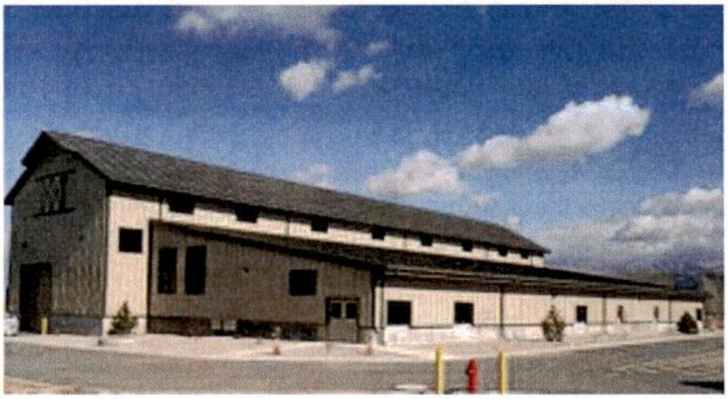
SANTAQUIN CITY

2023 SANITARY SEWER SYSTEM MASTER PLAN and CAPITAL FACILITIES PLAN



Prepared by:

SANTAQUIN CITY

AND

J-U-B ENGINEERS, INC.

J-U-B ENGINEERS, INC.

PROFESSIONAL ENGINEER CERTIFICATION

I, Michael J. Cope, do certify that this Master Plan & Capital Facilities Plan report was prepared under my charge, with the exception of the portions relating to wastewater treatment and effluent handling.

I, Gary Vance, do certify that the portions of this Master Plan & Capital Facilities Plan report relating to wastewater treatment and effluent handling were prepared under my charge.

EXECUTIVE SUMMARY

This 2023 Santaquin City Sanitary Sewer Master Plan and Capital Facilities Plan (the Plan) is intended to replace the 2016 Santaquin City Sanitary Sewer Master Plan and Capital Facilities Plan prepared by J-U-B Engineers and adopted by the Santaquin City Council in January 2017. The Plan also provides the foundation for collection of sanitary sewer impact fees in accordance with Utah State Code, §11-36a.

The Plan utilizes 2022 data, including telemetry data, flow measurements, GIS data, and land use as the existing system. Using this 2022 existing system as a base, we predict demand and identify future infrastructure improvements needed for the sanitary sewer system at 2032 and buildout of the City. Using these models, we can reasonably interpolate demands for other years.

The current level of service is consistent with standards of the State of Utah and sound engineering best practices. Any existing sanitary sewer system deficiencies are noted in this Plan but do not impair the overall system functionality.

It is recognized that with the anticipated growth, Santaquin City will need to increase capacity within the treatment facility, as well as make several strategic collection system tie-in connections. Some of these facilities will likely be installed by Santaquin City, some of them will likely be installed by land developers, and some of them will likely be installed by land developers with oversizing paid by the City. Ultimately the timing of anticipated improvements will be driven by specific developments with consideration being given to available funding, bonding, impacts fee reimbursements, or public private partnership opportunities.

The following recommendations are made as part of this Plan:

1. Establish impact fees to fund projects to meet future needs
2. Recommend creating a plan that addresses replacement of aging or inadequate infrastructure
3. Update the Master Plan/Capital Facilities Plan at least every five years, or when significant changes to planned land use, development or water use occur.
4. Periodically review and update user rates.

SANITARY SEWER MASTER PLAN AND CAPITAL FACILITIES PLAN

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I. INTRODUCTION

A. Purpose

This 2023 Santaquin City Sanitary Sewer Master Plan and Capital Facilities Plan is intended to replace the 2016 Santaquin City Sanitary Sewer Master Plan and Capital Facilities Plan prepared by J-U-B Engineers and adopted by the Santaquin City Council in January 2017.

The Plan will have the following goals:

1. Replace the 2016 Plan, which integrated a master plan and capital facilities plan for Santaquin City's sanitary sewer system.
2. Identify the City's current sanitary sewer system infrastructure and facilities.
3. Identify current and future infrastructure needs, along with an estimated time frame for construction and associated planning level cost estimates. Future projects will be determined through buildout (year 2060).
4. Provide direction for system development and level of service maintenance as growth occurs.

B. Background

The Santaquin City sanitary sewer collection and treatment system has evolved over the last 30 years. The first "citywide" sewer collection system and lagoon treatment facilities were built in 1993-1994 when the City's population was around 2,500[1]. Initial discharge of effluent was done by land application during the summer months, with effluent storage during the non-irrigation season. In 2003-2004, an additional, larger winter storage pond was constructed at the lagoon site to accommodate additional winter storage needs due to annual city growth rates close to 11% from the time the system was constructed. In 2011, facing treatment capacity concerns, Santaquin began the process to retire the treatment lagoons and construct a 1.4 MGD Membrane Bioreactor (MBR). The MBR was completed in 2013 and returns a Type I water quality effluent suitable for human contact. Rather than dispose of the effluent by land application, Santaquin City now uses the Type I water in the City's public pressurized irrigation system to supplement citywide irrigation needs.

While the sewer system has grown, Santaquin's general plan and zoning regulations have also evolved. The City completed an update to the General Plan in 2022, which included updates to the General Plan land uses. When compared to the previous General Plan land uses that were used in the 2016 master plan, the updated land uses include larger residential and agricultural areas and smaller commercial and industrial areas. The City has made an effort to preserve open space and agricultural areas, while also welcoming a variety of residential developments.

C. Scope

The Plan includes a discussion of system modeling, evaluation efforts, and summary results, as well as capital facilities planning for the City's sanitary sewer system to an

[1] www.census.gov

anticipated buildout in 2060. The area of consideration includes the current sewer system extent and those areas anticipated to be developed by 2060. Additional areas are included in the City's annexation and general plan but will need to be evaluated with future updates.

Furthermore, in an effort to maximize efficiency in the modeling process, future improvements were categorized according to their function as either "Project improvements" or "System improvements" with the Plan being focused on System Improvements.

Project improvements were determined to be facilities that are either:

1. Minimum improvements which all developers are required (by City and/or State Codes) to provide, (i.e. in the case of sanitary sewer lines this is an 8" minimum pipe size); or
2. Those improvements in excess of that listed above that are needed solely to accommodate new users within a specific development.

System Improvements are those improvements which exceed Project Improvement classification, and which are necessary to accommodate a larger segment of the community than will be within a specific development. System improvements may include an existing improvement that has reserve capacity to accommodate future growth, or a future improvement needed to accommodate growth.

While this Plan provides some direction for the City as future growth occurs, and the included capital facilities plan provides an organized approach for construction of sanitary sewer system improvements to serve the residents of Santaquin City, land could be developed in ways not currently anticipated (time, location, or type). It is expected that this Plan will be revisited and updated again in five years or after the next significant system improvement, whichever is sooner.

D. Objectives

The objectives of this Sanitary Sewer System Master Plan & Capital Facilities Plan are listed below:

1. Model and evaluate the existing (2022 – as of June 2022) sanitary sewer system
2. Establish system levels of service
3. Identify improvements needed to meet existing system deficiencies, if any
4. Model the future system required to serve projected buildout conditions based on the City's current General Plan
5. Identify improvements needed to meet future demand through buildout
6. Prioritize improvement projects
7. Estimate the cost of improvements
8. Identify potential sources of funding for needed improvements
9. Make recommendations for implementation of system improvements

II. APPROACH

A. Existing Conditions

The existing conditions are as of June 2022, which includes population, general plan land use, GIS data, and meter reads.

1. Existing Sewer System

   Santaquin City's sanitary sewer system consists of a citywide sanitary sewer collection system that accommodates nearly all existing homes, businesses, institutions, and City facilities. Figure A - 1 in Appendix A shows the existing sanitary sewer system extents.

2. Existing Equivalent Residential Units (ERUs)

   Santaquin City considers all residential units to be equal to one ERU. ERUs are used to equate non-residential users to an equivalent number of residential users. During the winter months when there is little outdoor water usage, sewer flows are generally closely related to water usage. Therefore, to calculate the number of existing ERUs within the City, J-U-B used water meter usage data, which consisted of monthly water usage readings from July 2021 to June 2022 for all meters, that was provided by the City. We discounted water from a few water users, such as nurseries, which use a lot of water, even in the winter, that would not end up in the sewer system. For each water meter that was actively recording water usage as of June 2022, and whose associated parcel also had a sewer connection, J-U-B used water usage reported in December 2021, January 2022, and February 2022 meter readings to calculate average winter water usage.

   The resulting average winter water usage for the 4,263 residential users who used water during the winter (which included single-family residential units, multi-family residential units, apartments, and mixed-use units) was 691,300 gallons per day, or 162 gallons per day (gpd) per residential unit.

   Using a value of 162 gpd per ERU, counting the number of residential units present in June 2022 (4,450 ERUs), and converting wintertime water use to ERUs for non-residential users present in June 2022 (356 ERUs) results in a total of 4,806 ERUs, with an estimated flow of 778,501 gallons per day.

   To reserve capacity in the existing system for higher flows than those that were measured, J-U-B and the City decided to model the existing system with flows of 200 gpd per ERU. J-U-B calculated non-residential ERUs by dividing the average winter water usage for each non-residential user present in June 2022 by 200 gpd, which reduced the number of non-residential ERUs to 295, for a total of 4,745 existing ERUs. These numbers, 200 gpd/ERU and 4,745 ERUs, are the basis of the average day existing conditions model and evaluation.

3. Existing Land Use and Sewer System Connections

   As indicated previously, nearly all of the residential, business, institutional, and City facilities are connected to the sanitary sewer system. The exceptions are a few private sewer systems that are typically more than 300 feet from an existing sewer line. The existing (2022) system has about 4,745 sewer system ERUs that provide service for sanitary sewer collection and treatment. There are approximately two dozen private sewer systems that are not serviced by the existing system. These private sewer systems are directed to individual septic systems authorized and administered through the Utah County Health Department.

4. Existing Population

   According to the 2020 US Census, the average household size in Santaquin was 3.78 persons per household. The census reported the population at Santaquin at 13,725 residents. Santaquin City estimates the population in 2022 to be 16,764.

5. Existing Level of Service (LOS)

   Santaquin City is required to operate under the treatment and collection standards set by the State of Utah Department of Environment Quality (see Section III for more discussion on the determined level of service).

B. Future Conditions

This report identifies two different future time periods for planning purposes – 2032 and 2060. Year 2032 was selected to forecast which capital projects are approaching in the near future, while the 2060 was selected to forecast capital projects needed beyond 2032 with a buildout population. Our analysis provides a basis for reasonable estimations (by interpolation) of demand and ERUs in any year between 2022 and 2060. Because the existing 2022 model is based on actual data, estimates closer to 2022 are more reliable than estimates in later years. This means a new impact fee facilities plan and impact fee analyses can be created without updating the master plan each time because the modeling basis has already been completed and the numbers can be determined through interpolation. Because the reliability of estimates decreases farther into the future, we recommend updating the master plan at least every five years, or if planned land uses change significantly.

This report identifies at what number of ERUs each future capital project will be needed. Based upon growth projections, it also predicts the approximate year that each project will be needed.

For the City to provide new users with the levels of service indicated herein, the sanitary sewer system will need improvements described in this document.

1. Future Equivalent Residential Connections

   As planned for existing ERUs, future ERUs are planned to contribute 200 gpd. All residential units are considered to be one ERU, while non-residential ERUs are calculated by dividing the anticipated flow by 200 gpd.

2. Future Land Use

   The study area boundary does not coincide with the current Santaquin City boundary nor its full annexation plan extent. Currently there are approximately 6,700 acres of land within the City limits with an additional 6,200 in the City's annexation policy. Most of the lands yet to be annexed are shown in the general plan as agriculture preservation areas or very minimal development potential within the plan horizon. Based on this, the study area boundary includes the current and anticipated future sanitary sewer service areas with significant development potential. The study area boundary includes 8,450 acres of land. Of these 8,450 acres, 1,057 acres is land that will not contribute to future sewer system demand (street right of way, railroad, open space etc.).

Figure A - 2 in Appendix A shows the current Santaquin City boundary, the study area boundary, and the anticipated future land uses provided by the Santaquin City Planning Department.

3. Future Population

Santaquin City has seen significant growth in recent years, particularly in residential areas. In projecting the population into the future, the City considered both observed historic growth in the City, as well as growth projections from the Mountainland Association of Governments (MAG). Table 1 shows anticipated growth projections for the City from 2021 to 2060 (which is considered the buildout population year).

Table 1: Santaquin City Growth Projections

Year	Esimated Population		Estimated ERUs[1]	
	Count	Growth Rate	Count	Growth Rate
2021	16,276	--	4,559	--
2022	16,764	3.00%	4,745	4.07%
2023	17,167	2.40%	4,898	3.23%
2024	17,853	4.00%	5,159	5.32%
2025	18,567	4.00%	5,430	5.26%
2026	19,310	4.00%	5,712	5.20%
2027	20,276	5.00%	6,079	6.43%
2028	21,289	5.00%	6,464	6.33%
2029	22,354	5.00%	6,869	6.26%
2030	23,472	5.00%	7,294	6.18%
2031	24,645	5.00%	7,739	6.11%
2032	25,877	5.00%	8,208	6.05%
2033	26,718	3.25%	8,527	3.89%
2034	27,587	3.25%	8,857	3.87%
2035	28,483	3.25%	9,198	3.84%
2036	29,409	3.25%	9,550	3.83%
2037	30,365	3.25%	9,913	3.80%
2038	31,352	3.25%	10,288	3.78%
2039	32,371	3.25%	10,675	3.76%
2040	33,423	3.25%	11,075	3.74%

Year	Esimated Population		Estimated ERUs[1]	
	Count	Growth Rate	Count	Growth Rate
2041	34,509	3.25%	11,488	3.73%
2042	35,630	3.25%	11,914	3.71%
2043	36,788	3.25%	12,354	3.69%
2044	37,984	3.25%	12,808	3.68%
2045	39,219	3.25%	13,277	3.66%
2046	40,493	3.25%	13,761	3.65%
2047	41,809	3.25%	14,261	3.63%
2048	43,168	3.25%	14,778	3.62%
2049	44,571	3.25%	15,311	3.61%
2050	46,020	3.25%	15,862	3.60%
2051	46,940	2.00%	16,211	2.20%
2052	47,879	2.00%	16,568	2.20%
2053	48,836	2.00%	16,932	2.19%
2054	49,813	2.00%	17,303	2.19%
2055	50,809	2.00%	17,681	2.19%
2056	51,825	2.00%	18,067	2.18%
2057	52,862	2.00%	18,461	2.18%
2058	53,919	2.00%	18,863	2.18%
2059	54,998	2.00%	19,273	2.17%
2060	56,098	2.00%	19,691	2.17%

[1]The estimated ERU growth rate is larger than the estimated population growth rate since ERU growth includes non-residential growth, which does not contribute to population growth.

The Santaquin City Planning Department estimates that 79% of the growth between 2022 and 2032 will occur within 10 development areas, with the remaining 21% of growth occurring throughout the City as background development. Figure C - 4 in Appendix C shows the areas that are anticipated to develop between 2022 and 2032, along with the percentage of growth associated with each area.

4. Future Level of Service (LOS)

   Santaquin City is required to operate under the treatment and collection standards set by the State of Utah Department of Environment Quality. Santaquin anticipates continued compliance with these standards and acknowledges that the standards will likely change as environmental and sanitary sewer treatment regulations become stricter. This potential was realized, in part, when the State of Utah and the EPA began limiting Type II water disposal into Utah Lake in 2014, which negatively affected all public sanitary sewer treatment facilities in Utah County, except Santaquin's due to their reuse authorization (see section III for more discussion on system LOS).

C. Existing (2022) System Demand

Existing average day, peak day, and peak hour demands were determined by evaluating the sanitary sewer lift station outflow meter records from June 12, 2021 to June 12, 2022. A sample diurnal curve is shown in Figure 1.

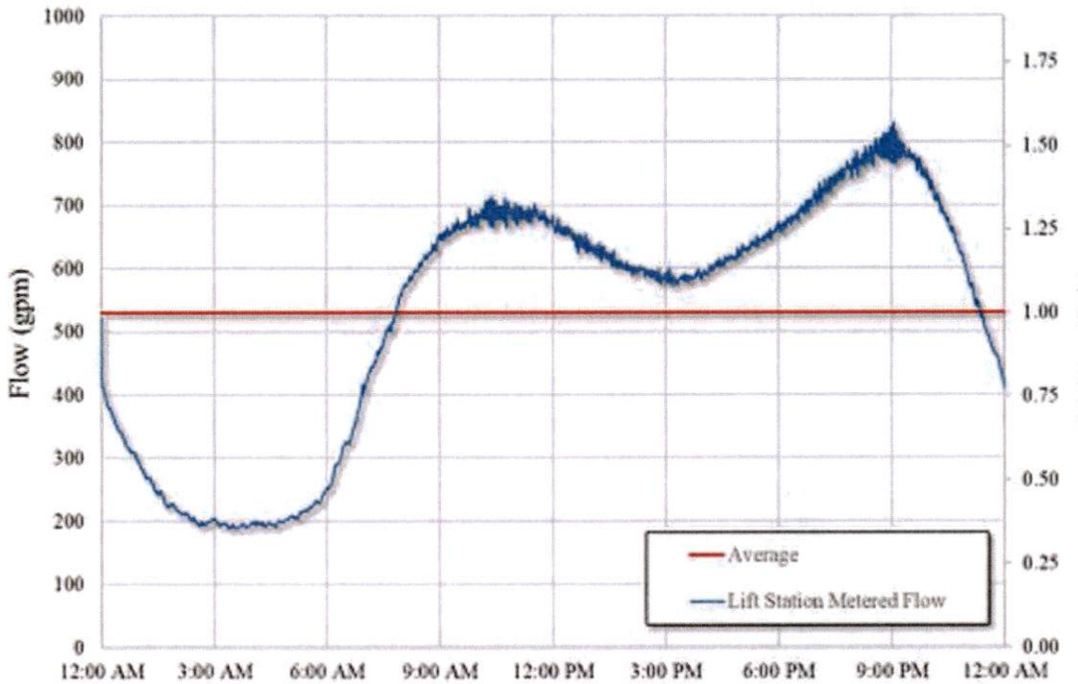


Figure 1: Sample Lift Station Meter Data from 2021-2022

J-U-B set flow meters in sewer pipe at five locations in June 2022. The five locations were identified by J-U-B and City staff at strategic locations to measure flow from specific parts of the City. The locations are shown on Figure A - 3 in Appendix A. A discussion of the flow measurements and figures showing the results are found in Appendix A.

D. Future Demand

Future demand was estimated by adding existing demand to demand resulting from future growth. Average day demand from future growth was estimated to be 200 gallons per day per ERU.

E. Model

J-U-B Engineers Inc. (J-U-B) developed a computer model for the system using InfoSWMM®, a graphically-based water modeling software that runs within ArcMap®. This model was updated by J-U-B Engineers using June 2022 conditions.

The model uses essential hydraulic data input to simulate the effect that input data has on the system under a specified scenario (i.e. peak day, peak instantaneous, average day, etc.). The data used for the model include the graphical layout and connectivity of the system, pipe lengths, pipe diameter, pipe roughness (a Manning's "n" roughness of 0.011 was used for all pipes in the model), demand at each node, and elevation of each node (provided by the City). Given the required data, the model determines the flow through each pipe and at each node that will result when the system meets a given demand at each node.

The layout and connectivity of the system is shown in Figure A - 1 in Appendix A. The model was calibrated using June 2021 – June 2022 lift station meter readings provided by the City and meters placed at five locations in the City. J-U-B created a diurnal curve to represent average day conditions and a separate diurnal curve to represent peak hour conditions. The average day diurnal curve was used to obtain the results shown in Figure A - 4 through Figure A - 9 in Appendix A. The peak hour diurnal curve was used to obtain the results shown in Figure A - 10 in Appendix A.

Appendix F contains model loading region data and an associated figure.

F. Capital Improvements

Capital improvements needed to correct existing (2022) deficiencies, if any, and to meet future needs are identified from the modeling and evaluation results. This Plan identifies these as individual capital improvement projects and includes associated opinions of probable cost (see Section VI "Capital Improvements").

III. LEVEL OF SERVICE

This Plan identifies the specific level of service provided by the system. The necessary system improvements listed in this Plan will allow the City to provide new users with the same level of service that currently exists.

A. System Improvements vs. Project Improvements

Improvements are categorized according to their function as either system improvements or project improvements. All improvements, both existing and future, are intended to be either system improvements or project improvements, but not both.

Project improvements are existing or future facilities necessary to provide service to occupants or users resulting from a specific development activity or development proposal.

System improvements are existing or future facilities not fitting the definition of a project improvement that are identified as such in this master plan and in the associated impact fee facility plan.

B. Level of Service Categories and Magnitude

The level of service criteria for the sanitary sewer system is defined as follows:

1. Collection/Transmission

Pipe capacity is typically calculated using Manning's equation, which was primarily developed for flow in open channels with rectangular, trapezoidal, and similar cross-sections. The equation has also been applied to pipe flow. However, as early as the mid-twentieth century, it had been observed that measured flow rates in partially full pipe flow do not agree with values calculated with the typical Manning's equation. The typical Manning's equation utilizes a constant n-value, no matter the depth of pipe flow, e.g. 0.013 for concrete, 0.011 for PVC. T.R. Camp developed a method for improving the agreement between measured values of partially full pipe flow rate and values calculated with the Manning equation. He did this by using a variation in Manning roughness coefficient with depth of flow in the pipe as a fraction of the pipe diameter. We developed Figure 2 from T.R. Camp's equations for a varying Manning roughness coefficient.

Santaquin City has chosen the following level of service: peak hour variable "n" value flow (or "q") divided by full flow (or "Qfull") of less than or equal to 85%, which corresponds to a flow depth of about 78%, and the pipe is not surcharged due to downstream capacity deficiencies. That depth is desirable because it provides a degree of protection against surcharging which causes overflows and lateral backups and contributes to odors and hydrogen sulfide generation.

If a pipe is located in an area without basements, then a peak hour flow level of service of up to 95% may be acceptable.

For pipes where buildout modeling indicates existing infrastructure will not meet the level of service, but there are no sewer laterals connected to the pipe or expected to connect to the pipe in the future, or the specific situation is not expected to create any operational or maintenance problems, the pipes will be placed on a watch list. As time passes, if it appears the pipes may become an operational or maintenance problem, improvements may be planned.

