs most noticeably in the area west of I-35 and in the northeast section of the city and along FM 455. The model indicates the 8-inch line and associated manholes directly downstream of the Duck Creek lift station force main along Keaton Road exceeds the pipe design capacity by close to 25% to 55%. Due to this surcharge in the pipe along Keaton Road, the model shows the upstream pipes and manholes running north to Chapman Road are backing up and are also surcharging.

The surcharging seen along FM 455, between Peach St and Willow St, and in the 16-inch lines that flow to the WWTP indicate the pipes are well exceeding design capacity. The 8-inch and 10-inch lines along 1st St and south of Locust St exceeds the pipe design capacity by close to 50% and 90%, respectively. The 16-inch line directly flowing to the WWTP exceeds design capacity by close to 80%. This is causing the upstream pipes and manholes in this area to back up and also surcharge

The smaller area on the east side of I-35 that also show surcharging. The first, along 5th Street north of Cowling Road shows the 8-inch pipe directly downstream of the South Bottom lift station exceeding the pipe design capacity by close to 90%.

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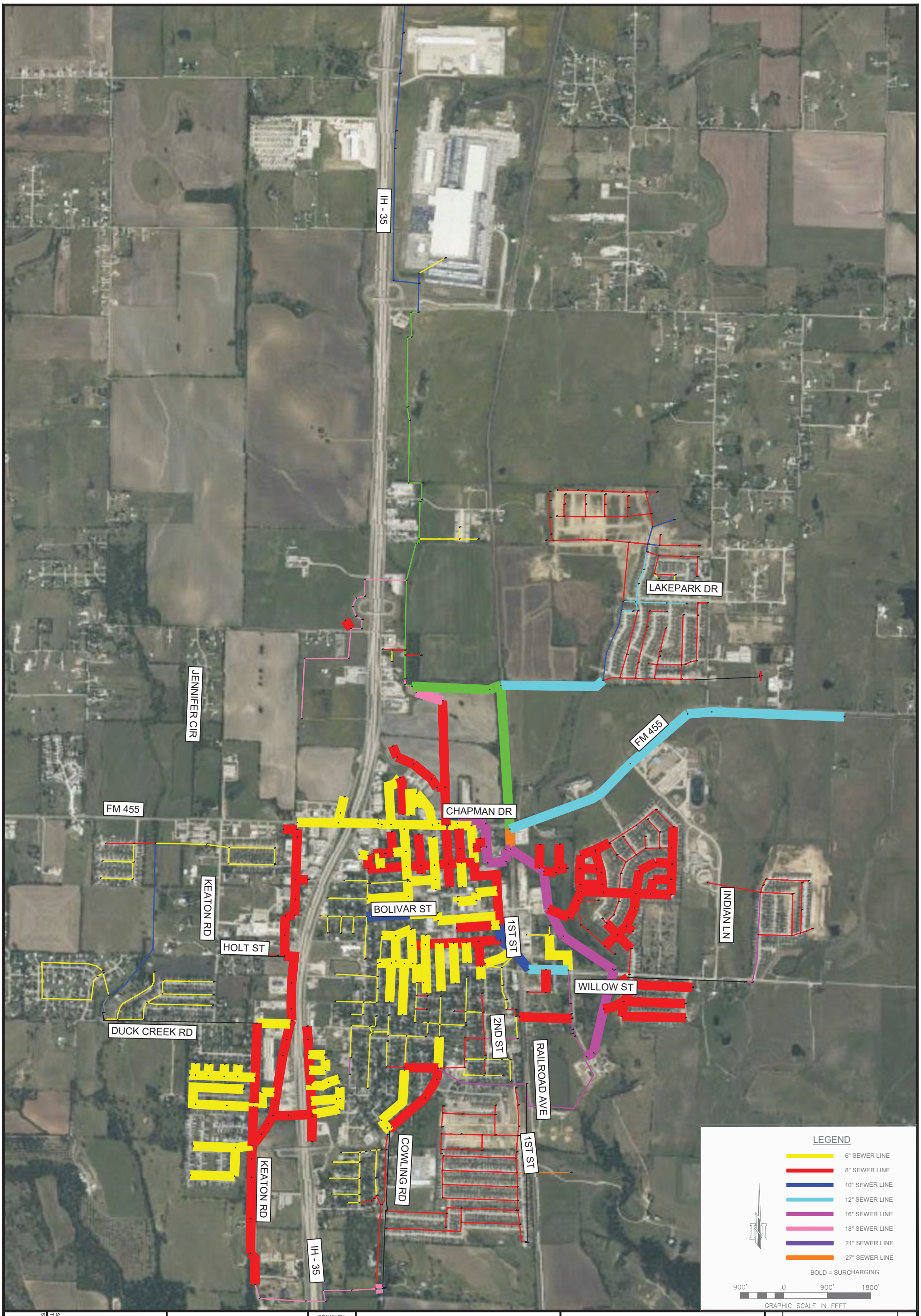