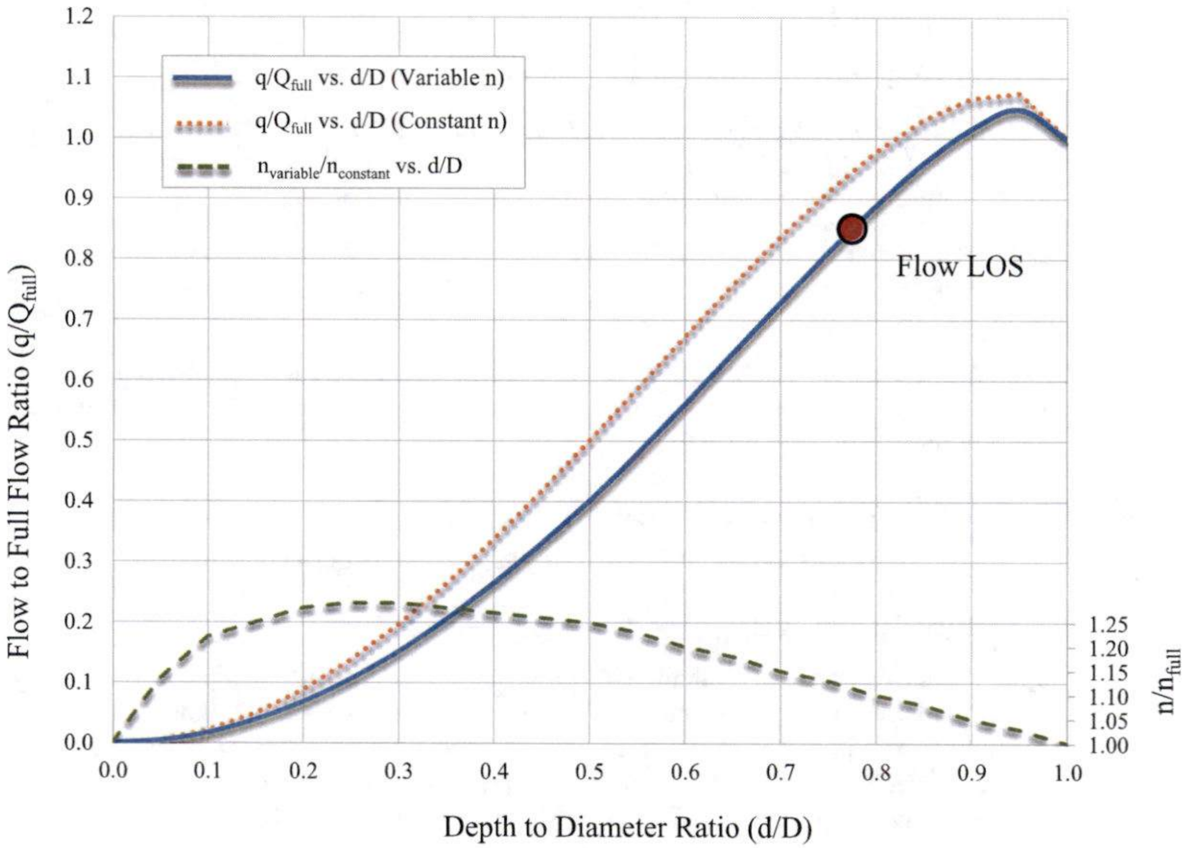


Figure 2: Variable vs Constant Manning's n for Pipe Flow

2. Lift Station Facilities

   The sewer lift station level of service relates to pump capacity and operation:

   - Pumps must have a capacity to pump at least 100% of peak hour flow rate while maintaining a standby pump.
   - The lift stations (excluding temporary ones) must have flow metering, backup power, variable frequency drive (VFD) motors if beneficial, and SCADA.

3. Treatment

   The level of service for treatment is for each component of the Water Reclamation Facility to have capacity to provide at least 100% of peak day or average day flow, as applicable.

4. Storage

The level of service for storage is to maintain sufficient storage capacity to store Type 1 water discharged from the Water Reclamation Facility until it can be pumped into the City's pressure irrigation system. The storage facilities shall have capacity to provide at least 100% of the total demand during the non-irrigation season. This could be accomplished through above-ground storage ponds or through infiltration for later reuse.

IV. EXISTING (2022) SANITARY SEWER SYSTEM

A. Overview

The Santaquin City sanitary sewer system consists of treatment facilities, storage facilities, pumping facilities and collection lines. Existing supply, existing demand, existing deficiencies and reserve capacity of system improvements for each category of improvements are described later in this report.

1. General System Description

The overall sanitary sewer system consists of approximately 67.5 miles of pipelines, 1,603 manholes, one lift station, the WRF treatment facility, and roughly 70 acres of winter storage ponds (with a capacity of 178 million gallons).

2. Operations

Currently, one hundred percent (100%) of the City's sanitary sewer gravity flows to an existing lift station located at the intersection of Center Street and Ginger Gold Road (1100 North). Flow is then pumped from this lift station to the WRF. The WRF treats the sanitary sewer to a Type 1 quality effluent.

From the WRF, the Type 1 effluent is pumped approximately 8,000 feet through a pipeline to the City's two winter storage ponds.

During the irrigation season, the stored Type 1 effluent is pumped into the pressure irrigation system for outdoor watering needs.

3. Historic Projects

Santaquin City has design, or so called "as built" plans, for some historic projects constructed as part of the sanitary sewer system. See Appendix B "Historic Projects" for a list of projects for which the City currently has record plans and details.

4. Maintenance

Santaquin City inspects all collection system lines using an SL-RAT system to identify any lines that are partially blocked. In addition, the City cleans 11% of lines and 5% of main transmission lines annually. This practice results in very few breaks or backups within the collection system and is a critical component of long-term system integrity. In support of this effort, Santaquin owns a vac-truck, which also helps in emergency situations.

B. Rights

1. Existing Water Rights

A complete evaluation of the City's water rights is outside the scope of this study. Therefore, no detailed discussion about overall water rights is included herein. For a detailed evaluation of current water rights held by Santaquin City, please refer to the December 2021 Projected Water Rights Use Analysis (40-Year Plan).

C. Existing (2022) Collection

1. Existing Collection Facilities

The collection and transmission portions of the sanitary sewer system contains approximately 67.5 miles of pipe and 1,603 manholes. The pipe sizes vary from 6 inches to 18 inches in diameter. All of the pipes are PVC pipe. The collection and transmission part of the system also includes one lift station. Table 2 includes a summary of the sewer main line pipes.

Table 2: Existing (2022) Sanitary Sewer Collection/Transmission Pipe Summary

Pipe Diameter	Pipe Length		% of
Inches	Feet	Miles	Total
6"	969	0.18	0.3%
8"	316,277	59.90	88.4%
10"	13,771	2.61	3.9%
10" FM	819	0.16	0.2%
12"	4,420	0.84	1.2%
12" FM	495	0.09	0.1%
15"	7,593	1.44	2.1%
18"	13,344	2.53	3.7%
Total	357,688	67.74	100%

2. Demand on Existing Collection Facilities

The existing system demand and peaking factors are shown in Table 3 based on the measured flow of 162 gpd per ERU, with all single-family residential units being equal to one ERU.

Table 3: Existing (2022) System Demand

	GPM	MGD	Peaking Factor	Cumulative
Average Day Based on June 2022 ERUs and Wintertime Water Use	541	0.779		
Peak Month	561	0.808	1.04	
Maximum Day (12/24/2021 - Christmas Eve)	672	0.967	1.20	1.24
Peak Hour (10:12 AM - 11:12 AM on 11/25/2021 - Thanksgiving)				
Day of Peak Hour	584	0.841		1.08
Peak Hour	1,212			2.24

Table 4 shows the existing system planned demand and peaking factors that are based on the increased flow of 200 gpd per ERU and all residential units being equal to one ERU. The values in Table 4 are used to evaluate adequacy of the existing infrastructure, assuming 200 gpd per existing ERU.

Table 4: Existing (2022) System Planned Demands

	GPM	MGD	Peaking Factor	Cumulative
Average Day	659	0.949		
Peak Month	684	0.985	1.04	
Maximum Day	819	1.179	1.20	1.24
Peak Hour				
Day of Peak Hour	712	1.025		1.08
Peak Hour	1,478			2.24

The existing ERUs and average day demand by land use are shown in Table 5.

Table 5: Existing (2022) Land Use, ERUs, and Demand

		Existing (2022)[1]	
Existing Land Use	Land Area (acres)	ERUS	Average Day Demand (Gallons)
Agriculture	57	3	600
Apartments Residential	3	64	12,800
Assisted Living Facility	3	14	2,889
Church	30	20	4,044
Commerical	114	221	44,259
Government Property	27	5	1,044
Mixed Use	17	63	12,600
Multi-Family Residential	52	716	143,200
Park	61	5	1,089
School	34	25	5,044
Single-Family Residential	1,101	3607	721,400
Total	**1,500**	**4,745**	**948,970**

[1]Based on 2022 demand of 200 gpd/ERU

The model results for the ratio of the maximum-flow-in-the-pipe-during-the-peak-hour to the capacity-of-the-pipe-flowing-full (q/Qfull) are shown in Figure A - 3 in Appendix A.

3. Existing Collection System Deficiencies

Figure A - 3 shows one area that has a pipe that is shown in red with a q/Qfull value greater than 0.85, or 85%. The pipe located near 50 West 770 North has a very flat slope, which can result in partial blockage and backup during low flows. To reduce the potential for pipe blockage at this location, the City made an operational decision to divert a majority of the flows to the west at the manholes located near 200 East 730 North and 50 West 770 North, which results in higher flows through the pipe with the flat slope. Therefore, the pipe shown in red is not deficient and the existing collection system has no deficiencies.

D. Existing (2022) Treatment

1. Existing Treatment Facilities

Santaquin City treats 100% of its sanitary sewer at the Water Reclamation Facility (WRF). The WRF was constructed in 2012 and 2013 and treats the collected sanitary sewer to a "Type 1" water quality level effluent using a Membrane Bio Reactor (MBR) filtration system. Type 1 quality is a standard of treatment designated by the State of Utah where "human contact of the effluent is likely".

Each of the components of the WRF have their own capacity. Some of them have capacity relative to peak hour flow, while others have capacity to average day. Table 6 shows the capacity of each of the components of the WRF.

Table 6: Existing (2022) WRF Capacity

WRF Component	Peak Hour Design Capacity (gpm)	AADF Design Capacity (MGD)
Center Street Lift Station Upgrades - new pump and parallel force mains	1,409	
Drum Screens	2,778	
Biological Process (1 train down for maintenance)		0.742
Membrane Process (1 basin down for maintenance)		0.803
Permeate Pumps		0.892
UV Disinfection	1,097	
Reclaimed Water Pumping	1,200	
Reclaimed Water Storage		1.150
Reclaimed Water Pipeline	1,770	
Dewatering Building and Screw Presses		1.983

The WRF was constructed for ease of expansion in the future to 1.72 MGD, which will handle an estimated 8,609 ERUs. Because the expected flow from buildout ERUs is higher than the expansion capacity, expansion of the WRF structure will be required. A LOS summary document for the WRF is in Appendix G.

2. Demand on Existing Treatment Facilities

The 2022 data indicates that average day flow to the WRF is 0.949 MGD and the peak hour demand is 1,478 gpm.

3. Existing Treatment Facility Delayed Growth-Related Projects

With the treatment level of service being 100% of the demand, UV disinfection and reclaimed water pumping need to be increased based on the peak hour capacity, and the biological process (with one train down for maintenance), the membrane process (with one train down for maintenance), permeate pumps, and biosolids holding capacity need to be increased based on the average day capacity. The 2016 Master Plan identified this infrastructure within the Impact Fee Facilities Plan as needing improvements to meet future needs. The City has been collecting impact fees to address these needs and has been monitoring existing demands and future needs to determine how much additional capacity will need to be added as part of the upcoming improvements, which are provided in this Plan.

E. Existing (2022) Storage

1. Existing Storage

The City stores the Type 1 effluent in two large winter storage ponds (formerly lagoon winter storage ponds), which have approximately 178 million gallons of total combined capacity. With stored water being pumped out of the ponds during a 180-day irrigation season, there are 185 days during which effluent from the WRF must be stored. This means the City currently has the ability to store 962,000 gallons of effluent per day during the non-irrigation season.

A listing of the current sanitary sewer storage facilities and their capacities is shown in Table 7.

Table 7: Existing (2022) Storage

Storage Facility	Capacity (MG)	ERUs[1]
Pond #1	52	1,751
Pond #2	126	4,242
Total Available Storage[2]	**178**	**5,993**

[1]The number of ERUs considers evaporation and losses from the storage ponds during the non-irrigation season, which equal approximately 10% of the annual WRF effluent volume.

[2]Santaquin is currently approved for an additional 179 MGD of recharge storage, but infrastructure for this capability has not yet been installed as the current water right does not allow for recovery of the water. The City has not yet obtained a separate recovery permit from the State.

2. Demand on Existing Storage

Current treatment levels are about 949,000 gallons per day. Based on historic WRF effluent pumping data, which adds to the winter storage ponds, and pressure irrigation pumping data, which draws from the winter storage ponds, approximately 30% of the annual WRF effluent volume is lost to evaporation from the winter storage ponds. We estimate that one-third of the evaporation and losses occur during the 185-day non-irrigation season, totaling approximately 187,000 gallons per day. With the LOS being 100% of demand, and accounting for evaporation and losses, the required storage is 762,000 gallons per day. At 185 days outside of the irrigation season, the current required storage is 141 million gallons.

Santaquin also has approval, through Water Right RC007, to store up to 179.2 million gallons in the local aquifer. The Division of Water Quality has indicated that additional treatment may be required to store treated effluent in the aquifer. To date, no facilities have been constructed to take advantage of this storage capability (see Future Storage Needs below).

3. Existing Storage Delayed Growth-Related Projects

The 2016 Master Plan identified additional storage needs in the Impact Fee Facilities Plan. The City has been collecting impact fees to address this need and has been monitoring existing demands and future needs to determine how much additional storage capacity will be needed as part of the upcoming improvements.

The current sanitary sewer storage demand was determined using the 2022 number of ERUs, and the established level of service. Table 8 shows the 2022 sanitary sewer storage demand, capacity, and excess storage.

Table 8: Existing (2022) Storage Demand, Capacity, and Excess Storage

	ERUs	Average Day Demand (MG)	Yearly Demand (MG)
WRF Wintertime Effluent	4,745	0.949	176
Wintertime Evaporation & Losses	936	0.187	35
Existing Demand	3,809	0.762	141
Existing Capacity	5,993	0.962	178
Excess Storage	2,185	0.200	37

V. FUTURE SANITARY SEWER SYSTEM AT BUILDOUT

A. Overview

1. General System Description

Figure C - 3 in Appendix C shows the anticipated sanitary sewer system at buildout. The sanitary sewer system at buildout will be comprised of the entire existing system infrastructure, along with the new improvements identified within this Plan. Note that only the system improvements are illustrated, which do not include service laterals or project specific improvements.

The Grey Cliffs development, which is shown in Figure C - 4, is anticipated to fully develop within the next 10 years. Due to the topography of the development area, only the eastern and southern portions of the development will be able to gravity flow to the south to the collection system in Cherry Lane. The Grey Cliffs development agreement with the City contains a temporary arrangement that will allow the developer to construct a development-specific lift station that will pump sanitary sewer flows from the northern portion of the development to the south until future infrastructure is in place to gravity flow the pumped areas to the north.

Santaquin City also provided currently approved development plans for several other known developments. We compared the planned development densities for these developments to the densities associated with the General Plan land use to ensure the planned densities were accounted for in the model. The Courtland Park development and the Green Hollow development required minor adjustments to densities within the model.

2. Operations

It is anticipated that the sanitary sewer system at buildout will be operated much the same as it is currently operated. Additional infrastructure identified in the Plan may require operational changes or additional operations.

B. Collection

1. Future Demand on Collection

At buildout, the collection system is estimated to serve 19,691 ERUs and have an average day demand of 3.94 MG. In the 2016 master plan, the buildout collection system was estimated to serve 16,289 ERUs, with an average day demand of 3.23 MG. The increase in buildout ERUs and average day demand seen in this Plan are a result of the recent updates the City made to the General Plan Land Use.

Figure C - 1 in Appendix C shows the buildout system model results without improvements to the existing system. It illustrates where pipes in the existing system would not have capacity for flows resulting from buildout land use.

Figure C - 2 in Appendix C shows the buildout system model results with improvements to the existing system. While the model results do show pipes that exceed the LOS with q/Qfull values greater than 0.85, many of these pipes do not have service lateral connections, or barely exceed a q/Qfull value of 0.85. See Section III LEVEL OF SERVICE for more information.

Figure C - 3 in Appendix C shows the buildout sanitary sewer system with improvements to address future needs shown in Figure C - 1.

Table C - 1 in Appendix C shows the existing (2022), 2032, and future demand q/Qfull of all pipes within the collection system.

Existing (2022), additional growth, and buildout demands are shown in Table 9. The ERUs associated with the additional growth and buildout demands were calculated based on the General Plan or existing densities for each of the land use type.

Table 9: Future Land Use, ERUs, and Demand

General Plan Land Use				Existing (2022)[2]		Additional Growth[3]		Buildout[4]	
Code	Description	Land Area (acres)	ERUs per Gross Acre[1]	ERUs	Average Day Demand (Gallons)	ERUs	Average Day Demand (Gallons)	ERUs	Average Day Demand (Gallons)
AHA	Agricultural Heritage Area	2,033	0.05	34	6,789	94	18,818	128	25,607
C	Commercial	112	6.66	117	23,454	571	114,222	688	137,676
CMU	Commercial Mixed Use	348	9.56	225	45,067	3,285	657,002	3,510	702,069
DTMU	Downtown Mixed Use	100	5.33	414	82,827	428	85,520	842	168,347
HP	Hillside Protection	165	0.00	0	0	0	0	0	0
HP/LL	Hillside Protection/Large Lot	1,605	2.50	0	0	2,935	587,088	2,935	587,088
I	Industrial	276	6.66	0	0	1,364	272,754	1,364	272,754
LL	Large Lot	175	2.48	213	42,600	267	53,360	480	95,960
MU	Mixed Use	119	14.12	52	10,344	1,483	296,696	1,535	307,040
NOS	Neighborhood w/ Open Space	1,398	3.36	1440	287,933	3,776	755,260	5,216	1,043,193
PR	Parks and Recreation	487	0.07	4	856	21	4,274	26	5,130
SF	Standard Single Family	744	2.13	1679	335,822	617	123,490	2,297	459,312
TN	Traditional Neighborhood (downtown adjacent)	221	1.92	566	113,278	104	20,734	670	134,012
	Total	7,784		4,745	948,970	14,946	2,989,218	19,691	3,938,188

[1]ERUs per Gross Acre for the AHA and HP/LL land uses were taken from the General Plan, while the others were calculated based on existing densities, which fell within the ranges provided in the General Plan

[2]Based on 2022 demand of 200 gpd/ERU

[3]Additional ERUs through buildout have a demand of 200 gpd/ERU

[4]Buildout demand equals existing plus additional growth

The Existing (2022), 2032, and Buildout scenario demand is shown in Table 10. Note that the same peaking factors used in the existing system were used for the buildout scenario.

Table 10: Existing (2022), 2032, and Buildout System Demand

	Year	ERUs	Average Day Demand / ERU (gpd)	Average Day Demand		Maximum Day Demand		Peak Hour Demand	Max Day to Peak Hour Factor
				MGD	gpm	MGD	gpm	gpm	
Existing	2022	4,745	200	0.949	659	1.179	819	1,478	1.81
	2032	8,208	200	1.642	1,140	2.039	1,416	2,556	1.81
Buildout	2060	19,691	200	3.938	2,735	4.892	3,397	6,133	1.81

2. Future Collection Needs

As shown on Figure C - 1, there are several existing pipe segments that would not meet the LOS of 85% q/Qfull at buildout. Many of the segments are along or near 14000 South, 100 South, 200 South, and the railroad tracks located in the southwestern part of the City.

It is anticipated that most of the pipes in the collection system will be built by land developers to serve future development as it occurs. The minimum pipe size required by State code is 8" in diameter. Some of the future pipes to collect and transmit sanitary sewer from areas of future development will need to be larger than the minimum pipe size. Some existing pipes will not meet buildout demand and need to be replaced by larger pipes.

3. Solutions to Future Collection Needs

Figure C - 3 in Appendix C shows the buildout system pipes that satisfy the established level of service for the future conditions. As is evident in the figure, these pipe sizes address the level of service needs with regard to capacity in the buildout condition. Table 13 contains improvement projects to resolve the deficiencies, as well as provide for future growth.

Since we expect that the future pipes will be built by land developers, Santaquin City will need to require that the developers install the size of lines shown in Figure C - 3. The developer will be responsible for installing an 8-inch line, and Santaquin City will be responsible for paying for the incremental cost difference between the required size and an 8-inch line. As such, these costs are not identified as discrete projects, but as a series of pipe segments for which the City will incur financial obligation when a developer installs them. Table E - 2 and Table E - 3 in Appendix E contain tabulations of estimated typical pipe installation and upsizing costs.

To estimate the upsizing costs that Santaquin City might incur by 2032, we used 2022 data and growth projections to calculate the q/Qfull in each future pipe segment in the year 2032, as well as at buildout. A tabulation of these demands is shown in Table C - 1 in Appendix C.

Table 11 shows the total length and weighted average flow for existing pipes, grouped by size, in existing conditions, in the year 2032, and at buildout. It also shows the percentage of existing pipe capacity expected to be consumed between 2022 and 2032.

Table 11: q/Qfull Summary for Existing (2022), 2032, and Buildout Pipe Upsizing

	Buildout Gravity Sewer Main Size			
	10"	12"	15"	18"
Total Length at Buildout (ft)	17,528	4,534	8,049	14,452
Weighted Average $q_{(existing)}/Qfull_{(existing)}$	19%	15%	8%	13%
Weighted Average $q_{(2032)}/Qfull_{(existing)}$	20%	34%	19%	24%
Weighted Average $q_{(buildout)}/Qfull_{(existing)}$	31%	78%	44%	32%
Percent of Existing Pipe Capacity Needed in 2032:	1.5%	19.1%	10.2%	10.6%

C. Treatment

1. Future Demand on Treatment

   As growth occurs there will be an associated increase of sanitary sewer flows that will require increased treatment capacity at the WRF and increased pumping capacity from the WRF to the winter storage ponds.

2. Future Treatment Needs

   Appendix G contains a WRF LOS document that shows future treatment capacity needs as growth occurs.

3. Solutions to Future Treatment Needs

   Additional infrastructure will be installed at the WRF to increase treatment capacity. The projects will affect biological treatment, pumping, filters, solids handling, etc. Different processes within the WRF treatment facility will need upgrading at different times in order to increase overall capacity.

D. Storage

1. Future Demand on Storage

   As growth continues to occur, additional non-irrigation-season storage will be required to provide the established level of service standards. Table 12 shows future demand on Type 1 water storage.

Table 12: Sanitary Sewer Storage Demand Tabulation

Table Row		Storage (MG)	
	Existing Storage		
a	Pond #1 Storage	52	
b	Pond #2 Storage	126	
c	Total Existing Storage	178	= a + b
	2022 Storage Needs		
d	2022 WRF Wintertime Effluent	176	
e	Wintertime Evaporation and Losses	35	
f	2022 Storage Demand	141	= d - e
g	Excess Storage	37	= c - f
	2032 Storage Needs		
h	2032 WRF Wintertime Effluent	304	
i	Wintertime Evaporation and Losses	60	
j	2032 Storage Demand	244	= h - i
k	Additional Storage Needed	66	= j - c
	Buildout Storage Needs		
l	Buildout WRF Wintertime Effluent	729	
m	Wintertime Evaporation and Losses	144	
n	Buildout Storage Demand	585	= l - m
o	Additional Storage Needed	407	= n - c

2. <u>Future Storage Needs</u>

   Non-irrigation-season storage demand exceeds current storage capacity.

3. <u>Solutions to Future Storage Needs</u>

   Future additional storage capacity needs could be met in a number of ways. These may include additional storage ponds and/or additional recharge and recovery of Type 1 water into the groundwater aquifer. The Type 1 effluent is needed for use in the pressure irrigation system. We recommend that additional storage facilities be provided for storage of the effluent during the non-irrigation season for use in the pressure irrigation system.

   As mentioned previously, Water Right RC007 allows for up to 550 acre-feet of groundwater recharge of Type 1 water, but not recovery of that water. To make full use of WR RC007, the City would need to construct three recharge/infiltration basins (spreading ponds) or trenches, as well as various pipeline work and metering devices to keep accurate records of the amount of water recharged. A recovery well could also be necessary to recover the recharged water.

Santaquin City has a great need to use as much of the Type 1 water as possible. As the State of Utah has not yet issued a recovery permit for recharged Type 1 water, any recharged water will not be available, by water right, to be recovered by the City. Therefore, the City will need to construct additional storage pond facilities to store and then make the best use of Type 1 water. These new storage ponds will increase the overall costs for storing Type 1 water, which is a larger burden that will be placed on future growth/development.

Since these new storage facilities are needed to accommodate future growth, impact fees may be used to fund design and construction of such. Table 13 identifies two projects needed to accommodate Santaquin's future storage needs.

VI. CAPITAL IMPROVEMENTS

A. List of Projects and Priorities

Table 13 shows capital improvement projects necessary to provide for future growth. It also indicates an approximate time frame and ERU count when those projects will be needed. We determined the ERU numbers from the model, then applied anticipated growth rates to identify the estimated year when each project will likely be needed. Payment to land developers for upsizing from 8-inch pipes to larger pipe sizes needed as system improvements will gradually occur as land develops from now until buildout. We included system improvement pipe upsizing projects in Table 13 based on the current General Plan and the hydraulic model. These pipe upsizing projects may vary if actual development is different than the General Plan.

The likely funding sources are based on project type (to resolve existing deficiency or meet future need) and anticipated year of need. More detailed information about each project and costs associated with each are found in Table E - 1 in Appendix E.

Figure D - 1 in Appendix D shows the projects that need to be constructed with growth to meet future needs. There are six pipe segments labeled as "Watch List" in Figure D - 1. These pipe segments barely exceed a q/Qfull value of 0.85 under the assumed buildout conditions and do not result in any backwater conditions. As actual land development may differ somewhat from the assumed future land uses and development densities, the pipe segments may have lower q/Qfull values. We therefore added the pipe segments to a watch list for the City to monitor their capacity rather than specifying improvement projects.

Table 13: Sanitary Sewer System Improvements

Project Number	Project Description	Estimated Cost (Rounded)[1]	Point at Which Project is Estimated to be Needed[2]		Land Developer (Project Improvements)	City Funds (Existing Deficiencies)	Impact Fees (System Improvements)
			ERUs	Year			
Collection Projects							
C-01	Install 18" Sewer Main Along Strawberry Canal Road from 400 East to 100 East	$ 634,200	6,079	2027	$ 339,450		$ 294,750
C-02	Install 10" & 15" Pipe along 400 East from 530 North to Strawberry Canal Road and Remove Pipe on 530 North	$ 843,900	6,079	2027	$ 608,220		$ 235,680
C-03[3]	Install 8" Sewer Main from west to 14400 South (county) and Summit Ridge Pkwy	$ 1,720,500	6,079	2027	$ 1,720,500		
C-04	Install 8" Sewer Main along Center Street from 100 South to Manhole at 70 South	$ 50,000	7,294	2030			$ 50,000
C-05	Install 10" Sewer Main Parallel to Existing 18" Sewer Main along Railroad Tracks East of Storage Ponds from 14000 South (county) to Highway 6 - Flows from 14000 South (county) will be Diverted to the Parallel 10" Sewer Main	$ 586,500	9,913	2037			$ 586,500
C-06	Install 8" Sewer Main along Strawberry Canal Road from 4800 West (county) to 400 East	$ 813,800	9,913	2037	$ 813,800		
C-07	Install 8" Sewer Main Along 350 West from 680 North to 700 North	$ 50,000	12,808	2044			$ 50,000
C-08	Install 15" Sewer Main Along Railroad Tracks East of Summit Ridge from Vista Ridge Drive to Topaz Drive (excluding under railroad tracks)	$ 464,400	13,277	2045			$ 464,400
C-09	Install 4" Force Main with Sewer Lift Station on 4800 West (county) and 12400 South (county)	$ 1,819,500	13,277	2045			$ 1,819,500

Table 13: Sanitary Sewer System Improvements (cont'd)

Project Number	Project Description	Estimated Cost (Rounded)[1]	Point at Which Project is Estimated to be Needed[2]		Land Developer (Project Improvements)	City Funds (Existing Deficiencies)	Impact Fees (System Improvements)
			ERUs	Year			
Collection Projects							
C-10[4]	Install 8" Sewer Main from SR-198 and 4400 West (county) to 12400 South and 4800 West (county)	$ 2,127,800	13,277	2045	$ 2,127,800		
C-11	Install 24" Sewer Main on Center Street to Lift Station	$ 47,100	13,761	2046			$ 47,100
C-12[4]	Install 8" Sewer Main Along 4800 West from 12800 South to 12400 South	$ 697,500	13,761	2046	$ 697,500		
C-13[4]	Install 8" Sewer Main on Strawberry Canal Road from 6250 West to Center Street Lift Station	$ 1,288,100	13,761	2046	$ 1,288,100		
C-14	Install 8" Sewer Main along 100 West from 100 South to Manhole at 70 South, and add Manhole at Intersection of 100 West 100 South	$ 48,900	14,778	2048			$ 48,900
C-15	Install 4" Force Main with Sewer Lift Station Northwest of Storage Ponds near Highway 6	$ 1,257,200	14,778	2048			$ 1,257,200
C-16[4]	Install 8" Sewer Main West of Storage Ponds to Highway 6 Lift Station (Project 15)	$ 819,600	14,778	2048	$ 819,600		
C-17	Install 8" Sewer Main along 400 East from 200 South to 140 South	$ 72,100	15,862	2050			$ 72,100
C-18	Install 8" Sewer Main North of 400 North and East of 400 East for Development	$ 1,371,800	15,862	2050	$ 1,371,800		
C-19[3]	Install 4" Force Main with Sewer Lift Station south of Genola near Highway 6	$ 2,005,000	17,681	2055	$ 2,005,000		
C-20	Install 8" Sewer Main along Center Street from 550 South to Manhole at 520 South	$ 27,900	19,273	2059			$ 27,900
	Subtotal	**$16,745,800**			**$ 11,791,770**	**$ -**	**$ 4,954,030**

Table 13: Sanitary Sewer System Improvements (cont'd)

Project Number	Project Description	Estimated Cost (Rounded)[1]	ERUs Served[5]	Anticipated Construction Year	Land Developer (Project Improvements)	City Funds (Existing Deficiencies)	Impact Fees (System Improvements)
Treatment Projects							
T-01[6]	Upgrade Permeat Pumps	$ 75,000	2,909	2023/2024			$ 75,000
T-02[6]	Process Train #3 and New Biosolids Holding Tank- Convert Train 3 to BNR Process and Replace Solids Holding Tank and Pumps	$ 4,221,000	3,710	2023/2024			$ 4,221,000
T-03[6]	Reclaimed Water System Add 4th Pump	$ 245,000	4,104	2023/2024			$ 245,000
T-04[6]	Outfit Membrane Tank 5 and Flow Channel	$ 2,463,000	4,014	2023/2024			$ 2,463,000
T-05[6]	Center Street Lift Station & FM- Add Third Pump and Add Parallel Force Main	$ 1,589,000	4,524	2023/2024			$ 1,589,000
T-06[7]	Add Conveyors and Loadout Facility for Biosolids	$ 600,000	–	2023/2024			$ 600,000
T-07	Convert Backpulse Tank and Outfit Membrane Train 6	$ 2,496,000	5,352	2025			$ 2,496,000
T-08	Reclaimed Water System Add Parallel FM	$ 2,581,000	6,051	2027			$ 2,581,000
T-09[8]	UV System Upgrades- Populate First Channel	$ 479,000	3,750	2027			$ 479,000
T-10[7]	Add Grit Removal System	$ 2,025,000	–	2027			$ 2,025,000
T-11	New 1.5 MGD AADF WRF	$ 37,500,000	7,420	2031			$ 37,500,000
T-12	Upsize Headworks Drum Screens	$ 2,570,000	8,920	2035			$ 2,570,000
T-13	Biosolids - when both screw presses are running 40 hrs/wk, expand building and add a 3rd screw press or a belt filter press for more capacity.	$ 3,526,000	9,913	2037			$ 3,526,000
T-14	UV System Upgrades- Populate Second Channel	$ 1,220,000	15,004	2049			$ 1,220,000
	Subtotal	$ 61,590,000			$ -	$ -	$ 61,590,000

Table 13: Sanitary Sewer System Improvements (cont'd)

Project Number	Project Description	Estimated Cost (Rounded)[1]	ERUs Served[5]	Anticipated Construction Year	Land Developer (Project Improvements)	City Funds (Existing Deficiencies)	Impact Fees (System Improvements)
Storage/Disposal Projects							
S-01	Winter Storage Pond- Convert Existing Treatment Lagoons	$ 3,675,000	5,993	2027			$ 3,675,000
S-02	Winter Storage Pond- New Winter Storage Near Existing	$ 31,633,000	7,205	2030			$ 31,633,000
	Subtotal	$ 35,308,000			$ -	$ -	$ 35,308,000
	Total	$113,643,800			$ 11,791,770	$ -	$ 101,852,030

[1]Costs are in 2022 dollars

[2]Project ERUs and years are estimates only. Actual timing will vary based on development.

[3]Project considered to be a project improvement as it serves land owned by a single property owner.

[4]Project anticipated to be completed by a developer. However, project also serves as a system improvement and could be paid for using impact fees if it is needed before the adjacent land develops.

[5]ERUs served prior to planned project.

[6]The City has been collecting impact fees to address the project need and has been monitoring existing demands and future needs to determine how much additional capacity will be needed as part of the improvement.

[7]Project need is due to growth, but there is not a specific number of ERUs that will trigger the project. Project will be completed when the City determines it is needed.

[8]Current UV disinfection system is working well and appears to have sufficient capacity despite having exceeded the ERUs. See Ultraviolet Light Disinfection in Appendix G.

As shown in Table 13, the estimated cost for all future projects is $113,643,800. The City expects to pay $101,852,030 from collected impact fees, while the rest will be funded by development or by the City to encourage or facilitate development.

B. Funding Sources

Section 302 (2) of the Impact Fee Act requires the City to "generally consider all revenue sources, including impact fees and anticipated dedication of system improvements, to finance the impacts on system improvements." By doing so, the City ensures fair and equitable treatment among users and concludes whether impact fees are the most appropriate method to fund the growth.

There are a number of revenue sources available for managing and expanding Santaquin's sanitary sewer system. They are listed below.

1. User Charges

The City collects user fees for sanitary sewer services. User fees pay for the waste water within the collection system that is collected, treated, stored, and disposed of by the City. User fees are the primary source of funding for the operation and maintenance expenses of the City's sanitary sewer system.

2. Grants, Low Interest Loans, and Donations

Santaquin City has had grants and low interest loans for sanitary-sewer-related projects in the past. It is possible that it may get additional grants for future projects.

Additionally, some infrastructure is donated, though this typically is at the project improvement level rather than at the system improvement level.

3. Special Assessment or Tax Increment Areas

   This method of financing growth is acceptable and allocates the cost of the new development to the new development. However, special assessment areas can be expensive to establish and complicated to administer, especially if a large development is being considered. Moreover, the special assessments may not accurately reflect the true cost of the facilities.

   Tax Increment Areas are a public/private partnership tool to leverage future public revenues against existing developer and investor dollars. These types of financing can also be complicated and may require the City to take on significant risk if development does not move forward in a timely fashion.

4. General Obligation Bonds and Sales Tax Revenue Bonds

   The City may elect to issue bonds to maintain a steady flow of funds to pay for needed facilities. The City has issued bonds in the past and may determine that bonds are a suitable mechanism for funding future sanitary sewer system facilities. The City may use the revenues from impact fees and user charges to pay debt service on bonds. Bonds may be issued in addition to collecting impact fees.

5. Impact Fees

   This source is a common and equitable method of funding new system improvements because it imposes the cost of providing capacity for new growth upon that new growth. The detailed analysis required to impose impact fees accurately allocates the true impact on a system or facility to those creating the impact. Those creating the most impact, therefore, pay more. The speculative nature of these revenues, and their elasticity, however, make cash flows from impact fees unpredictable. In addition, the City may use impact fees to pay for costs of issuance on future bonding.

   The City may, on a case-by-case basis, work directly with a developer to adjust the standard impact fee to respond to unusual circumstances and ensure that impact fees are imposed fairly. The City may also, on a case-by-case basis, adjust the amount of the fee based upon studies and data submitted by a developer.

6. Developer Installed and Financed (Reimbursable by Impact Fees)

   This is a source that the City has recently used to help fund infrastructure needs within specific development areas of the City. This type of arrangement is typically accomplished with a development agreement between the City and the developer, with the private funds being spent for initial improvements and the public funds received based on market conditions, reimbursing developers in accordance with planned expenditures. With this option, the development community accepts more risk, thus providing more fiscally sound practice for the City.

All the above forms of financing associated with a sanitary sewer system have a place and are needed. For instance, user rates are needed for ongoing operation and maintenance costs; grants, low interest loans, and some bonds may be necessary for major infrastructure improvements; special assessment bonds can work well where there is a deficiency in a particular localized area, or as a tool to build infrastructure to spur development; impact fees are the equitable, appropriate, and needed means of funding system improvements to accommodate future growth.

VII. CONCLUSION & RECOMMENDATIONS

A. Conclusion

This Master Plan effort was undertaken to evaluate Santaquin City's existing sanitary sewer collection system; to identify existing deficiencies, if any; to identify reserve capacities; and to identify future system needs related to demand due to growth. Recommendations follow.

B. Recommendations

1. Establish Impact Fees to Fund Projects to Meet Future Needs

   This report, in conjunction with an Impact Fee Facility Plan (IFFP) and Impact Fee Analysis (IFA), will provide the basis for collection of impact fees needed to help construct the improvements required to support future growth.

   We recommend that Santaquin City adopt impact fees in an amount that will fund the projects required to meet future needs without subsidizing the effect of growth using sewer utility rates paid by existing system users.

   We recommend that Santaquin City implement a practice of following this Plan in constructing the projects anticipated to satisfy the demand of future growth. As growth occurs and other factors affect conditions relative to the assumptions made in this Plan, the City will need to consider adjusting priorities as needed to accommodate changing conditions.

   As the City approaches buildout conditions, we recommend that the pipe segments on the Watch List on Figure D - 1 be monitored to determine if improvement projects are warranted. Additionally, we recommend that the City avoid adding new service connections to these segments.

2. Replacement of Aging or Inadequate Infrastructure

   With the original piping, manholes, and lift station at 30 years old, we recommend implementing a long-term replacement plan with associated financing.

3. Master Plan and Capital Facilities Plan

   We recommend that Santaquin City update this Plan as needed, but at intervals of not more than every five years. An interim update may be needed if planned land uses change significantly.

4. Periodic Review of User Rates

   We recommend that Santaquin City periodically review and update their sewer user rates. User rates cover operation & maintenance for the system. As costs to maintain and operate the system will likely increase over time, user rates need be updated periodically to make sure that revenue generated can cover costs. More frequent smaller adjustments are more tolerable than infrequent large adjustments.

5. Large Developments

For large developments that will be constructed in a number of phases and over multiple years, we recommend that the City require a utilities plan as part of the development agreement. A utilities phasing plan clearly defines when and how key infrastructure will be constructed within the development. The utilities phasing plan should be negotiated in such a manner that it will protect the City's financial interests and hold the developer responsible for supporting growth within the development, even if ownership changes. In Santaquin, we recommend that utilities phasing plans be required for the following types of developments:

- Developments larger than 10 acres
- Developments that will be constructed in multiple phases or issue multiple plats
- Areas being evaluated for annexation

APPENDIX A
EXISTING (2022) SYSTEM

I. EXISTING CONDITIONS MAPS

Maps showing the existing sewer system, the general plan land use in place June 2022, and the ratio of existing flow to existing capacity (q/Q) are shown in Figures A-1, A-2, and A-3.

II. FLOW MEASUREMENTS

On June 9, 2022, J-U-B installed ISCO 2150 Area Velocity Flow Meters at five locations throughout the City to collect flow data that would be used to calibrate the existing sewer model. Each flow meter consisted of a data collection module and an area velocity probe that was secured to a stainless-steel band that was installed inside of the collection system pipe at the metering site. The area velocity probes took velocity measurements using doppler radar technology and flow level measurements using pressure transducers. Flowrates were calculated using the velocity and level measurements in conjunction with the pipe size. At the time of installation, J-U-B set each of the meters by measuring the inside diameter of the pipe, both horizontally and vertically, and manually measuring the flow level in an effort to match the levels read by the meters to those measured manually.

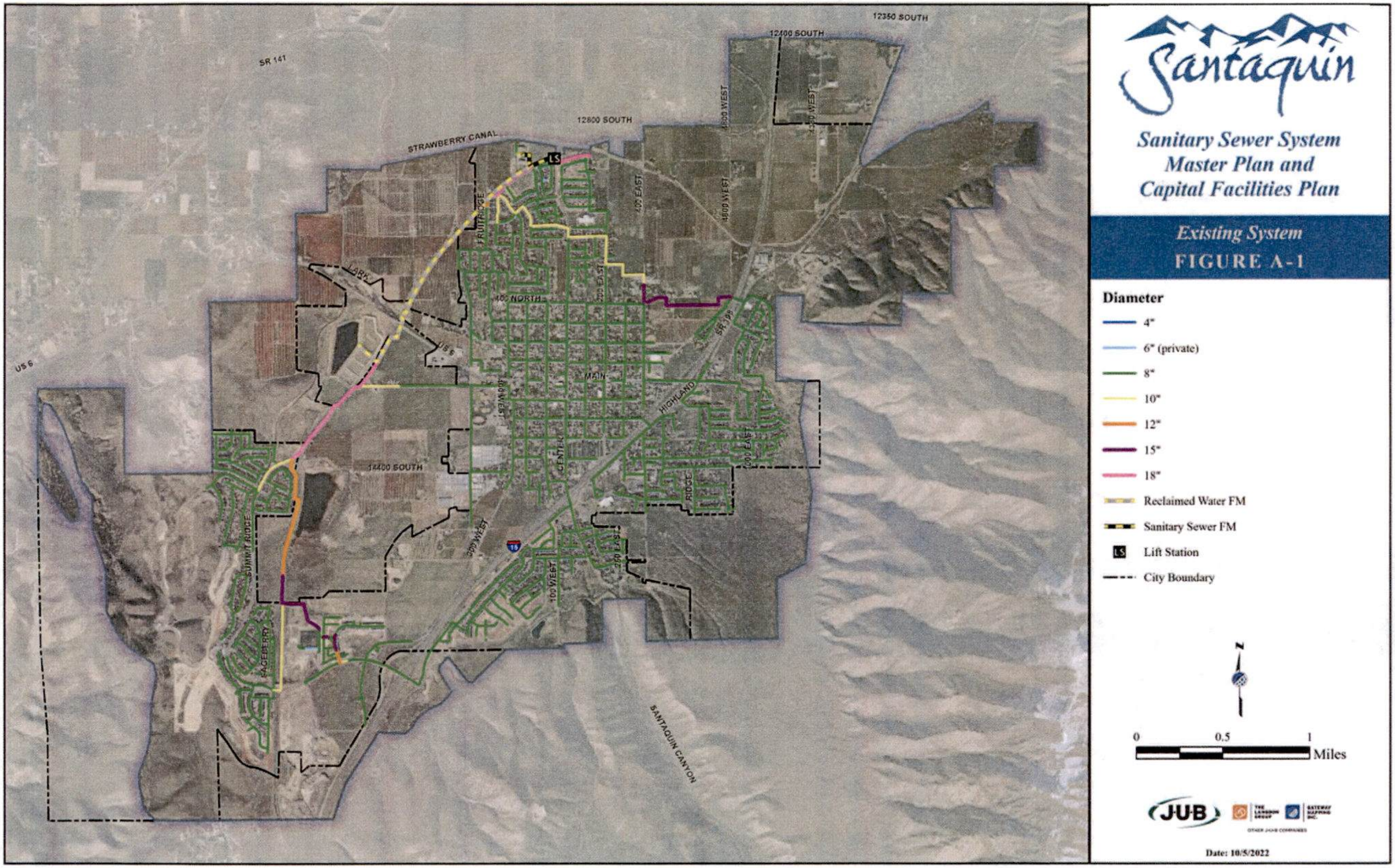
On June 13, 2022, J-U-B visited each of the meter sites to see if the meters were functioning properly and discovered that the meter at Site 5 was experiencing level drift, which is when the level measurements artificially drift upwards over time. J-U-B recalibrated the meter at Site 5 at that time and again on June 17, 2022. Despite the level drift, J-U-B was able to correct the level measurements using a calculated correction factor, which allowed for use of all data collected at Site 5. After a two-week metering period, J-U-B removed the flow meters on June 23, 2022. At the time of removal, J-U-B discovered that the flow meter communication cables had interfered with the flows at Sites 2 and 3, which resulted in artificially high level readings between June 13 and June 23 at the two sites. Data after June 13 at Sites 2 and 3 was therefore not reliable.

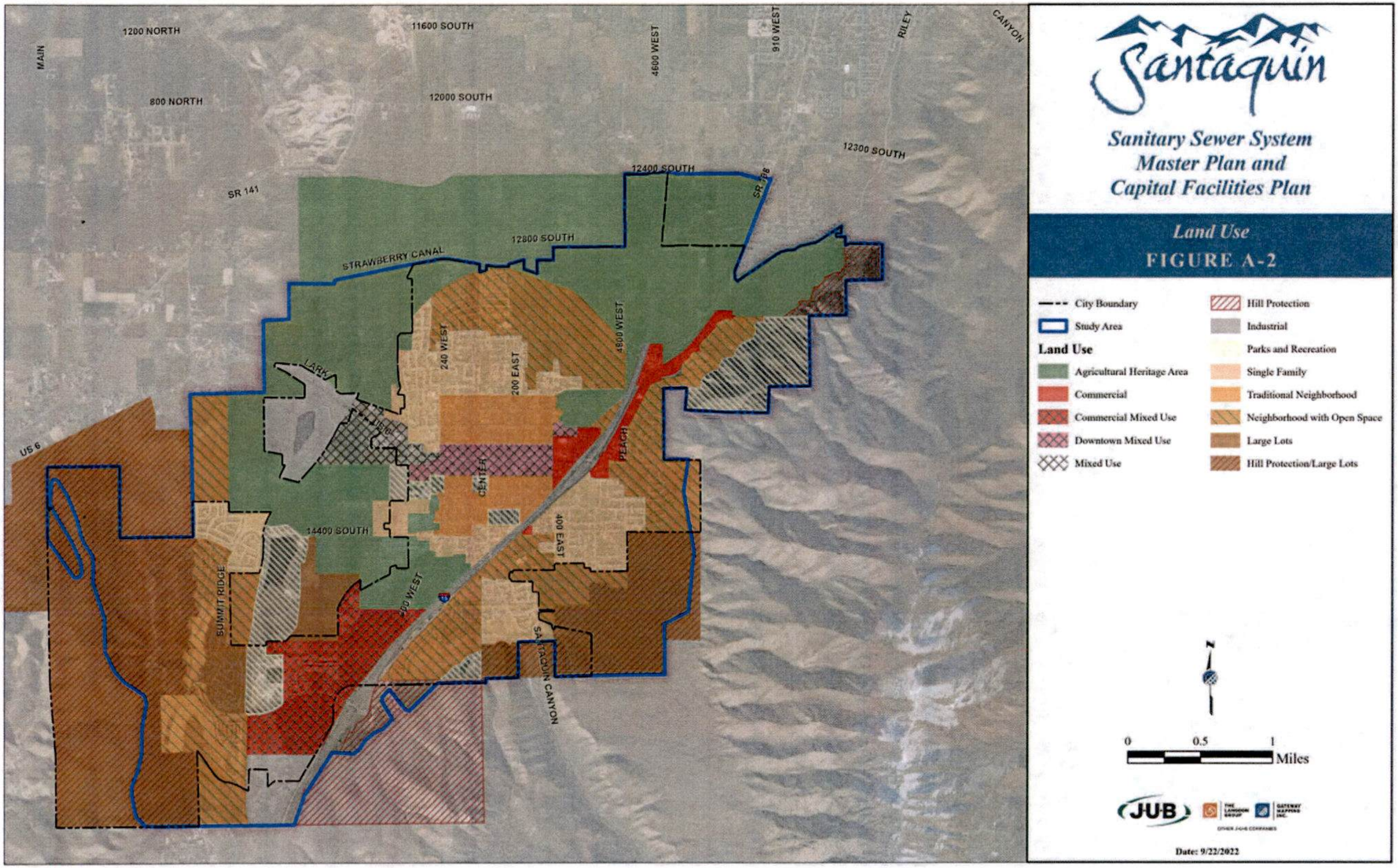
After retrieving the flow meters and compiling the measurements, we calibrated the flow measurements using a mass balance. We determined from sewer flow measurements at the lift station that June flows are close to the average wintertime flows. We knew how many ERUs were upstream of each flow measurement location, and we used that ERU count to calculate the average day sewer flow volume expected to pass through each of the measured locations. We calibrated the flow measurements at each location to match the average daily sewer flow volume passing through the location.