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DESIGNED BY:
LATEST REVISION:
KSA JOB NO.:
SNG.004

PROJECT NAME: PROPOSED WASTEWATER COLLECTION SYSTEM
SANGER, TEXAS

SHEET NAME: 20-YEAR SYSTEM PEAK HOUR

MARK	REVISION	DATE

\\KSA.NET\GATEWAY\PROJECTS\SNG004\MCK\010 MODELS OR RENDERINGS\SEWER SYSTEM\USE THIS MODEL\ SANGER UPDATED SEWER MODEL 2022 - SUBDIVIDED BY LS - FINAL.DWG | 20 - PK | 4/19/2022 | 11:35 AM
DRAWING PATHNAME | LAYOUT | PLOT DATE - TIME

PROJECT TITLE: ---- - CITY XX, TEXAS

6.3 Modeling Summary

Table 6.1

Modeling Findings	Existing System	2025	2030	2040
Population	9,080	10,629	12,442	17,048
Active Connections	3,386	3,966	4,643	6,361
Collection System Flow Scenarios and Requirements				
Average Daily Flow	No surcharging	No surcharging	No surcharging	No surcharging
Peak Hour Flow	Surcharging	Surcharging	Surcharging	Surcharging
Notes	South Bottom lift station is operating over capacity at peak hour flows.	South Bottom lift station is operating over capacity at peak hour flows.	South Bottom lift station is operating over capacity at peak hour flows. The lower elevation of the area east along FM 455 would a require a lift station to pump flows to the existing WWTP.	South Bottom lift station is operating over capacity at peak hour flows. Surcharging indicates a need for another lift station east along FM 455. The lower elevation of this area would also require a lift station to pump flows to the existing WWTP.

7. Summary of Recommended Collection System Improvements

7.1 Existing System Recommendations

South Bottom and Duck Creek Lift Stations – Proposed Options

The two options and the estimated costs are detailed below.

Option 1: Upsizing lines along Duck Creek and Keaton Road, and upgrading South Bottom Lift Station

- Upsize the 6-inch line along Duck Creek directly downstream of the Duck Creek force main to a 12-inch
- Upsize the 8-inch line from Duck Creek to existing line that feeds into the South Bottom lift station to a 12-inch
- Upgrade S. Bottom lift station (capacity to be determined)
- Will also upsize along S 5th St from Diane Dr to First Baptist Church, and west along Marcia Ln to 12-inch

Pros:

- Pipe bursting ideal candidate to save costs
- If S. Bottom lift station is upgraded, it will be able to support more development from Duck Creek, Holt Road, and gravity flow from the west side of I-35
- Do not have to cross I-35
- If new WWTP is built south of the City near Rector Road, can allow for everything to have gravity flow from South Bottom to the proposed WWTP instead of pumping it back to the existing WWTP

Cons:

- Potentially high cost compared to Option 2
- Does not decrease the load on the South Bottom lift station
- South Bottom lift station will need to be upgraded

Option 2: Extending the Duck Creek force main across I-35 to manhole at Diane Drive and Marcia Lane

- Extend existing Duck Creek force main to flow directly into gravity network that feeds into WWTP
  - Across I-35 along Duck Creek/Austin St, to Diane Dr, and then down to the existing manhole on Marcia Ln (about 3000 feet)
  - Will also upsize along S 5th St from Diane Dr to First Baptist Church, and west along Marcia Ln to 12-inch (about 2500 feet)

Pros:

- Decreases the load on S. Bottom lift station (Duck Creek no longer flowing through South Bottom)
- Allow for more development in other areas that flow to South Bottom lift station (Holt Road, south side of city, and other gravity flow areas west of I-35)
- Do not have to upsize the 8-inch line along Keaton Rd

Cons:

- Reduction in Duck Creek lift station capacity (up to 200 GPM, because the force main is longer, there is higher head loss)

Table 7.1

Duck Creek & South Bottom Lift Stations: Option 2 Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
6-inch force main extension along Duck Creek/Austin St from Keaton Rd to Diane Dr, and down to existing manhole at Marcia Ln	LF	3,000	$ 115	$ 345,000.00
			Total	$ 345,000.00

Table 7.2

Duck Creek & South Bottom Lift Stations: Option 1 Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
Upgrade South Bottom Lift Station (Additional 500 GPM pump, extending wet well, control panel adjustments, new concrete pad, etc)	LS	1	$ 700,000	$ 700,000.00
12" along Duck Creek - Duck Creek force main to I-35	LF	610	$ 170	$ 103,700.00
12" along Keaton Rd - from Duck Creek to existing 18" Line	LF	5,000	$ 170	$ 850,000.00
			Total	$ 1,653,700.00

Additional Recommendations

Additionally, the upsizing of the lines in Table 7.3 below is recommended to reduce surcharging seen in the model at peak hour flows.

Table 7.3

Existing System Additional Line Improvements				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
12" along S 5th St - from Diane Dr to First Baptist Church, and west along Houston St	LF	2500	$ 170	$ 425,000.00
10" along S 5th St - from Houston St to Church St	LF	570	$ 145	$ 82,650.00
12" along Bolivar St - S 5th St to N 1st St	LF	1290	$ 170	$ 219,300.00
18" along N 1st St from Cherry St and crossing Railroad	LF	1040	$ 180	$ 187,200.00

10" running NE from Willow St to Railroad	LF	580	$ 145	$ 84,100.00
15" from RR Ave to Jones St	LF	960	$ 175	$ 168,000.00
10" along Smith St and Kirkland St to E Willow St	LF	970	$ 145	$ 140,650.00
			Total	**$ 1,306,900.00**

7.2 Future Considerations for Lake Ray Roberts Development

Lake Ray Roberts Future Developments – Proposed Options

The two options and the estimated costs are detailed below.

Option 1: New Wastewater Treatment Plant independent of existing system.

- Construct a new WWTP in the area east along FM 455 for development near Lake Ray Roberts.
  Pros:
  - Does not require long distance of force main piping to connect with the existing system

  Cons:
  - More involved site evaluation and construction than Option 2
  - Requires permitting
  - Must meet new discharge requirements

Option 2: New lift station and associated force main piping to connect to existing system

- Construct a lift station and extended force main piping along FM 455 to connect to the existing collection system
  Pros:
  - Does not require permitting

  Cons:
  - Requires an extensive length of force main and gravity line to connect to existing system (approximately 15,000 feet total)
  - Depending on the amount of growth expected in the future, this could add a lot of additional flow in the existing system

Table 7.4

Lake Ray Roberts Development: Option 1 Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
New Wastewater Treatment Plant (this does not include engineering, permitting, land acquisition, loan fees, etc)	LS	1	$ 5,150,000	$ 5,150,000.00
			Total	$ 5,150,000.00

Table 7.5

Lake Ray Roberts Development: Option 2 Cost Estimate				
Description	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
New Lift Station	LS	1	$ 900,000	$ 900,000.00
12" force main along FM 455	LF	7000	$ 170	$ 103,700.00
15" line connecting force main to existing system	LF	4300	$ 175	$ 752,500.00
			Total	$ 1,756,200.00

7.3 Future Improvements Involving New Lines for Growth Areas and Existing Line Upsizing

5-Year Improvements

Please refer to section 4.2 for the locations of the growth areas for the five-year improvements.

Line Improvements related to Future Development at Growth Areas				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
Area #1 – 8” Line	LF	200	$ 120.00	$ 24,000.00
Area #2 – 6” Line	LF	1200	$ 115.00	$ 138,000.00
Area #3 – 6” Line	LF	500	$ 115.00	$ 57,500.00
Area #4 – 8” Line	LF	1600	$ 120.00	$ 192,000.00
Area #5 and North– 10” Line	LF	3300	$ 145.00	$ 478,500.00
Area #6 – 6” Line	LF	1200	$ 115.00	$ 138,000.00
Area #7 – 10” Line	LF	2100	$ 145.00	$ 304,500.00
Area #8 – 8” Line	LF	1500	$ 120.00	$ 180,000.00
Area #9 – 6” Line	LF	350	$ 115.00	$ 40,250.00
Line Improvements related to Upsizing of Existing Undersized or Surcharging Lines				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
12" Line along Peach St - from N 4th St to N 2nd St, across and down to 15" line on Cherry St	LF	2050	170	$ 348,500.00
12" running north from cul-de-sac at RR Ave to E Willow St	LF	420	170	$ 71,400.00
15" pipes connecting east development along McReynolds to existing16" (3 sections)	LF	1250	175	$ 218,750.00
			Total	**$ 2,191,400.00**

10-Year Improvements

Please refer to section 4.2 for the locations of the growth areas for the ten-year improvements.