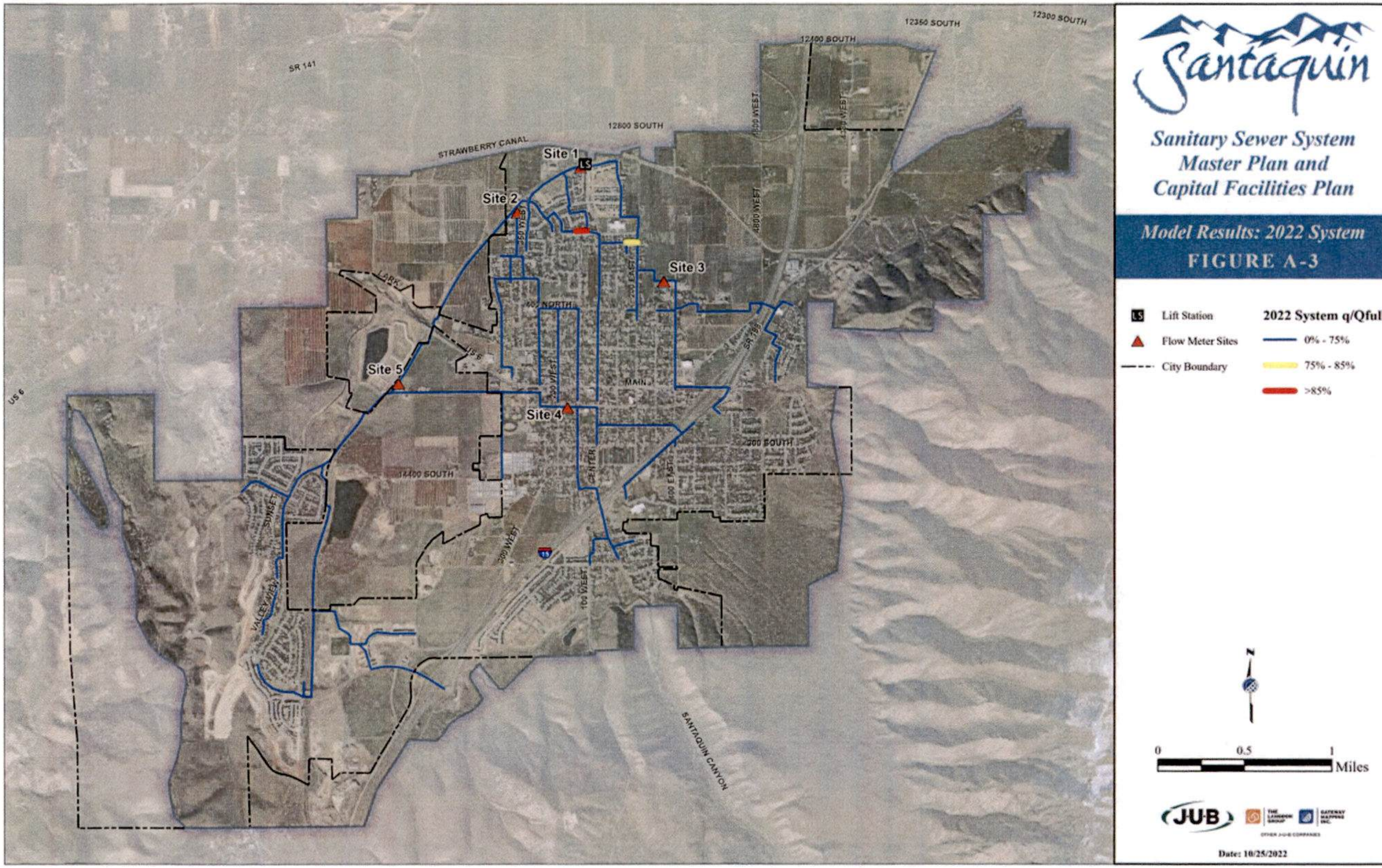
Figure A - 4 through Figure A - 8 show the measured flows, as well as the modeled existing conditions average day flows, at each of the five locations.

Figure A - 9 shows the average day flow at the lift station, as well as the modeled existing conditions average day flow.

Figure A - 10 shows the peak hour flow at the lift station, as well as the modeled existing conditions peak hour flow. The peak hour flow occurred on November 25, 2021, which was Thanksgiving Day.


Santaquin
Sanitary Sewer System
Master Plan and
Capital Facilities Plan
Existing System
FIGURE A-1
Diameter
4"
6" (private)
8"
10"
12"
15"
18"
Reclaimed Water FM
Sanitary Sewer FM
Lift Station
City Boundary
0
0.5
1
Miles
J-U-B
Date: 10/5/2022
12350 SOUTH
12400 SOUTH
SR 141
12800 SOUTH
STRAWBERRY CANAL
FRUITRIDGE
LARK
US 6
400 NORTH
MAIN
HIGHLAND
400 EAST
14400 SOUTH
CENTER
RIDGE
300 WEST
100 WEST
SUMMIT RIDGE
SANTAQUIN CANYON
LS


Santaquin
Sanitary Sewer System
Master Plan and
Capital Facilities Plan
Land Use
FIGURE A-2
City Boundary
Study Area
Land Use
Agricultural Heritage Area
Commercial
Commercial Mixed Use
Downtown Mixed Use
Mixed Use
Hill Protection
Industrial
Parks and Recreation
Single Family
Traditional Neighborhood
Neighborhood with Open Space
Large Lots
Hill Protection/Large Lots
0
0.5
1
Miles
N
JUB
Date: 9/22/2022
1200 NORTH
11600 SOUTH
MAIN
800 NORTH
12000 SOUTH
4600 WEST
910 WEST
RILEY
CANYON
12300 SOUTH
12400 SOUTH
SR 141
SR 198
12800 SOUTH
STRAWBERRY CANAL
4800 WEST
240 WEST
200 EAST
LARK
US 6
PEACH
CENTER
400 EAST
14400 SOUTH
SUMMIT RIDGE
500 WEST
SANTAQUIN CANYON


12350 SOUTH
12300 SOUTH
12400 SOUTH
SR 141
12800 SOUTH
STRAWBERRY CANAL
Site 1
LS
Site 2
Site 3
Site 4
Site 5
US 6
14400 SOUTH
MAIN
400 NORTH
200 SOUTH
CENTER
100 WEST
200 WEST
SR 198
SANTAQUIN CANYON
Santaquin
Sanitary Sewer System
Master Plan and
Capital Facilities Plan
Model Results: 2022 System
FIGURE A-3
Lift Station
Flow Meter Sites
City Boundary
2022 System q/Qfull
0% - 75%
75% - 85%
>85%
N
0
0.5
1
Miles
J-U-B
Date: 10/25/2022

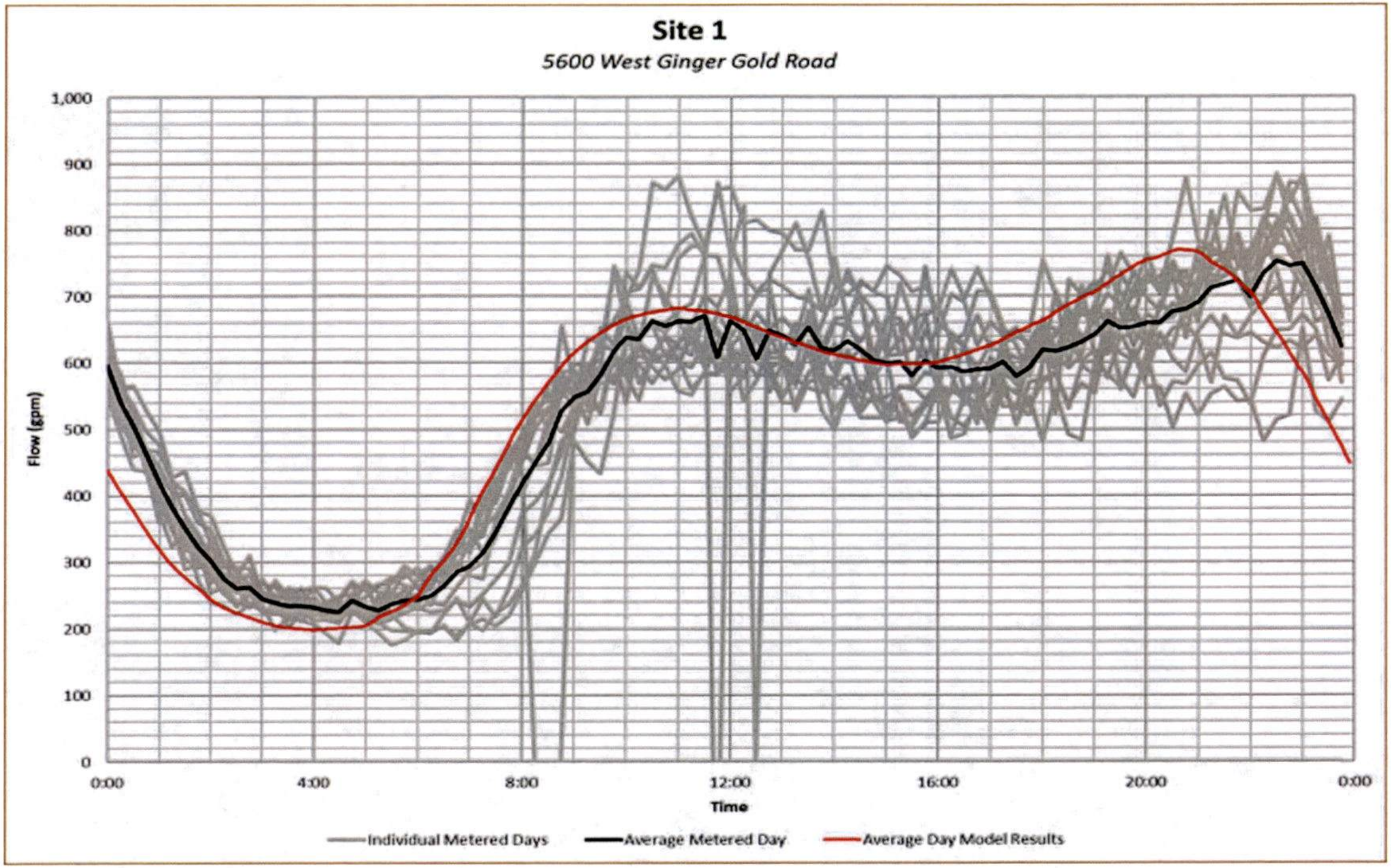


Figure A - 4: Sewer Flow Measurements at Site 1

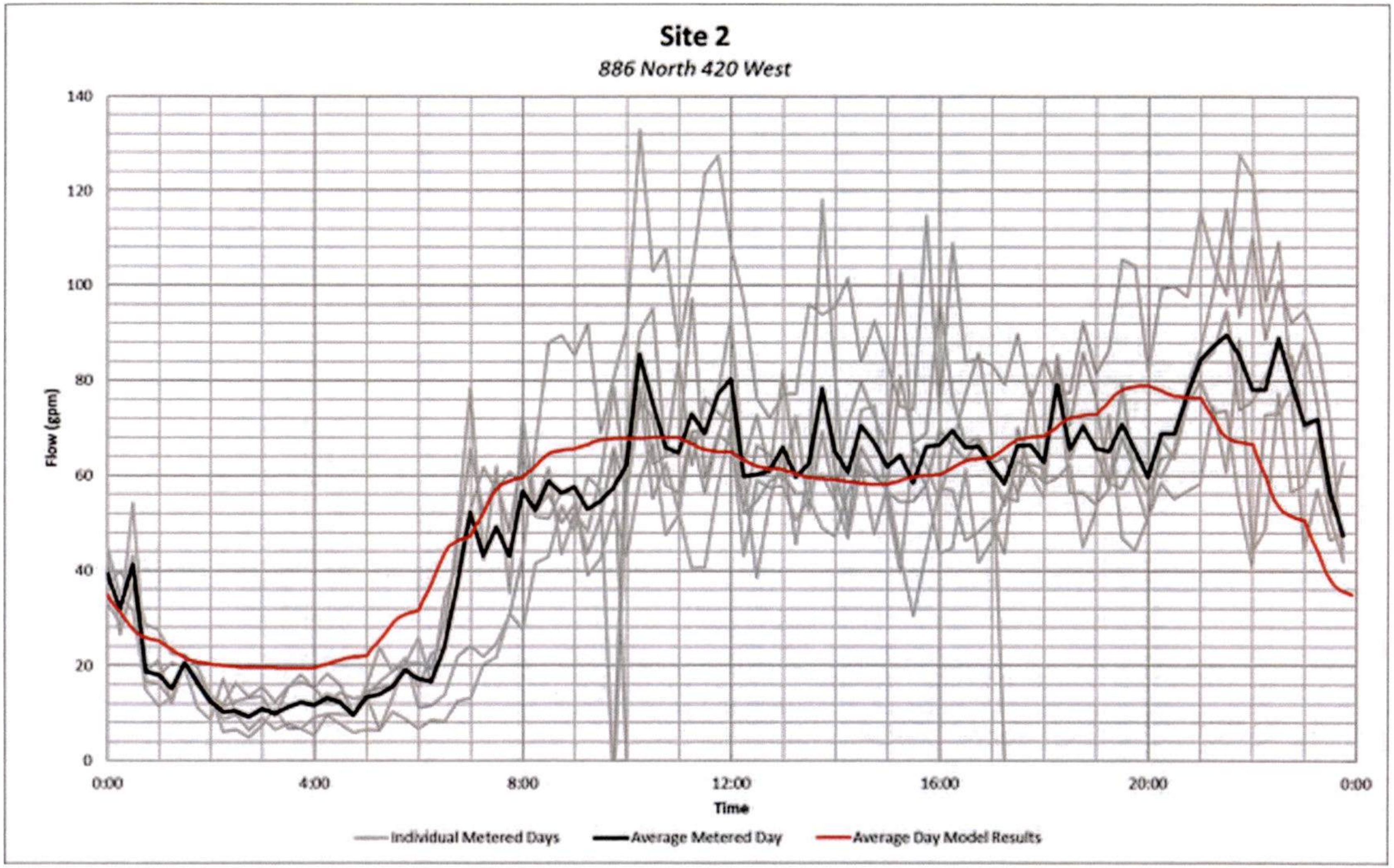


Figure A - 5: Sewer Flow Measurements at Site 2

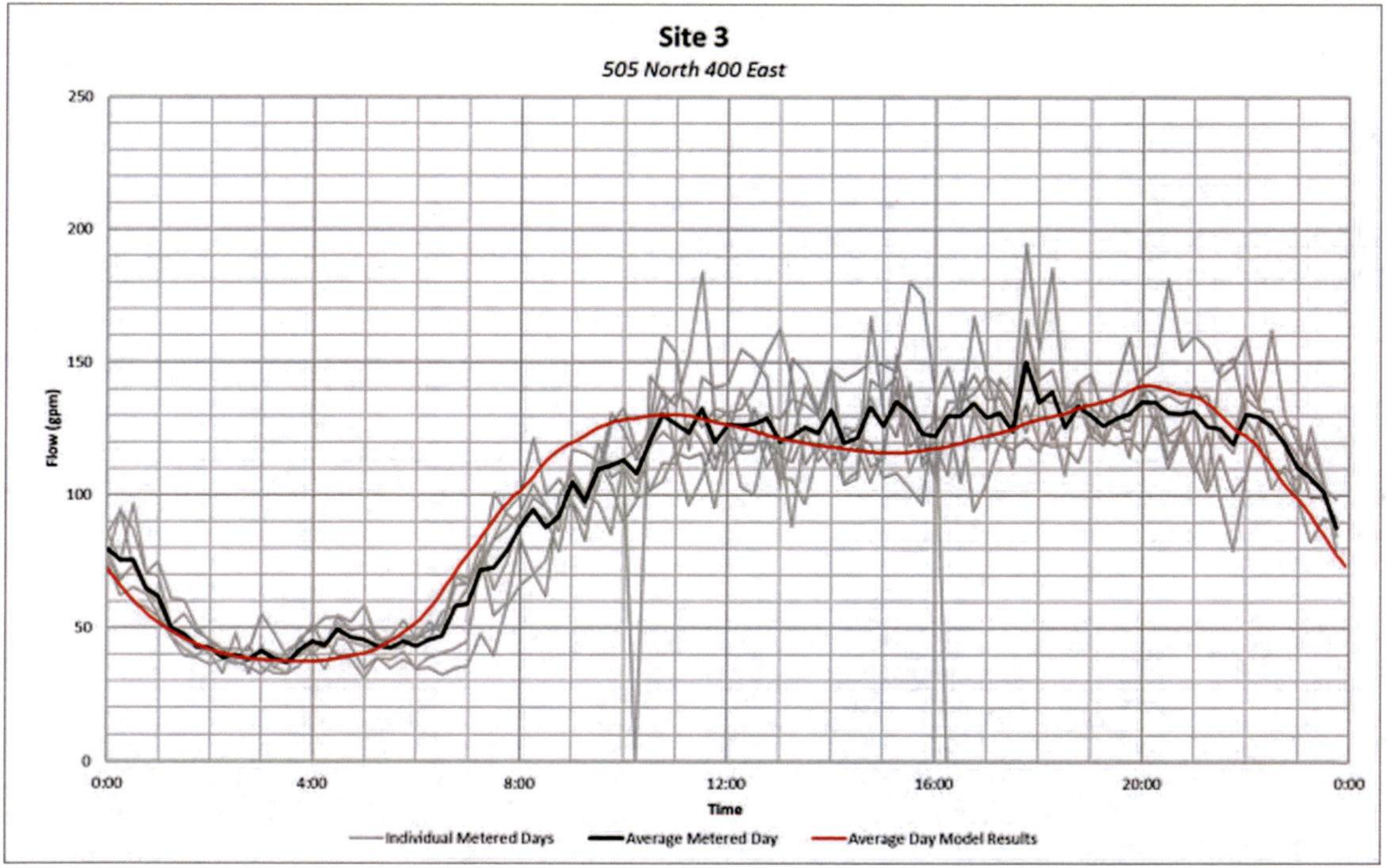


Figure A - 6: Sewer Flow Measurements at Site 3

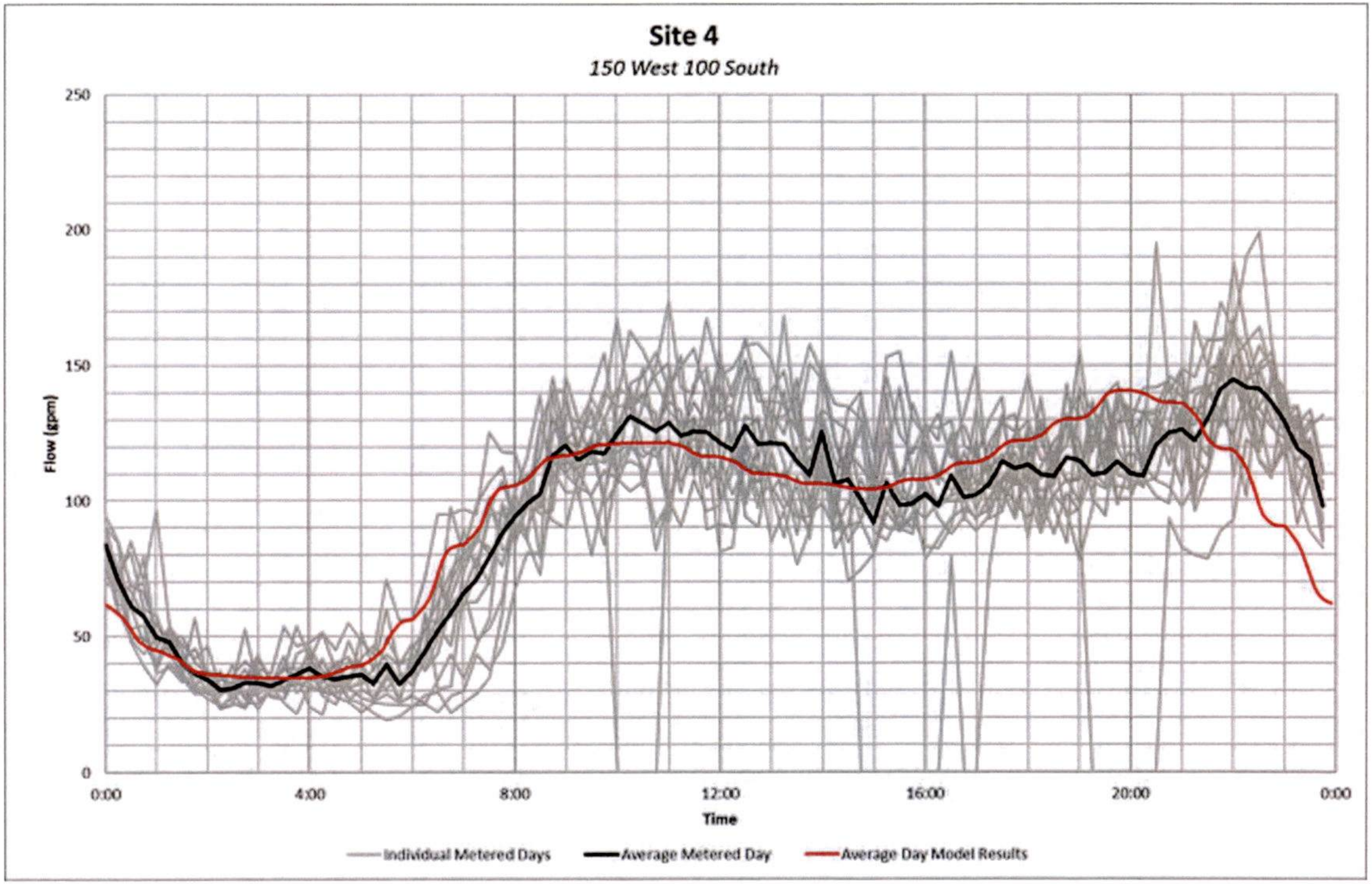


Figure A - 7: Sewer Flow Measurements at Site 4

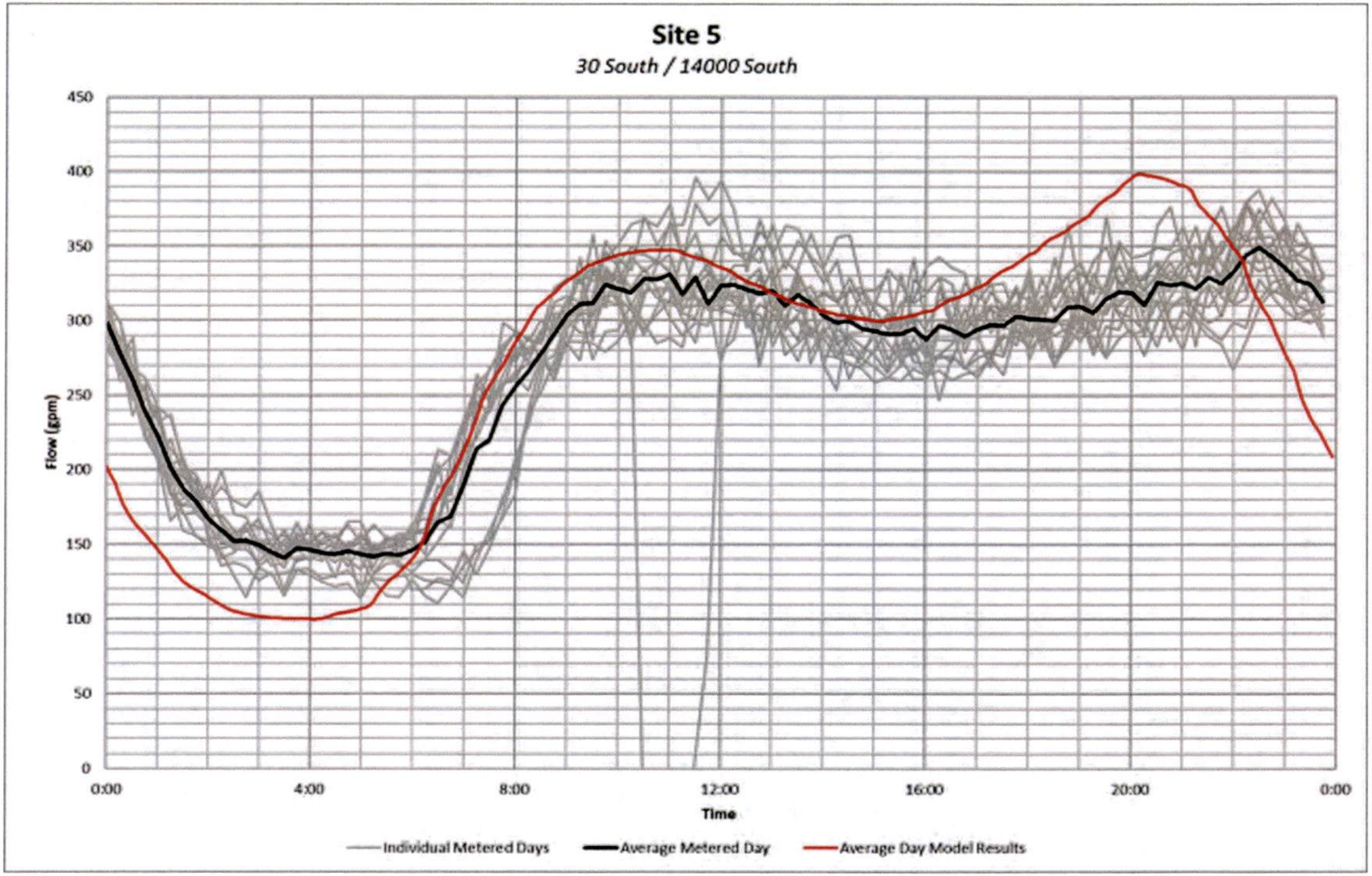


Figure A - 8: Sewer Flow Measurements at Site 5

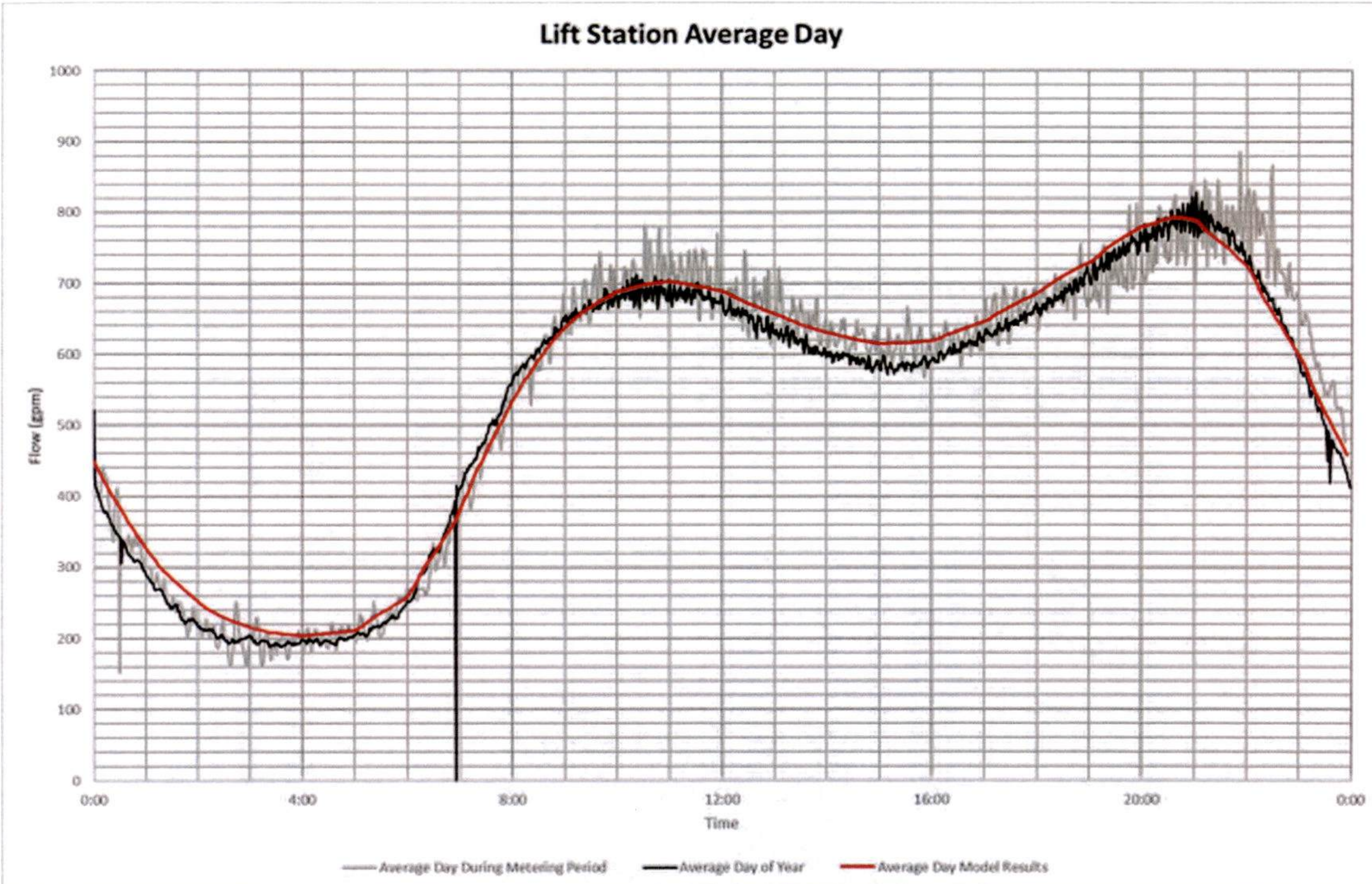


Figure A - 9: Average Day Sewer Flow Measurements at Lift Station

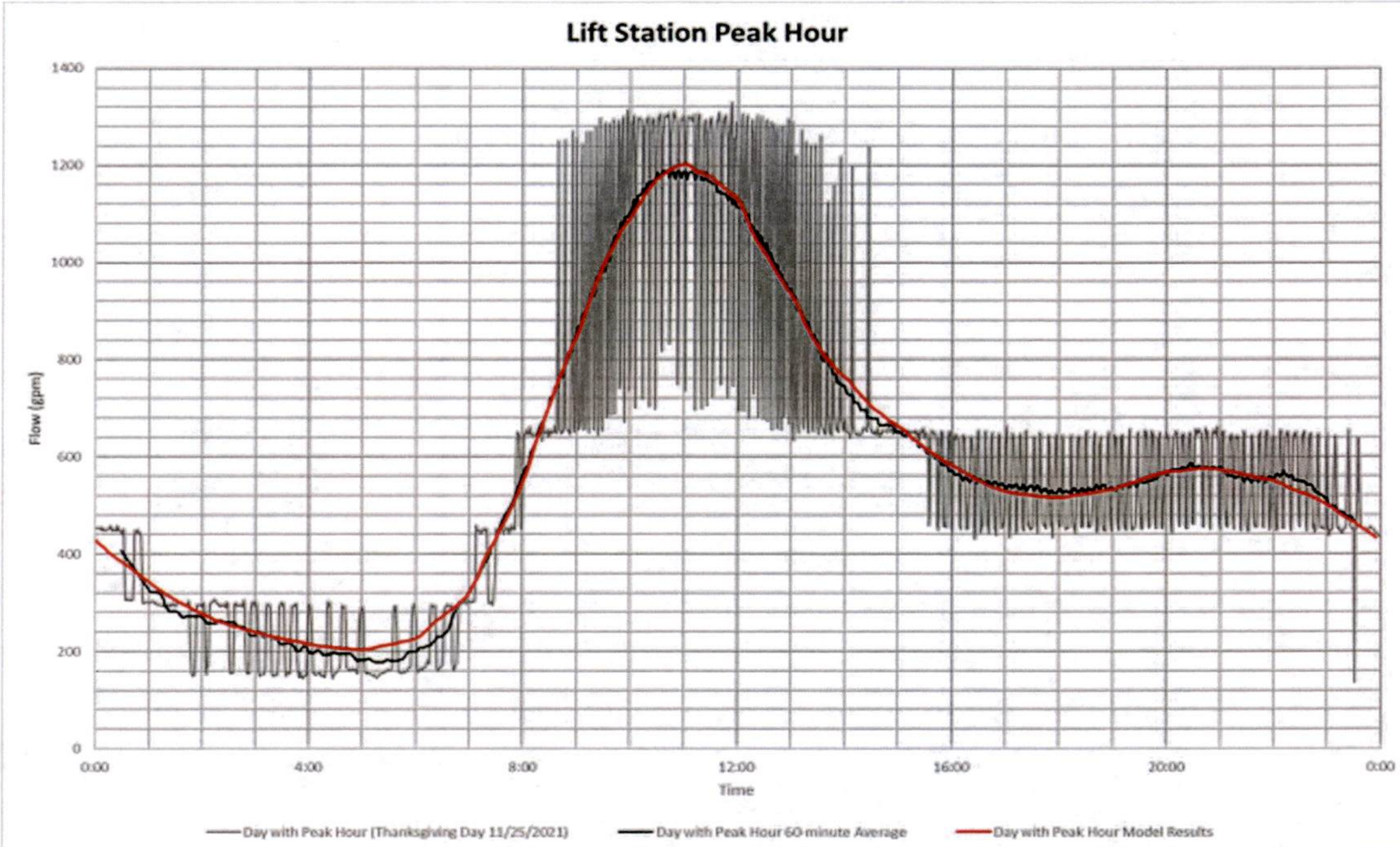


Figure A - 10: Peak Hour Sewer Flow Measurements at Lift Station

APPENDIX B
HISTORIC PROJECTS

Name and Description	Approximate Year of Construction
Original Sanitary Sewer System (including 52 MG Winter Storage Pond)	1993-1994
Main Street & I-15 Gravity Line	1998
Large Winter Storage Pond	2001-2002
Land Application Pump	2009
900 South and Center Street Sewer	2009-2010
Water Reclamation Facility (WRF)	2012-2013
Water Reclamation Facility (WRF) Phase 2 Upgrade	2019

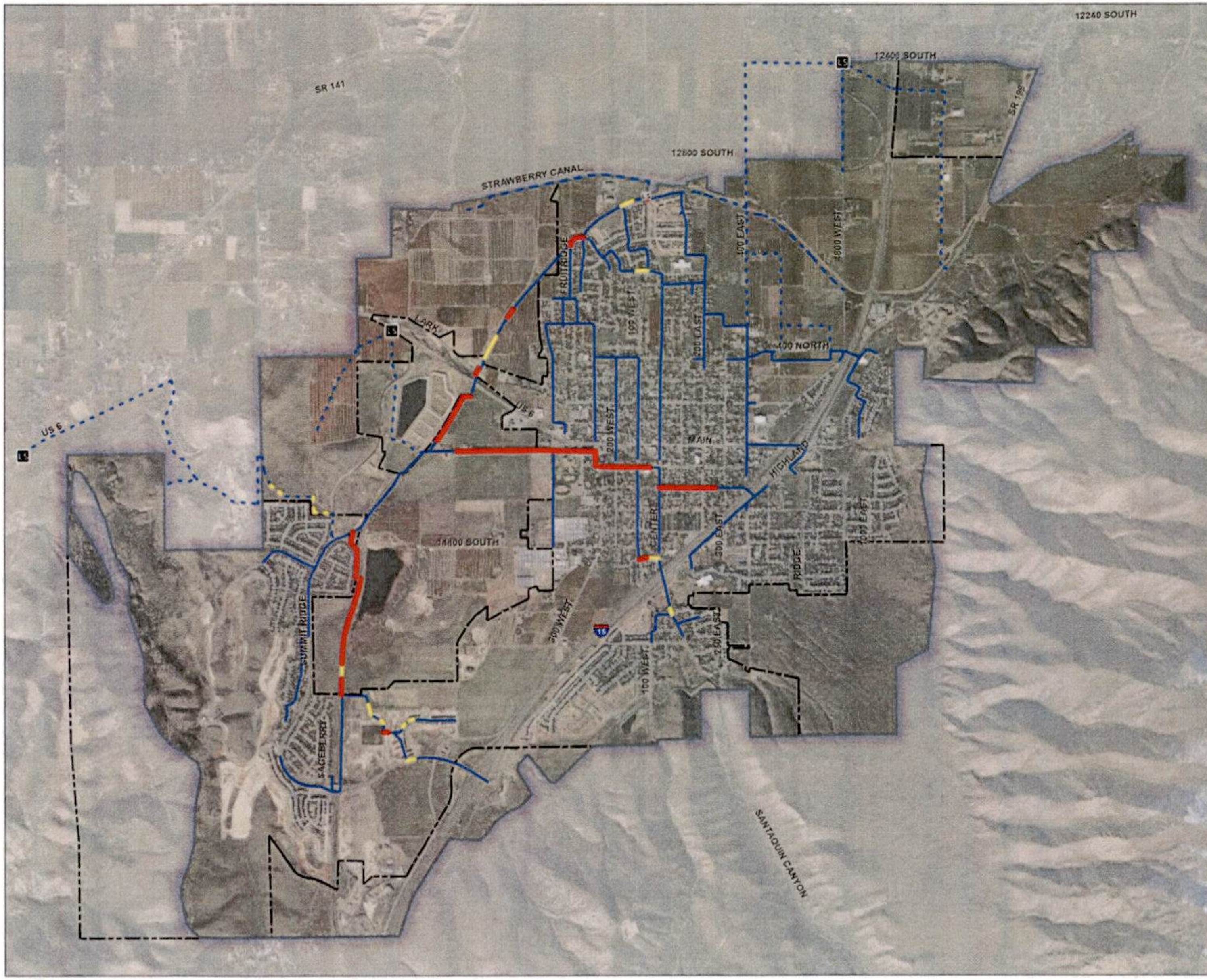
APPENDIX C
FUTURE SYSTEM MAPS AND TABLE

Santaquin

Sanitary Sewer System Master Plan and Capital Facilities Plan

Model Results: Buildout System w/o Improvements

FIGURE C-1



Future Buildout System q/Qfull

- 0% - 75%
- 75% - 85%
- >85%

Buildout System q/Qfull

- 0% - 75%
- 75% - 85%
- >85%
- Future Lift Station
- Existing Lift Station
- City Boundary

N

0 0.5 1 Miles

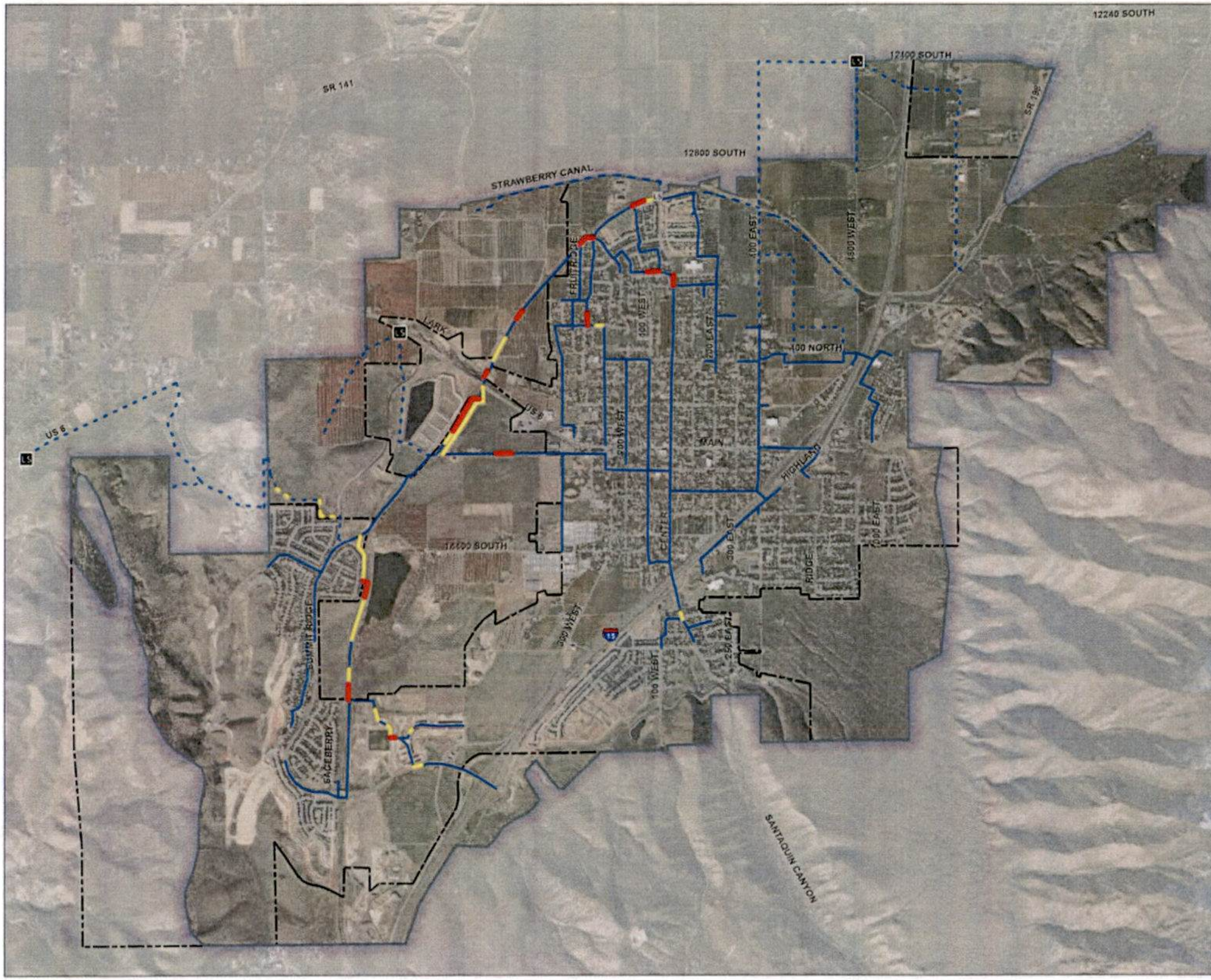
J-U-B

THE LANGDON GROUP

GATEWAY MAPPING INC.

OTHER J-U-B COMPANIES

Date: 1/19/2023



Santaquin

Sanitary Sewer System Master Plan and Capital Facilities Plan

Model Results: Buildout System with Improvements

FIGURE C-2

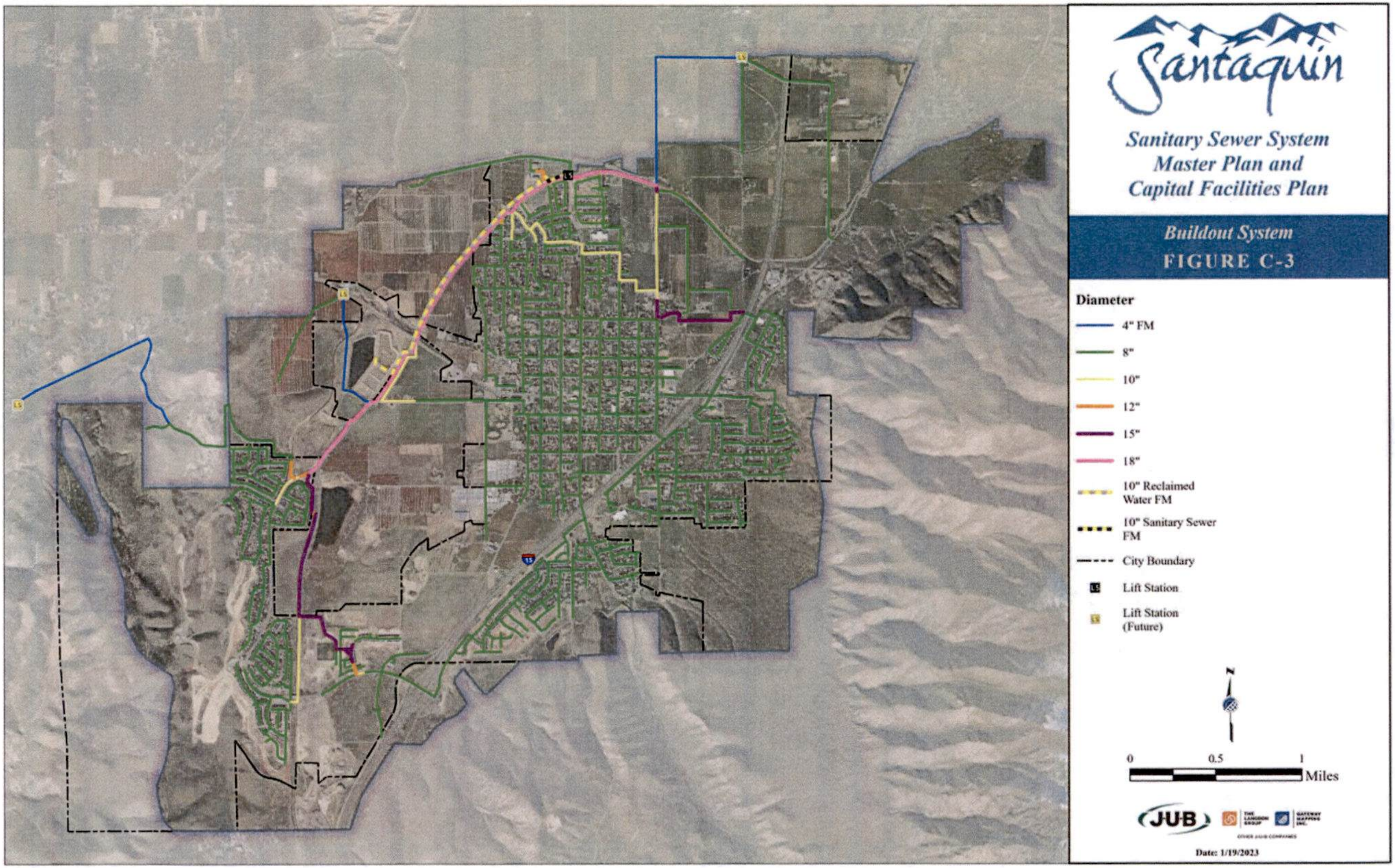
Future Buildout System q/Qfull	Buildout System q/Qfull
0% - 75%	0% - 75%
75% - 85%	75% - 85%
>85%	>85%
	Future Lift Station
	Existing Lift Station
	City Boundary

0 0.5 1 Miles

JUB — THE LANGDON GROUP — GATEWAY MAPPING INC.