Line Improvements related to Future Development at Growth Areas				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
Area #5 and North - 8" Line	LF	3450	$ 120.00	$ 414,000.00
Area #7 - 8" Line	LF	1800	$ 120.00	$ 216,000.00
Area #10 - 12" Line (connect to existing system)	LF	15000	$ 170.00	$ 2,550,000.00
Area #10 - 8" Line	LF	3300	$ 120.00	$ 396,000.00
Area #11 - 8" Line	LF	1950	$ 120.00	$ 234,000.00
Line Improvements related to Upsizing of Existing Undersized or Surcharging Lines				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
10" along Locust St from S 2nd to 1St St	LF	400	$ 145.00	$ 58,000.00
15" pipe connecting small area near Pleasant Run to existing 16" line	LF	225	$ 175.00	$ 39,375.00
8" line along Chapman Dr from s 5th to 4th St	LF	250	$ 120.00	$ 30,000.00
			Total	**$ 3,937,375.00**

20-Year Improvements

Please refer to section 4.2 for the locations of the growth areas for the twenty-year improvements.

Line Improvements related to Future Development at Growth Areas				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
Area #5 and North - 8" Line	LF	2400	$ 120.00	$ 288,000.00
Area #7 - 8" Line	LF	2100	$ 120.00	$ 252,000.00
Area #10 - 8" Line	LF	525	$ 120.00	$ 63,000.00
Area #11 - 8" Line	LF	1500	$ 120.00	$ 180,000.00
Line Improvements related to Upsizing of Existing Undersized or Surcharging Lines				
Description	**Unit**	**Quantity**	**Unit Price**	**Total Cost**
15" along FM 455 from RR to 1250' east of Green Valley Café	LF	6850	175	$ 1,198,750.00
21" line on east side of RR from Chapman Dr to WWTP	LF	4850	185	$ 897,250.00
12" from behind Dollar General to Peach St	LF	1420	170	$ 241,400.00
15" from RR ave to Jones St	LF	725	175	$ 126,875.00
8" along 2nd St from Plum to Peach		270	120	$ 32,400.00
8" along 3rd from Peach to Elm		440	120	$ 52,800.00
8" along Elm from 2nd to 1st		390	120	$ 46,800.00
			Total	$ 3,379,275.00

The costs estimated for the 5, 10, and 20 year improvements include only construction estimates and does not include engineering fees, administrative costs, funding fees, acquisition costs, construction supervision, etc.

7.4 Summary of Proposed Improvements for Future Development

7.4.1 5-Year Improvements

1. Duck Creek & South Bottom lift station improvements
2. Collection system surcharge improvements
3. Line extensions and collection system improvements to service future development areas including areas 1, 2, 3, 4, 5, 6, 7, 8, and 9.

7.4.2 10-Year Improvements

1. New WWTP or new lift station for developments near Lake Ray Roberts
2. Line extensions and collection system improvements to service future development areas including areas 5, 7, 10, and 11.
3. Collection system surcharge improvements

7.4.3 20-Year Improvements

1. Line extensions and distribution system improvements to service future development areas including areas 5, 7, 10, and 11.
2. Collection system surcharge improvements

7.4.4 Impact Fee Analysis

The impact fee was calculated by estimating the cost of each improvement required to provide sewer service to the extents of the Proposed Improvements for Future Development. The total costs of these improvements was then divided by the number of additional future connections to be served. This provides an average per connection cost for the improvements. The impact fee analysis is briefly described as follows:

$$Impact\ Fee = \frac{Total\ Cost\ of\ Sewer\ Improvements}{Total\ Connections\ Served\ (Units\ to\ be\ Added)}$$

The resulting impact fee is $3,200 per connection and 50% of this fee is $1600.