OTHER J-U-B COMPANIES

Date: 1/19/2023



Santaquin
Sanitary Sewer System
Master Plan and
Capital Facilities Plan
Buildout System
FIGURE C-3
Diameter
4" FM
8"
10"
12"
15"
18"
10" Reclaimed Water FM
10" Sanitary Sewer FM
City Boundary
Lift Station
Lift Station (Future)
N
0
0.5
1
Miles
J-U-B
Date: 1/19/2023

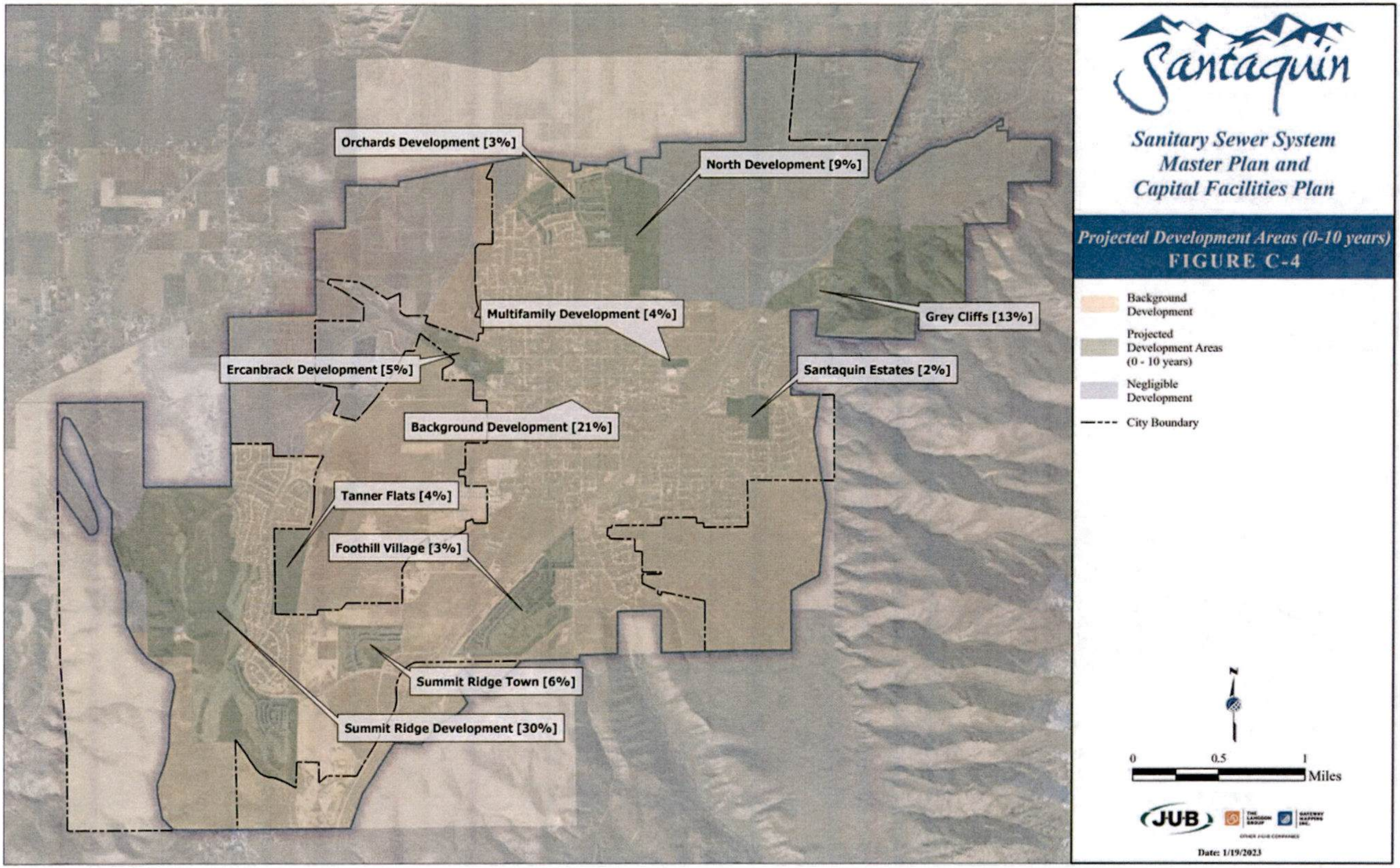

Santaquin
Sanitary Sewer System
Master Plan and
Capital Facilities Plan
Projected Development Areas (0-10 years)
FIGURE C-4
Background Development
Projected Development Areas (0 - 10 years)
Negligible Development
City Boundary
Orchards Development [3%]
North Development [9%]
Multifamily Development [4%]
Grey Cliffs [13%]
Ercanbrack Development [5%]
Santaquin Estates [2%]
Background Development [21%]
Tanner Flats [4%]
Foothill Village [3%]
Summit Ridge Town [6%]
Summit Ridge Development [30%]
N
0
0.5
1
Miles
JUB
Date: 1/19/2023

Table C - 1: Future Collection Pipe Flows Tabulation (q/Qfull)

Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	Flow (gpm) 2022 Demand	Flow (gpm) 2032 Demand	Flow (gpm) Buildout Demand	Flow (gpm) 2022 Capacity	% of Max Capacity Consumed in Next 10 Years
CDT-261	10	355	242	115	87	598	
CDT-59	10	385	6	8	303	1513	1%
CDT-61	10	376	6	6	303	2888	
CDT-63	10	382	367	366	444	884	
CDT-65	10	401	367	366	444	826	
CDT-67	10	409	366	366	444	783	
CDT-69	10	424	367	367	444	1132	
CDT-71	10	403	7	7	302	761	
CDT-73	10	399	7	7	302	3279	
CDT-75	10	372	358	358	434	817	
N110	10	226	60	185	238	907	52%
N112	10	213	60	184	239	2593	52%
N114	10	406	60	186	240	2065	53%
N116	10	202	60	185	238	1129	53%
N118	10	204	60	257	539	1131	37%
N278	10	757	334	232	243	501	
N668	10	189	366	366	444	1234	
N672	10	103	358	357	433	1433	
N674	10	205	41	42	48	1508	3%
N676	10	235	40	43	48	2376	5%
N678	10	65	41	42	49	1140	2%
N680	10	78	41	42	49	868	2%
N684	10	401	292	292	358	1816	
N696	10	302	59	257	539	1162	95%
N698	10	132	311	311	380	1440	
N704	10	274	311	311	380	1736	
N706	10	258	311	310	380	761	
N708	10	240	317	316	385	656	
XJ12	10	400	371	367	558	748	
XJ14	10	340	307	202	211	384	
XJ15	10	299	331	228	239	641	
XJ16	10	317	334	231	243	506	
XJ17	10	281	371	367	557	650	
XJ21	10	424	307	202	211	1353	
XJ267	10	308	335	315	432	684	
XJ269	10	419	335	315	432	1325	
XJ271	10	420	335	318	464	1700	
XJ32	10	233	304	197	206	1239	
XJ33	10	228	242	134	112	586	
XJ34	10	299	242	114	87	673	
XJ52	10	290	242	115	87	615	
XJ53	10	329	243	114	87	650	
XJ541	10	183	303	198	207	1094	
XJ6	10	195	7	7	302	850	

Table C - 1: Future Collection Pipe Flows Tabulation (q/Qfull) (cont'd)

Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	Flow (gpm)				% of Max Capacity Consumed in Next 10 Years
			2022 Demand	2032 Demand	Buildout Demand	2022 Capacity	
XJ61	10	322	242	448	340	682	46%
XJ628	10	398	106	261	423	842	37%
XJ629	10	229	107	267	499	840	32%
XJ630	10	364	106	277	621	1630	28%
XJ631	10	300	106	277	621	1538	27%
XJ632	10	400	107	277	621	960	28%
XJ633	10	396	107	277	621	1213	27%
XJ634	10	404	106	278	621	1714	28%
XJ675	10	246	106	276	622	2467	27%
XJ685	10	396	87	147	613	815	10%
XJ8	10	314	293	292	> 301	301	
XJ9	10	398	293	292	358	648	
Total of all 10 inch pipes							
Total Length:		17,528					
Weighted Average Values:			216	234	363	1154	11%

Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	Flow (gpm)				% of Max Capacity Consumed in Next 10 Years
			2022 Demand	2032 Demand	Buildout Demand	2022 Capacity	
N650	12	266	149	195	246	5121	19%
N812	12	347	150	196	247	392	18%
XJ1	12	25	151	195	246	1909	18%
XJ656	12	245	261	643	> 1372	1372	28%
XJ657	12	306	260	643	> 1293	1293	30%
XJ658	12	256	260	643	> 1320	1320	29%
XJ659	12	410	261	643	> 1345	1345	28%
XJ660	12	326	260	622	1947	2001	19%
XJ661	12	146	260	623	> 1079	1079	34%
XJ662	12	399	260	623	> 1334	1334	27%
XJ663	12	401	260	623	> 1334	1334	27%
XJ664	12	401	261	623	> 1345	1345	27%
XJ665	12	395	260	598	> 1476	1476	23%
XJ666	12	404	260	590	> 1771	1771	19%
XJ684	12	208	87	152	665	1675	95%
Total of all existing 12 inch pipes							
Total Length:		4,534					
Weighted Average Values:			237	541	1238	1594	28%

Table C - 1: Future Collection Pipe Flows Tabulation (q/Qfull) (cont'd)

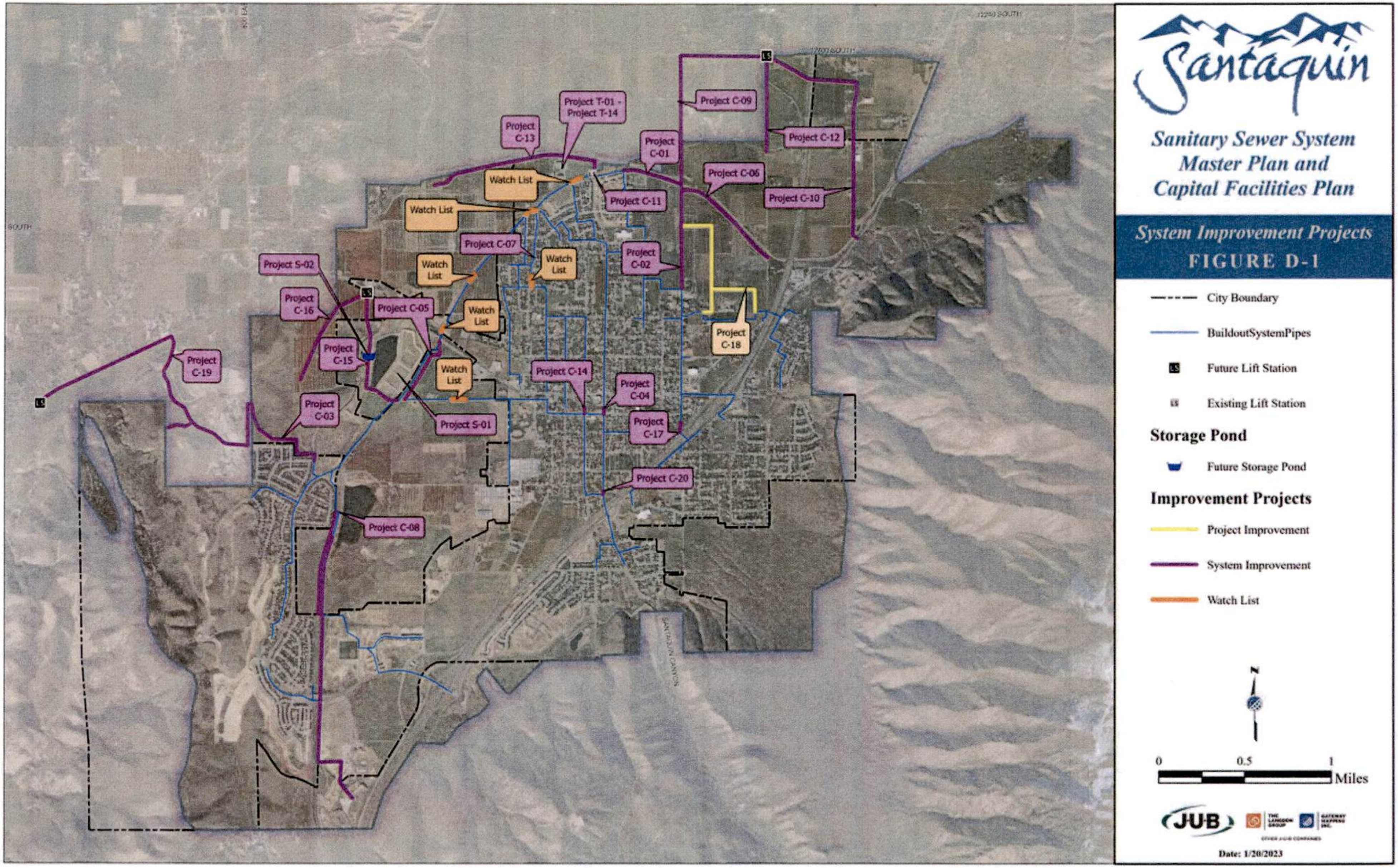
			Flow (gpm)				
Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	2022 Demand	2032 Demand	Buildout Demand	2022 Capacity	% of Max Capacity Consumed in Next 10 Years
CDT-269	15	206	154	309	1144	1499	13%
CDT-273	15	115	155	309	> 1137	1137	14%
CDT-291	15	221		24	291	2648	8%
CDT-293	15	135		23	289	2534	8%
XJ100	15	241	86	221	96	1229	61%
XJ101	15	399	86	221	96	923	61%
XJ102	15	404	87	221	97	1698	61%
XJ103	15	399	87	221	97	903	61%
XJ530	15	283	68	200	190	4882	66%
XJ539	15	44	236	442	331	981	47%
XJ667	15	398	259	590	1809	2296	18%
XJ668	15	421	261	590	> 1570	1570	21%
XJ669	15	424	155	314	1187	1803	13%
XJ670	15	116	154	309	1143	1626	14%
XJ671	15	400	154	309	1143	1538	14%
XJ672	15	233	153	310	1143	1520	14%
XJ673	15	305	154	310	1144	1695	14%
XJ674	15	294	154	309	1144	1465	14%
XJ676	15	399	261	591	1809	2614	18%
XJ677	15	252	154	310	1143	1551	14%
XJ678	15	125	86	151	665	1543	10%
XJ679	15	285	87	151	664	1578	10%
XJ68	15	143	237	443	330	952	46%
XJ71	15	337	86	221	230	933	59%
XJ72	15	267	90	229	243	695	57%
XJ77	15	285	91	230	243	574	57%
XJ78	15	155	92	230	243	1506	57%
XJ79	15	204	237	442	331	1378	46%
XJ98	15	276	87	221	97	1380	61%
XJ99	15	281	86	221	96	1340	61%
Total of all existing 15 inch pipes							
Total Length:		**8,049**					
Weighted Average Values:			**136**	**301**	**721**	**1627**	**35%**

Table C - 1: Future Collection Pipe Flows Tabulation (q/Qfull) (cont'd)

			Flow (gpm)				
Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	2022 Demand	2032 Demand	Buildout Demand	2022 Capacity	% of Max Capacity Consumed in Next 10 Years
CDT-11	18	294	772	1371	559	3939	44%
CDT-13	18	214	773	1371	561	5293	44%
CDT-135	18	243	1486	2584	3069	32301	36%
CDT-15	18	181	773	1371	551	5295	44%
CDT-17	18	500	770	1368	550	5344	44%
CDT-19	18	223	773	1372	553	5646	44%
CDT-21	18	60	770	1369	549	5659	44%
CDT-23	18	115	771	1369	550	3691	44%
CDT-25	18	112	770	1367	553	5425	44%
CDT-27	18	81	774	1372	553	4498	44%
CDT-29	18	118	770	1370	552	4449	44%
CDT-31	18	50	772	1371	552	5114	44%
CDT-33	18	153	774	1373	547	10324	44%
CDT-35	18	352	770	1370	553	5170	44%
CDT-37	18	200	770	1372	553	4011	44%
CDT-39	18	400	770	1368	549	5385	44%
CDT-41	18	389	772	1372	550	5043	44%
CDT-43	18	288	773	1371	> 5020	5020	12%
CDT-45	18	216	772	1371	> 2868	2868	21%
CDT-47	18	106	770	1336	> 1994	1994	28%
CDT-49	18	334	771	1335	3343	3504	17%
CDT-51	18	302	771	1338	3345	8469	17%
CDT-53	18	173	772	1335	3344	5472	17%
CDT-55	18	38	434	1017	4465	7110	13%
CDT-57	18	397	435	1015	2881	6304	20%
N201	18	339	1409	2068	1811	5358	32%
N203	18	176	1442	2102	1850	5361	31%
N205	18	162	1445	2100	1850	6422	31%
N207	18	233	48	480	1171	3454	37%
N209	18	195	48	481	1172	3973	37%
N211	18	210	49	480	1172	1959	37%
N213	18	299	49	480	1171	1738	37%
N221	18	236	1492	2579	3021	4416	36%
N369	18	307	770	1369	560	5542	44%
N370	18	305	771	1372	558	5317	44%
N371	18	306	772	1369	550	9644	44%
N373	18	302	770	1352	> 2693	2693	22%
N374	18	364	768	1335	> 3111	3111	18%
N710	18	62	1303	1952	1568	6616	33%
N716	18	278	1296	1941	1563	6513	33%
N808	18	182	918	1561	807	3079	41%
N810	18	256	917	1561	807	4076	41%
N814	18	291	1295	1942	1561	8868	33%
N816	18	286	1298	1951	1568	7094	33%

Table C - 1: Future Collection Pipe Flows Tabulation (q/Qfull) (cont'd)

			Flow (gpm)				% of Max Capacity Consumed in Next 10 Years
Pipe Segment ID	Existing Diameter (in)	Segment Length (ft)	2022 Demand	2032 Demand	Buildout Demand	2022 Capacity	
N818	18	308	1304	1952	1568	6298	33%
N820	18	317	1303	1951	1574	7121	33%
N822	18	300	1441	2099	1845	11532	31%
XJ635	18	447	436	1015	2657	6812	22%
XJ636	18	400	435	1018	2653	4225	22%
XJ637	18	404	433	1019	2653	4334	22%
XJ638	18	98	432	1017	2653	4237	22%
XJ639	18	401	433	1019	2655	4247	22%
XJ640	18	399	435	1019	2655	4262	22%
XJ641	18	396	433	1018	2653	4371	22%
XJ642	18	377	433	1018	2629	4869	22%
XJ643	18	279	432	1016	2630	5208	22%
Total of all 18 inch pipes							
Total Length:		**14,452**					
Weighted Average Values:			**769**	**1376**	**1816**	**5712**	**32%**


Santaquin
Sanitary Sewer System Master Plan and Capital Facilities Plan
System Improvement Projects
FIGURE D-1
City Boundary
BuildoutSystemPipes
Future Lift Station
Existing Lift Station
Storage Pond
Future Storage Pond
Improvement Projects
Project Improvement
System Improvement
Watch List
Project T-01 - Project T-14
Project C-13
Project C-09
Project C-12
Project C-01
Project C-06
Project C-10
Project C-11
Watch List
Project C-07
Project C-02
Project S-02
Project C-16
Project C-05
Project C-15
Project C-18
Project C-19
Project C-14
Project C-04
Project C-03
Project S-01
Project C-17
Project C-20
Project C-08
0 0.5 1 Miles
J-U-B
Date: 1/20/2023

APPENDIX E
OPINION OF CONCEPTUAL PROJECT COSTS

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs

Project Number	Sanitary Sewer System Improvement Projects				
C-01	*Install 18" Sewer Main Along Strawberry Canal Road from 400 East to 100 East*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 18" Sewer Main	1,825	LF	$ 278	$ 507,350
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 126,838
				Total	**$ 634,200**
C-02	*Install 10" & 15" Pipe along 400 East from 530 North to Strawberry Canal Road and Remove Pipe on 530 North*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 10" Sewer Main	3,080	LF	$ 204	$ 628,320
	Furnish and Install 15" Sewer Main	190	LF	$ 246	$ 46,740
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 168,765
				Total	**$ 843,900**
C-03	*Install 8" Sewer Main from west to 14400 South (county) and Summit Ridge Pkwy*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	7,400	LF	$ 186	$ 1,376,400
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 344,100
				Total	**$ 1,720,500**
C-04	*Install 8" Sewer Main along Center Street from 100 South to Manhole at 70 South*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	215	LF	$ 186	$ 39,990
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 9,998
				Total	**$ 50,000**
C-05	*Install 10" Sewer Main Parallel to Existing 18" Sewer Main along Railroad Tracks East of Storage Ponds from 14000 South (county) to Highway 6 - Flows from 14000 South (county) will be Diverted to the Parallel 10" Sewer Main*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 10" Sewer Main	2,300	LF	$ 204	$ 469,200
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 117,300
				Total	**$ 586,500**
C-06	*Install 8" Sewer Main along Strawberry Canal Road from 4800 West (county) to 400 East*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	3,500	LF	$ 186	$ 651,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 162,750
				Total	**$ 813,800**
C-07	*Install 8" Sewer Main Along 350 West from 680 North to 700 North*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	215	LF	$ 186	$ 39,990
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 9,998
				Total	**$ 50,000**

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects				
C-08	*Install 15" Sewer Main Along Railroad Tracks East of Summit Ridge from Vista Ridge Drive to Topaz Drive (excluding under railroad tracks)*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 15" Sewer Main	1,510	LF	$ 246	$ 371,460
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 92,865
				Total	**$ 464,400**
C-09	*Install 4" Force Main with Sewer Lift Station on 4800 West (county) and 12400 South (county)*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 4" Sewer Force Main	6,660	LF	$ 166	$ 1,105,560
	Furnish and Install Sewer Lift Station	1	LS	$ 350,000	$ 350,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 363,890
				Total	**$ 1,819,500**
C-10	*Install 8" Sewer Main from SR-198 and 4400 West (county) to 12400 South and 4800 West (county)*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	7,700	LF	$ 186	$ 1,432,200
	Jack and Bore 12" Steel Casing under Freeway, Including Railroad Fees	300	LF	$ 900	$ 270,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 425,550
				Total	**$ 2,127,800**
C-11	*Install 24" Sewer Main on Center Street to Lift Station*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 24" Sewer Main	95	LF	$ 396	$ 37,620
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 9,405
				Total	**$ 47,100**
C-12	*Install 8" Sewer Main Along 4800 West from 12800 South to 12400 South*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	3,000	LF	$ 186	$ 558,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 139,500
				Total	**$ 697,500**
C-13	*Install 8" Sewer Main on Strawberry Canal Road from 6250 West to Center Street Lift Station*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	5,540	LF	$ 186	$ 1,030,440
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 257,610
				Total	**$ 1,288,100**
C-14	*Install 8" Sewer Main along 100 West from 100 South to Manhole at 70 South, and add Manhole at Intersection of 100 West 100 South*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 8" Sewer Main	210	LS	$ 186	$ 39,060
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 9,765
				Total	**$ 48,900**

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects						
C-15	*Install 4" Force Main with Sewer Lift Station Northwest of Storage Ponds near Highway 6*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 4" Force Sewer Main	3,950	LF	$	166	$	655,700
	Furnish and Install Sewer Lift Station	1	LS	$	350,000	$	350,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	251,425
					Total	**$**	**1,257,200**
C-16	*Install 8" Sewer Main West of Storage Ponds to Highway 6 Lift Station (Project 15)*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 8" Sewer Main	3,525	LF	$	186	$	655,650
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	163,913
					Total	**$**	**819,600**
C-17	*Install 8" Sewer Main along 400 East from 200 South to 140 South*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 8" Sewer Main	310	LF	$	186	$	57,660
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	14,415
					Total	**$**	**72,100**
C-18	*Install 8" Sewer Main North of 400 North and East of 400 East for Development*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 8" Sewer Main	5,900	LF	$	186	$	1,097,400
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	274,350
					Total	**$**	**1,371,800**
C-19	*Install 4" Force Main with Sewer Lift Station south of Genola near Highway 6*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 4" Force Sewer Main	7,550	LF	$	166	$	1,253,300
	Furnish and Install Sewer Lift Station	1	LS	$	350,000	$	350,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	400,825
					Total	**$**	**2,005,000**
C-20	*Install 8" Sewer Main along Center Street from 550 South to Manhole at 520 South*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install 8" Sewer Main	120	LF	$	186	$	22,320
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	5,580
					Total	**$**	**27,900**

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects				
T-01	*Upgrade Permeat Pumps*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Replace 10 HP Motors with 15 HP Permeate Pumps	1	LS	$ 50,000	$ 50,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 10,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 15,000
				Total	$ 75,000
T-02	*Process Train #3 and New Biosolids Holding Tank- Convert Train 3 to BNR Process and Replace Solids Holding Tank and Pumps*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Remove Existing Coarse Bubble Aeration and Decant Pumping Systems	1	LS	$ 25,000	$ 25,000
	Furnish and Install Submersible Mixers in Anoxic Basins	2	EA	$ 37,500	$ 75,000
	Furnish and Install Fine Bubble Diffusers	1	LS	$ 81,250	$ 81,250
	Extend SS Air Main Piping from Blower Header to Aeration Tanks	1	LS	$ 125,000	$ 125,000
	Aeration Control Valves and Actuators	3	EA	$ 18,750	$ 56,250
	Furnish and Install 4th Aeration Blower	1	EA	$ 125,000	$ 125,000
	Train 3 Analyzers/ Instruments - DO, Level	1	LS	$ 37,500	$ 37,500
	Remove Dewatering Feed Pumps/Piping from Kiva #2	1	LS	$ 18,750	$ 18,750
	Furnish and Install Recycle Pumps (~2000gpm @ 15' TDH) in Kiva #2	2	EA	$ 50,000	$ 100,000
	Furnish and Install Recycle Pump Piping, Fittings and Valves (Assume 12" DIP)	1	LS	$ 250,000	$ 250,000
	Furnish Train 3 Gate at Splitter Box, Influent Piping	1	LS	$ 18,750	$ 18,750
	Construct 100,000 gal Biosolids Holding Tank	1	LS	$ 312,500	$ 312,500
	Sludge Holding Tank - Cover or Odor Control	1	LS	$ 62,500	$ 62,500
	Furnish and Install Coarse Bubble Diffusers and Decant Mechanism	1	LS	$ 125,000	$ 125,000
	Extend Air Piping to new Biosolids Holding Tank location	1	LS	$ 93,750	$ 93,750
	Furnish and Install New Dewatering Feed Pumps	2	EA	$ 50,000	$ 100,000
	Furnish and Install Dewatering Pump Piping, Fittings and Valves	1	LS	$ 125,000	$ 125,000
	New Dewatering Feed Pump Structure adjacent to Dewatering Bldg	400	SF	$ 375	$ 150,000
	Furnish and Install WAS Pumps	2	EA	$ 50,000	$ 100,000
	Internal WAS Piping and Valves	1	LS	$ 62,500	$ 62,500
	WAS Piping to new Biosolids Holding Tank	200	LF	$ 100	$ 20,000
	Conveyor and Roll-Off at Dewatering Building	1	LS	$ 125,000	$ 125,000
	Electrical and Instrumentation	1	LS	$ 562,500	$ 562,500
	SCADA Integration	1	LS	$ 62,500	$ 62,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 563,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 844,000
				Total	$ 4,221,000
T-03	*Reclaimed Water System Add 4th Pump*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 4th Reclaimed Water Pump w/ VFD	1	LS	$ 100,000	$ 100,000
	Electrical and Instrumentation	1	LS	$ 25,000	$ 25,000
	Misc Fittings, Valves, Etc.	1	LS	$ 37,500	$ 37,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 33,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 49,000
				Total	$ 245,000

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects						
T-04	*Outfit Membrane Tank 5 and Flow Channel*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish Cassette Frames (per existing procurement contract) (SUEZ)	2	EA	$	35,375	$	70,750
	Furnish Membrane Modules (per existing procurement contract) (SUEZ)	96	EA	$	1,923	$	184,560
	Ancillary Membrane Equipment (SUEZ)	1	LS	$	290,000	$	290,000
	On and Off Site services and support (SUEZ)	1	LS	$	200,000	$	200,000
	Freight and Delivery (SUEZ)	1	LS	$	25,000	$	25,000
	Furnish Inlet Baffle Plate	1	LS	$	18,750	$	18,750
	Furnish and Install Coating	2,000	SF	$	56	$	112,500
	Remove Knockout Walls	2	EA	$	3,125	$	6,250
	Core Drill Channel for Recycle Piping	1	LS	$	12,500	$	12,500
	Furnish and Install Scour Air Blower	1	LS	$	81,250	$	81,250
	Furnish Permeate and Air Piping	1	LS	$	25,000	$	25,000
	Install Spare Permeate Pump	1	LS	$	12,500	$	12,500
	Procure Shelf Spare Permeate Pump	1	EA	$	43,750	$	43,750
	Furnish Chemical Piping	1	LS	$	9,375	$	9,375
	Furnish Inlet Gate and Actuator	1	LS	$	31,250	$	31,250
	Add Electric Actuator to MBR Drain Valve	1	LS	$	18,750	$	18,750
	GC- Furnish, Install, StartUp and Testing for Train 5	1	LS	$	218,750	$	218,750
	Electrical and Controls	1	LS	$	250,000	$	250,000
	SCADA Controls and Integration	1	LS	$	31,250	$	31,250
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	328,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	493,000
					Total	$	2,463,000
T-05	*Center Street Lift Station & FM- Add Third Pump and Add Parallel Force Main*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Purchase and Install 3rd Submersible Pump w/ Appurtenances- includes VFD's and new triplex controls.	1	LS	$	337,500	$	337,500
	Lift Station Piping Upgrades - Triplex Piping Upgrades	1	LS	$	125,000	$	125,000
	Electrical and Instrumentation	1	LS	$	62,500	$	62,500
	Furnish and Install 10" C-900 PVC Parallel Force Main - Center Stcet LS to RR Tracks	680	LF	$	278	$	188,700
	Tie in Parallel 10" FM w/ Existing 12" FM at RR Tracks	1	LS	$	9,375	$	9,375
	Flow Meter for Parallel Force Main- 10" Mag Meter	1	LS	$	18,750	$	18,750
	Flow Meter Vault - Precast Concrete	1	LS	$	9,375	$	9,375
	Furnish and Install 12" C-900 PVC Parallel Force Main - RR Tracks to WRF Headworks.	480	LS	$	313	$	150,000
	Tie in Parallel 12" FM at WRF Headworks	1	LS	$	9,375	$	9,375
	Electrical, Instrumentataion and Controls	1	LS	$	133,594	$	133,594
	SCADA Programming and Updates	1	LS	$	15,000	$	15,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	212,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	318,000
					Total	$	1,589,000
T-06	*Add Conveyors and Loadout Facility for Biosolids*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Purchase Screw Conveyors	2	LS	$	68,750	$	137,500
	Install Concrete Loadout Pad for Rolloff or Truck	1	LS	$	62,500	$	62,500
	Widen Access Driveway and Apron	1	LS	$	31,250	$	31,250
	Install Screw Conveyors	1	LS	$	62,500	$	62,500
	Miscellaneous Metals-Transition Chutes/Conveyor Supports	1	LS	$	18,750	$	18,750
	Solids Hauling Truck (to be purchahsed outside of WRF budget)	1	LS	$	-	$	-
	Electrical, Instrumentataion and Controls	1	LS	$	81,250	$	81,250
	SCADA Programming and Updates	1	LS	$	6,250	$	6,250
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	80,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	120,000
					Total	$	600,000

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects						
T-07	*Convert Backpulse Tank and Outfit Membrane Train 6*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish Cassette Frames (per existing procurement contract) (SUEZ)	2	EA	$	35,375	$	70,750
	Furnish Membrane Modules (per existing procurement contract) (SUEZ)	96	EA	$	1,923	$	184,560
	Ancillary Membrane Equipment (SUEZ)	1	LS	$	290,000	$	290,000
	On and Off Site services and support (SUEZ)	1	LS	$	200,000	$	200,000
	Freight and Delivery (SUEZ)	1	LS	$	25,000	$	25,000
	Furnish Inlet Baffle Plate	1	LS	$	18,750	$	18,750
	Furnish and Install Scour Air Blower	1	LS	$	81,250	$	81,250
	Furnish and Install Permeate and Air Piping	1	LS	$	25,000	$	25,000
	Install Spare Permeate Pump	1	LS	$	6,250	$	6,250
	Procure Shelf Spare Permeate Pump	1	EA	$	43,750	$	43,750
	Furnish Chemical Piping	1	LS	$	9,375	$	9,375
	Furnish Gate and Actuator	1	LS	$	31,250	$	31,250
	Remove Piping (Utility Water Intake, Effluent, Backpulse)	1	LS	$	18,750	$	18,750
	Piping Changes Outside Tank	1	LS	$	18,750	$	18,750
	Basin Effluent Weir	1	LS	$	9,375	$	9,375
	Connect Tank Drain to Drain Pump Intake Manifold, Drain Vlave Electric Actuator	1	LS	$	25,000	$	25,000
	Install Tank for Utility Water Needs	1	LS	$	12,500	$	12,500
	Temp Bypass Piping/Piping	1	LS	$	62,500	$	62,500
	GC- Furnish, Install, StartUp and Testing for Train 5	1	LS	$	218,750	$	218,750
	Electrical and Controls	1	LS	$	250,000	$	250,000
	SCADA Controls and Integration	1	LS	$	62,500	$	62,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	333,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	499,000
					Total	**$**	**2,496,000**
T-08	*Reclaimed Water System Add Parallel FM*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Furnish and Install Parallel 10" C-900 PVC Force Main	6,200	LF	$	278	$	1,720,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	344,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	516,000
					Total	**$**	**2,581,000**
T-09	*UV System Upgrades- Populate First Channel*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Remove baffle wall	1	LS	$	6,250	$	6,250
	Install 12 additional lamp modules (4 modules x 3 banks)	1	LS	$	250,000	$	250,000
	Electrical and Instrumentation	1	LS	$	62,500	$	62,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	64,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	96,000
					Total	**$**	**479,000**
T-10	*Add Grit Removal System*						
	Item Description	**Qty**	**Unit**	**Unit Price**		**Amount**	
	Demolition-Site Prep	1	LS	$	25,000	$	25,000
	Purchase Grit Removal/Pumping/Washing System	1	LS	$	437,500	$	437,500
	Expand Headworks Building	600	SF	$	313	$	187,500
	Grit Chamber- System Installation	1	LS	$	250,000	$	250,000
	Misc Piping and Valves	1	LS	$	75,000	$	75,000
	Site Work- Asphalt/Concrete	1	LS	$	50,000	$	50,000
	Electrical, Instrumentataion and Controls	1	LS	$	312,500	$	312,500
	SCADA Programming and Updates	1	LS	$	12,500	$	12,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)					$	270,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)					$	405,000
					Total	**$**	**2,025,000**

Table E - 1: Sanitary Sewer Projects - Opinion of Conceptual Project Costs (cont'd)

Project Number	Sanitary Sewer System Improvement Projects				
T-11	*New 1.5 MGD AADF WRF*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	New 1.5 MGD AADF WRF - 'Mirror' existing MBR WRF liquid train.	1	LS	$ 37,500,000	$ 37,500,000
	Contractor Mob., Insurance, Bonding, OH&P (already included in cost)				$ -
	Other Costs: Program Costs, Engineering, Legal, Administrative (already included in cost)				$ -
				Total	**$ 37,500,000**
T-12	*Upsize Headworks Drum Screens*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Demo and Remove Existing Drum Screens/Waspactors	1	LS	$ 25,000	$ 25,000
	Furnish and Install New Drum Screens (6 MGD peak hour) and Washer/Compactors	2	EA	$ 625,000	$ 1,250,000
	Misc changes; piping, flow split , etc.	1	LS	$ 187,500	$ 187,500
	Electrical and Controls	1	LS	$ 250,000	$ 250,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 343,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 514,000
				Total	**$ 2,570,000**
T-13	*Biosolids - when both screw presses are running 40 hrs/wk, expand building and add a 3rd screw press or a belt filter press for more capacity.*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Furnish and Install 1 Larger Screw Press (80 gpm)	1	EA	$ 500,000	$ 500,000
	Misc Changes; Piping, Polymer, Access Platform, etc.	1	LS	$ 125,000	$ 125,000
	Expand Dewatering Building	1,000	LF	$ 313	$ 312,500
	Conveyor	1	LS	$ 62,500	$ 62,500
	Overhead Crane for Maintenance	1	LS	$ 75,000	$ 75,000
	Electrical and Instrumentation	1	LS	$ 100,000	$ 100,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 235,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 353,000
					$ 1,763,000
				Total	**$ 3,526,000**
T-14	*UV System Upgrades- Populate Second Channel*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Electrical and Instrumentation	1	LS	$ 62,500	$ 62,500
	Populate second channel- fully outfitted (8 modules x 3 banks)	1	LS	$ 750,000	$ 750,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 163,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 244,000
				Total	**$ 1,220,000**
S-01	*Winter Storage Pond- Convert Existing Treatment Lagoons*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Recondition Existing Clay Liners - Clear and Grub, Import Bentonite, Discing, Sand Protection, Geotech Services, Piping Connections	490,000	SF	$ 5	$ 2,450,000
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 490,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 735,000
				Total	**$ 3,675,000**
S-02	*Winter Storage Pond- New Winter Storage Near Existing*				
	Item Description	**Qty**	**Unit**	**Unit Price**	**Amount**
	Winter Storage Pond	247	MG	$ 75,000	$ 18,525,000
	Reclaimed Water Pipeline to Summit Ridge	7000	FT	$ 250	$ 1,750,000
	Vertical Turbine PI Pump Station	1	LS	$ 812,500	$ 812,500
	Contractor Mob., Insurance, Bonding, OH&P (20%)				$ 4,218,000
	Other Costs: Program Costs, Engineering, Legal, Administrative (25%)				$ 6,327,000
				Total	**$ 31,633,000**

Table E - 2: Sanitary Sewer Unit Prices Used for Estimated Pipe Installation and Oversizing Reimbursement

Item	Unit	Unit Price	+ Backfill Material	+ Bedding Material	+ Asphalt Repair	Manhole[1]	Total Cost / Foot
8" Gravity Sewer Main	L.F.	$ 100	$ 19	$ 9	$ 25	$ 33	$ 186
10" Gravity Sewer Main	L.F.	$ 112	$ 20	$ 9	$ 30	$ 33	$ 204
12" Gravity Sewer Main	L.F.	$ 125	$ 21	$ 9	$ 34	$ 33	$ 222
15" Gravity Sewer Main	L.F.	$ 145	$ 23	$ 9	$ 36	$ 33	$ 246
18" Gravity Sewer Main	L.F.	$ 170	$ 25	$ 10	$ 40	$ 33	$ 278
24" Gravity Sewer Main	L.F.	$ 280	$ 29	$ 10	$ 44	$ 33	$ 396
4" Force Main, Valves, Fittings	EA.	$ 90	$ 16	$ 8	$ 19	$ 33	$ 166
6" Force Main, Valves, Fittings	EA.	$ 100	$ 18	$ 8	$ 19	$ 33	$ 178
8" Force Main, Valves, Fittings	EA.	$ 115	$ 19	$ 9	$ 25	$ 33	$ 201
10" Force Main, Valves, Fittings	EA.	$ 130	$ 20	$ 9	$ 30	$ 33	$ 222

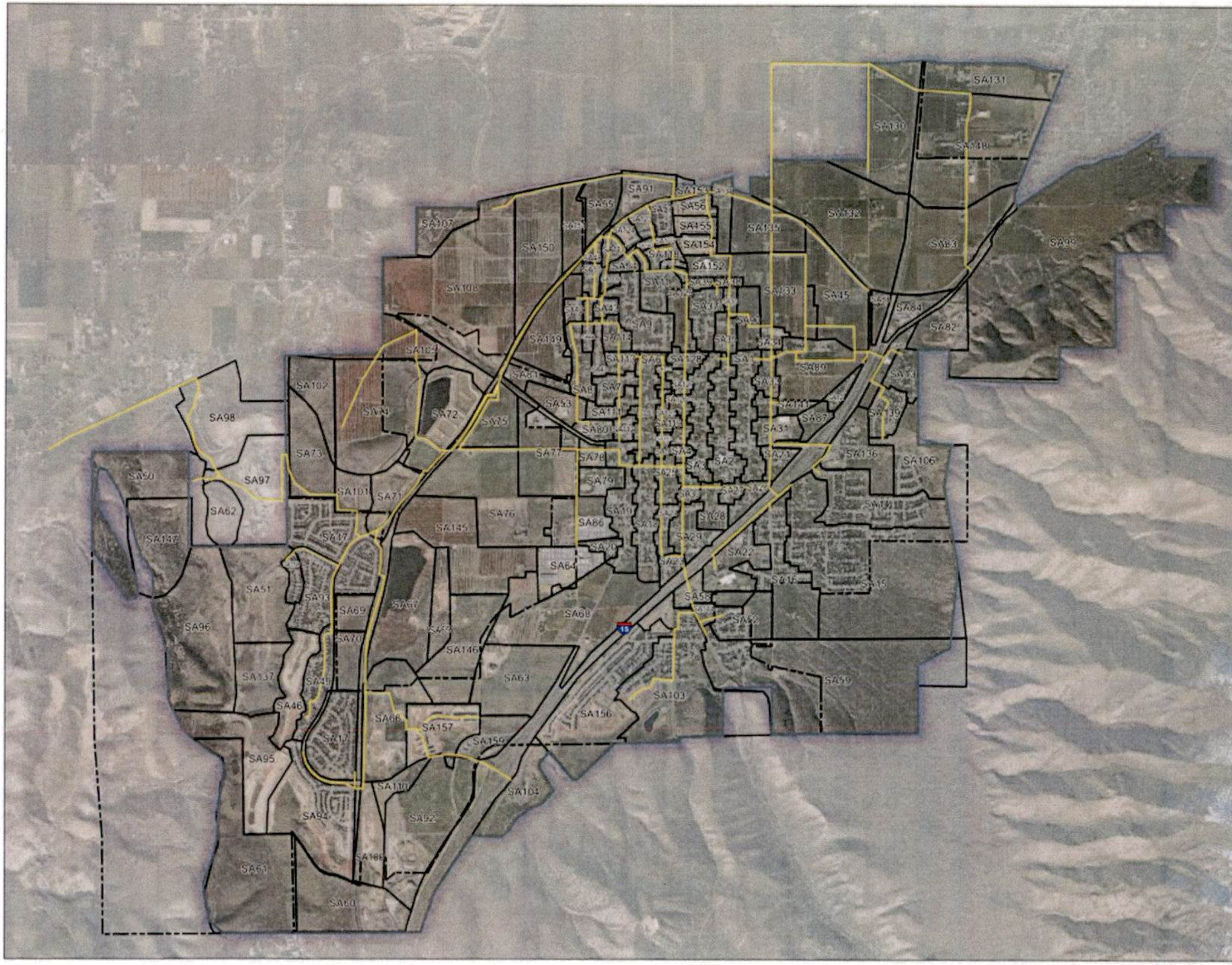
[1]Assumes one manhole per 400 feet at $13,000 each

Table E - 3: Sample of Detailed Sanitary Sewer Pipe Costs Used for Estimated Pipe Installation and Oversizing Reimbursement

Item	Unit	Unit Price
8" Gravity Sewer Main	L.F.	$ 186
10" Gravity Sewer Main	L.F.	$ 204
12" Gravity Sewer Main	L.F.	$ 222
15" Gravity Sewer Main	L.F.	$ 246
18" Gravity Sewer Main	L.F.	$ 278
24" Gravity Sewer Main	L.F.	$ 396
4" Force Main, Valves, Fittings	L.F.	$ 166
6" Force Main, Valves, Fittings	L.F.	$ 178
8" Force Main, Valves, Fittings	L.F.	$ 201
10" Force Main, Valves, Fittings	L.F.	$ 222
Oversizing 8 to 10 inch Pipes	L.F.	$ 18
Oversizing 8 to 12 inch Pipes	L.F.	$ 36
Oversizing 8 to 15 inch Pipes	L.F.	$ 60
Oversizing 8 to 18 inch Pipes	L.F.	$ 92
Oversizing 8 to 24 inch Pipes	L.F.	$ 210
Oversizing 4 to 6 inch Pipes (FM)	L.F.	$ 12
Oversizing 6 to 8 inch Pipes (FM)	L.F.	$ 23
Oversizing 8 to 10 inch Pipes (FM)	L.F.	$ 35

FM - Force Main

APPENDIX F
FLOW GENERATION DATABASE (MODEL LOADING REGIONS)



Santaquin

Sanitary Sewer System Master Plan and Capital Facilities Plan

Model Loading Regions

FIGURE F-1

Buildout System

Service Area

Service Area ID

N

0 0.5 1 Miles

J-U-B

Date: 1/19/2023

Table F - 1:Flow Generation Database (Model Loading Regions)

Region Number	Discharge Manhole ID	Existing ERUs	Horizon ERUs	Buildout ERUs
SA1	K2	133	138	189
SA2	J8	87	91	140
SA3	H1	94	97	135
SA4	G22	59	60	78
SA5	F11	14	15	21
SA6	E2	64	67	106
SA7	D2	42	43	49
SA8	C2	41	43	60
SA9	N948	127	129	150
SA10	XJ750	29	29	30
SA11	N950	57	58	66
SA12	X67	52	53	64
SA13	J-74	69	71	76
SA14	X91	179	188	254
SA15	Q9	194	240	763
SA16	N1	121	133	276
SA17	SR778	155	156	165
SA18	W17	86	87	103
SA19	W13	125	129	181
SA20	C28	23	23	24
SA21	M16	75	75	82
SA22	XJ762	46	53	137
SA23	X18	36	36	39
SA24	F20	27	28	34
SA25	W19	26	27	35
SA26	W29	28	28	33
SA27	W27	16	16	17
SA28	W25	15	15	19
SA29	G32	49	50	65
SA30	W21	16	16	19
SA31	M9	53	57	109
SA32	M6	12	23	25
SA33	A26	28	34	41
SA34	X82	23	24	35
SA35	J4	13	14	22
SA36	A17	14	14	15
SA37	x193	64	65	73
SA38	X171	8	14	14
SA39	N870	12	12	12
SA40	Y42	22	22	26
SA41	SR635	0	9	23
SA42	X203	25	25	29
SA43	B10	22	22	22
SA44	X22	17	17	20
SA45	N1008	0	0	285
SA46	N100	0	137	157
SA47	SR626	357	361	379
SA48	A1	15	15	17
SA49	SR744	78	78	84
SA50	N501	0	0	263
SA51	N158	0	158	183
SA52	XJ815	55	60	122
SA53	C11	2	118	311

Region Number	Discharge Manhole ID	Existing ERUs	Horizon ERUs	Buildout ERUs
SA54	N936	27	27	32
SA55	N982	0	0	1
SA56	N207	59	86	89
SA57	N201	100	108	116
SA58	X61	1	7	69
SA59	X156	24	86	790
SA60	SR696	0	37	460
SA61	SR715	0	37	453
SA62	N158	0	4	51
SA63	230	0	72	895
SA64	C28	2	2	2
SA65	SR667	0	6	68
SA66	SR656	0	11	136
SA67	SR679	0	0	1
SA68	C28	24	36	171
SA69	SR680	0	63	69
SA70	SR682	0	73	80
SA71	SR683	0	2	19
SA72	N515	0	0	132
SA73	N513	0	0	213
SA74	N515	0	0	277
SA75	N374	1	54	614
SA76	W2	1	9	100
SA77	W6	3	27	284
SA78	W11	9	12	40
SA79	C22	2	2	2
SA80	C15	29	38	132
SA81	N373	9	58	141
SA82	X178	0	162	190
SA83	N878	0	0	5
SA84	N880	0	0	84
SA85	X179	6	41	81
SA86	C25	1	3	21
SA87	X67	1	8	82
SA88	N330	0	0	0
SA89	X77	10	22	52
SA90	A19	1	61	78
SA91	N211	1	1	3
SA92	SR703	9	104	1283
SA93	N100	83	87	132
SA94	SR709	173	414	449
SA95	SR716	0	200	239
SA96	N501	0	222	298
SA97	N160	0	0	49
SA98	N160	0	0	151
SA99	N882	0	265	292
SA100	SR710	0	22	277
SA101	N180	0	0	1
SA102	N514	0	0	155
SA103	N12	111	162	342
SA104	N56	0	0	0
SA105	N516	0	0	97
SA106	J-86	51	64	213

Table F - 1:Flow Generation Database (Model Loading Regions) (cont'd)

Region Number	Discharge Manhole ID	Existing ERUs	Horizon ERUs	Buildout ERUs
SA107	N972	0	0	2
SA108	N972	0	0	202
SA109	J-66	21	21	22
SA110	SR704	0	13	157
SA111	D11	16	18	24
SA112	D15	53	54	75
SA113	B18	18	19	27
SA114	B12	15	17	36
SA115	N960	17	17	17
SA116	A9	9	9	11
SA117	N962	21	22	22
SA118	N900	44	44	44
SA119	F8	13	14	24
SA120	F5	7	7	8
SA121	F3	7	7	7
SA122	N898	14	14	14
SA123	N200	15	41	41
SA124	N974	12	32	32
SA125	G18	7	8	23
SA126	G15	12	12	15
SA127	G12	8	8	12
SA128	G6	19	19	23
SA129	A11	9	12	44
SA130	N326	0	0	4
SA131	N510	0	0	3
SA132	N872	0	0	9
SA133	N352	0	107	289
SA134	N208	0	50	54
SA135	N210	0	103	176
SA136	X57	29	103	227
SA137	N158	0	82	94
SA138	B9	14	14	16
SA139	J-76	90	91	98
SA140	N910	9	9	9
SA141	N148	0	102	108
SA142	N894	14	14	14
SA143	F12	0	1	7
SA144	XJ159	18	18	18
SA145	SR665	0	1	9
SA146	SR686	0	26	327
SA147	N501	0	0	165
SA148	N511	0	0	10
SA149	N512	2	4	25
SA150	N990	0	0	4
SA151	N512	0	0	1
SA152	N864	15	16	16
SA153	N203	0	1	11
SA154	N860	37	45	45
SA155	N856	43	50	50
SA156	N56	257	323	386
SA157	SR699	207	415	583
SA158	N158	23	24	35
SA159	SR635	9	34	320
	Total	4,745	8,208	19,691

APPENDIX G
WATER RECLAMATION FACILITY LEVEL OF SERVICE

Santaquin Water Reclamation Facility

Existing System Capacity Analysis

April 2023

Note: All of the assumptions and recommendations herein assume one Water Reclamation Facility at the current location to full buildout. If another WRF is built (e.g., south of lagoons), these assumptions and recommendations herein would change.

Water Reclamation Facility Demands

The existing system demand and peaking factors are shown in Table G - 1 based on the measured flow of 162 gpd per ERU, with all single-family residential units being equal to one ERU.

Table G - 1: Existing (2022) System Demand

	GPM	MGD	Peaking Factor	Cumulative
Average Day Based on June 2022 ERUs and Wintertime Water Use	541	0.779		
Peak Month	561	0.808	1.04	
Maximum Day (12/24/2021 - Christmas Eve)	672	0.967	1.20	1.24
Peak Hour (10:12 AM - 11:12 AM on 11/25/2021 - Thanksgiving)				
Day of Peak Hour	584	0.841		1.08
Peak Hour	1,212			2.24

162 gpd is an extremely low flow rate and it is recommended that future planning utilize a higher per capita flowrate that is more comparable to typical design guidance. It is anticipated that the per capita flowrates will increase as the collection system ages. Table G - 2 shows the existing system planned demand and peaking factors that are based on the increased flow of 200 gpd per ERU and all residential units being equal to one ERU. The values in Table G - 2 are used to evaluate adequacy of the existing infrastructure, assuming 200 gpd per existing ERU.

Table G - 2: Existing (2022) System Planned Demands

	GPM	MGD	Peaking Factor	Cumulative
Average Day	659	0.949		
Peak Month	684	0.985	1.04	
Maximum Day	819	1.179	1.20	1.24
Peak Hour				
Day of Peak Hour	712	1.025		1.08
Peak Hour	1,478			2.24

Center Street Influent Lift Station

The original KSB submersible pumps were replaced with two new 6-inch Flygt pumps in 2013. At that time, the Center Street lift station was reconfigured to serve as the influent lift station to the plant. In the updated configuration, the lift station pumps sewage to the headworks building where it is screened prior to entering the biological process. The pumps operate in a duty/standby configuration and are not intended to operate simultaneously. On rare circumstances, the pumps have had to operate in parallel to keep up with inflow. Utah Administrative Code R317 requires that the lift station needs to be capable of pumping the peak hour flow rate with the largest pump out of service. In this case, the city has an identical shelf spare that can be installed if one of the pumps is damaged, but this does not technically comply with Utah wastewater rules. In the future, it is recommended to install a 3rd pump in the wet well so the lift station operates under a triplex arrangement and full redundancy is provided.

The design capacity of each pump is 1,409 gpm (2.03 MGD) at 62.3 ft TDH. The installed capacity of the pumps is actually 1,550-1,600 gpm based on readings from the magnetic flow meter (these flows will likely decrease to closer to the design capacity as the pipe ages). The average day flow at the treatment plant is 659 gpm (0.949 MGD), with a corresponding peak hour flow rate of 1,478 gpm. As this peak flow rate is similar to the existing pumping capacity, it is recommended the existing pumps be replaced with larger pumps, or a third pump be installed.

Wastewater is conveyed from the Center Street Lift Station (LS) to the WRF through a single force main. A portion of this 10-inch force main, from the Center Street LS to the railroad tracks, was previously used to convey wastewater to the 420 West LS. This 10-inch pipeline includes a flow meter and valves. After the pipeline passes under the railroad tracks it upsizes to a 12-inch line and connects to the screens in the headworks building. During construction of the WRF a parallel 10-inch force main (C-900 PVC) was laid under the railroad tracks (but not the entire distance from the lift station to the plant). This 10-inch pipeline can be utilized to maintain acceptable velocities into the WRF in the future. In order to maintain a maximum velocity of 7 fps in the 10-inch line a parallel line should be laid in the segment from the Center Street LS to the railroad tracks in the future when flows exceed 1,713 gpm. Likewise, in order to maintain a maximum velocity of 7 fps in the 12-inch line from the railroad tracks to the WRF a parallel line should be laid in that segment when flows exceed 2,467 gpm. Alternatively, the existing lines could be abandoned and replaced with a single 18" force main from the lift station to the headworks (splitting the flow at the existing railroad crossings). An 18" force main would have a capacity of 5,500 gpm but may have issues with solids deposition during periods of lower flow rates.

Future detailed analysis can identify the most cost-effective way to accommodate higher flow rates, either through the installation of a parallel or larger force main to reduce pipe line velocities, installation of larger pumps (or a third pump) to overcome increased head loss associated with velocities greater than 7 ft/sec, or a combination thereof. It is recommended to address all capacity deficiencies noted below simultaneously in a single larger project. This is what is included in the cost tables at the end of this document.

Table G - 3: Influent Lift Station Expansion Summary

Component	Design Capacity			ERU Level of Service (gpd/ERU)	ERU Capacity
	Peak Hour Flow Basis (gpm)	Average Daily Flow Basis (gpm)[a]	Average Daily Flow Basis (gpd)		
Lift station pumps (duty/standby)	1,409	628	904,807	200	4,524
10" Portion of Forcemain, Valves & Flowmeter (Center Street LS to RR)	1,713	764	1,100,330	200	5,502
12" Portion of Forcemain (RR to WRF)	2,467	1,100	1,584,475	200	7,922

a. Assumes a peak hour flow factor of 2.24 (See Table G - 1)

<u>Headworks Building</u>

Rotary Drum Fine Screens

The two rotary drum screens are each capable of processing a peak hour flow of 4.0 MGD (2,778 gpm), which in Santaquin equates to an average day flow of 1.78 MGD (1,239 gpm). The screens need to be able to pass the pumping capacity from the lift station, which currently is approximately 1,550 gpm. Because one unit is sized to handle all design flow conditions, the other unit is redundant. One hundred percent reliability is required because bypassing the screens is not permissible; doing so would jeopardize the membrane equipment and potentially lead to costly repairs. An additional drum screen is needed when the capacity is 100% of system demand. The additional drum screen will require the headworks building to be expanded. Alternatively, it may be more cost effective to install 2 larger (6.0 MGD) screens within the existing building footprint.

Grit Removal (Future)

Grit removal equipment was not included as part of the 2013 WRF Project for the following reasons:

- Potential for settling in the grit chamber at initial lower flow conditions which could cause operational problems
- Relatively new and "tight" collection system should minimize grit loading to the plant
- Large wet well upstream of the plant at the Center Street lift station results in much of the grit settling out in the wet well

During design, it was decided that the potential benefits of the grit system did not justify its expense especially during the lower flow, early years. However, the site was master planned to allow for the addition of a grit removal system in the future. Space for a future vortex grit chamber was provided in the yard between the headworks building and the process building. Two tees were stubbed out of the screened influent line to the biological basins and are spaced appropriately to install a future grit chamber. The design included sufficient hydraulic head for the screened influent to gravity flow through the future grit chamber and on to the biological basins.

Operations staff have noted that grit does tend to accumulate in the Center Street LS wet well, which is occasionally cleaned using a vacuum truck. Regular cleaning of the wet well may reduce the amount of grit that passes into the treatment facility. However, as flows increase the ability to capture grit within the wet well may decrease due to the increased turbulence and shorter detention times.

The need for a grit removal system can be assessed by evaluating the buildup of grit within the process basins or noting if excessive wear is occurring on equipment such as the screens, pumps or membranes. In 2023 the City reported they have seen increased grit buildup in the MBR basins. At city discretion, it may be beneficial to add a grit removal system in the future.

Odor Control Biofilter

The existing biofilter is adequately sized to provide all of the odor control needs at the headworks and dewatering building for the foreseeable future. That said, the fans may struggle to push air through the biofilter as the media compacts and ages over time. It is anticipated that the biofilter media will need to be replaced in the near future if odor control is utilized on a routine basis. However, it is understood the biofilter is only used sporadically as odor generation is minimal and there haven't been any odor complaints from neighbors. Additional biofilter media and larger exhaust fans may need to be installed if the buildings are expanded in the future.

Table G - 4: Headworks Building Expansion Summary

Component	Design Capacity			ERU Level of Service (gpd/ERU)	ERU Capacity
	Peak Hour Flow Basis (gpm)	Average Daily Flow Basis (gpm)[a]	Average Daily Flow Basis (gpd)		
Screens (duty/standby)	2,778	1,239	1,783,927	200	8,920

Component	Design Capacity	Expansion	ERU Capacity
Grit Removal System	Not installed	Install if grit accumulation becomes an issue	City judgment
Biofilter	Treats airflow based on volume of HW/DW building	Expand when HW/DW building is expanded. Replace biofilter media as required every 5-10 years. Monitor exhaust fan pressure gauge to determine when media needs to be replaced.	Expand when headworks building is expanded

a. Assumes a peak hour flow factor of 2.24

Biological Processes

The biological process consists of three parallel process trains. Two process trains are fully outfitted and are currently used as process basins while the third train is now serving as a biosolids holding tank. From commissioning until 2017, only one train was in service. The second train was brought on-line in October 2017. The process was designed to have a maximum month capacity of 0.77 MGD (0.713 MGD AADF) in each process train or a total maximum month capacity of 2.31 MGD with all three trains in operation. Per DWQ rules, a redundant or standby process train is not required, thus simultaneous operation of each train is possible. Based on the current configuration, two process trains could operate concurrently at a firm capacity of 1.54 MGD on a maximum monthly basis. This translates to an AADF of 1.48 MGD using a maximum month peaking factor of 1.04. With the third process train in service, the AADF capacity of biological process would reach 2.22 MGD.

Operations staff have noted that it has been difficult to maintain treatment when one train is down for a couple weeks to perform cleaning and diffuser replacement. As the flow rates continue to increase, it will be even more difficult to perform routine maintenance while treating through a single basin. Therefore, prior to the next maintenance cycle (within the next 5 years or so), it is recommended to outfit the third process train to provide a redundant process basin.

The third train would need to be converted from its current configuration as a biosolids holding tank to biological process basins. Several changes would be required to make this conversion, these include:

- Remove existing coarse bubble aeration system and decant pumping system
- Purchase and install two submersible mixers in each anoxic basin
- Purchase and install fine bubble diffusers in the three aerobic basins
- Extend air main from blower room to third aeration basin.

- Install fourth process aeration blower
- Remove dewatering feed pumps and piping from 'Kiva 2'
- Install new recycle pumps (duty/standby) and piping in 'Kiva 2'
- Construct dedicated biosolids holding tank
- Install new dewatering feed pumps and piping inside a new building
- Install new WAS pumps and piping inside a new building

Future process trains (beyond three) will either need to be housed in a new building or an expansion of the existing process building. The facility has been configured to support the addition of future process trains on the east side of the process building.

Table G - 5: Biological Processes Capacity Summary

Component	Current Status	Design Capacity on Max Month Basis (gpd)	Design Capacity on AADF Basis (gpd)	ERU Level of Service (gpd/ERU)	ERU Capacity
Process Train 1	In Service	770,000	742,000	200	3,710
Process Train 2	In Service	770,000	742,000	200	3,710
Process Train 3	Used for Biosolids Holding Tank	770,000	742,000	200	3,710
Total Existing Capacity (2 Trains)		**1,540,000**	**1,484,000**	**200**	**7,420**
Existing Firm Capacity when One Train is Down for Maintenance (1 Train)		**770,000**	**742,000**	**200**	**3,710**
Total Future Capacity (3 Trains)		**2,310,000**	**2,226,000**	**200**	**11,130**
Total Future Firm Capacity (2 Trains)		**1,540,000**	**1,484,000**	**200**	**7,420**

Membrane Bioreactor

The WRF was originally constructed with six membrane tanks, three of which were originally outfitted with membrane cassettes. In 2019, an additional tank was outfitted with membranes. The two remaining tanks are for future use, with one temporarily serving as a backpulse tank. In the future, as additional membrane cassettes are placed into service, a dedicated backpulse tank will not be required (the permeate flows will be adequate for backpulsing).

The membrane system was originally designed with an assumed minimum water temperature of 10°C. Actual temperature data over the past nine years since startup has shown the minimum water temperature is actually about 14°C. The higher temperature allows more capacity in the membranes since the viscosity of the water is reduced allowing higher flux rates. The membrane manufacturer, Veolia (formally Suez/GE), has indicated that the flux rates can be increased by 22% based on this temperature difference.

This increase in flux rates and overall system capacity has been summarized below in Table G - 6. Specifically, the difference in temperatures is accounted for between Phases 2 and 2A. In terms of average daily flow, the capacity of the membranes increases from 0.87 to 1.07 MGD based on the temperature change.

In order to realize the additional membrane capacity, it is necessary to increase the permeate pump capacity which were sized for operation at 10°C. Attaining increased flow in the existing permeate pumps is possible by increasing the motor size from 10 to 15 HP, according to Veolia who supplied the pumps. Therefore, when additional capacity is needed, the City can upsize the existing permeate pump motors. This change will also require reprogramming of membrane system controls to allow higher permeate pump flow rates. Veolia indicated the remainder of the equipment associated with the membranes can accommodate the increased flowrates with no changes.

Currently, each permeate pump is rated to pass a maximum flow rate of 347 gpm. With 4 trains in service, the total peak permeate flow is 1,388 gpm. The firm capacity (one train down for maintenance or cleaning) is 1,041 gpm. Installing 15 HP motors on the existing permeate pumps will increase the future total capacity to 1,693 gpm and future firm capacity to 1,270 gpm.

A detailed summary table showing the capacity of the membrane bioreactor components at the increased flux rate (14 deg C) is included in the Appendix.

Table G - 6: Membrane Bioreactor Capacity Summary

Component	Status	AADF Capacity (gpd)		ERU Level of Service (gpd/ERU)	ERU Capacity	
		10°C	14°C		10°C	14°C
Membrane Tank 1	In Service	217,500	267,500	200	1,088	1,338
Membrane Tank 2	In Service	217,500	267,500	200	1,088	1,338
Membrane Tank 3	In Service	217,500	267,500	200	1,088	1,338
Membrane Tank 4	In Service	217,500	267,500	200	1,088	1,338
Membrane Tank 5	Future	217,500	267,500	200	1,088	1,338
Membrane Tank 6	Future	217,500	267,500	200	1,088	1,338
Total Existing Capacity (4 Tanks)		870,000	1,070,000	200	4,352	5,352
Total Existing Firm Capacity (3 Tanks)[a]		652,500	802,500	200	3,264	4,014
Total Future Capacity (6 Tanks)		1,305,000	1,605,000	200	6,528	8,028
Total Future Firm Capacity (5 Tanks)[a]		1,087,500	1,337,500	200	5,440	6,690

a. Considers N-1 Condition where one tank may be out of service for cleaning/maintenance

Chemical Feed Systems

The existing sodium hypochlorite chemical feed system is not routinely used. Its purpose is to dose existing process piping to mitigate filamentous growth and also to further disinfect effluent if required. It is not anticipated that the existing chemical feed system will need to be upgraded in the foreseeable future.

As part of the 2019 upgrades, new chemical feed systems for membrane cleaning (sodium hypochlorite and citric acid) were installed. These replaced the pneumatically operated chemical feed systems originally provided by Veolia, which were problematic with regards to performance and operation. The replacement chemical feed pumps are diaphragm style pumps and were each provided as a duplex (duty/standby) skid system. The metering pumps are designed to deliver the required quantities of chemical for either maintenance or recovery cleaning.

Table G - 7: Chemical Feed Systems Expansion Summary

Component	Pump Make/Model	Design Capacity	Expansion	ERU Capacity
Sodium Hypochlorite Chemical Feed System (Backup Disinfection System)	Pulsafeeder	10 gph	This chemical feed skid is not routinely used and upgrades are not anticipated.	No capacity limitation anticipated
Sodium Hypochlorite Chemical Feed System (Membrane Cleaning)	Grundfos DME 940-4 AR	248 gph	Not required - system is sized to meet future cleaning requirements	N/A
Citric Acid Chemical Feed System (Membrane Cleaning)	Grundfos DME 375-10 AR	99 gph	Not required - system is sized to meet future cleaning requirements	N/A

Ultraviolet Light Disinfection

From the table below, the maximum flow capacity for one duty channel with the channel reduction baffle is 1.58 MGD. This includes two duty banks with 4 modules per bank and 8 lamps per module. The third bank of lamps is redundant. This is what was installed in the initial 2013 construction.

The maximum flow for one channel with the channel reduction baffle removed is 3.16 MGD. This includes two duty banks with 8 modules per bank and 8 lamps per module. The third bank of lamps is redundant.

The maximum flow for two channels with no channel reduction baffles is 6.32 MGD. This includes two duty banks with 8 modules per bank and 8 lamps per module in each channel. The third bank of lamps is redundant in each channel.

The 1,388 gpm that can be delivered by the permeate pumps exceeds the design capacity of the UV disinfection system in its current configuration (1.58 MGD = 1,097 gpm). However, City staff report the UV system is working well and there appears to be plenty of capacity available even without removing the baffle wall. This may be due to the conservativeness included by the manufacturer in the design of the equipment. For example, the design UV transmittance is 65% and it is anticipated the actual UVT is higher than this. It should also be noted that the UV equipment only sees what the permeate pumps can deliver, which is less than the influent peak hour flowrate to the plant. Influent peak flows are attenuated and excess is retained in the process basins until the permeate pumps can catch up. When the permeate pumps are equipped with larger motors in the future, additional flows will need to be disinfected and the capacity of the UV system will need to be reevaluated at that time.

Table G - 8: UV Disinfection Capacity Criteria[a]

Design Flow, mgd	Total # of Channels	Total # of Duty Channels	Banks per Channel	# of Banks at Duty	Modules per Bank	Lamps per Module	Total # of Duty Lamps per Bank	Total # of Lamps
1.58	1	1	3	2	4[b]	8	32	96
3.16	1	1	3	2	8	8	64	192
6.32	2	2	3	2	8	8	64	384

a. Design assumptions: the design dose is 80 mJ/cm^2, the UV transmittance is 65%, the fouling factor and aging factor are 0.9, and there is always one redundant bank that is not included in the "duty" and is not part of the delivered dose. Of the three banks of lamps there are always two on and one in standby mode.
b. Channel reduction baffle is installed.

Table G - 9: UV Disinfection Expansion Summary

Component	Design Capacity	Expansion	ERU Capacity
UV Disinfection System as currently configured	1,097 gpm at peak hour flow	Remove baffle wall when permeate pumps are upgraded and effluent flows can exceed 1,388 gpm	3,750
UV Disinfection System with baffle wall removed	2,194 gpm at peak hour flow	Populate second channel when peak permeate flows approach 2,100 gpm	7,500
UV Disinfection System with both channels populated	4,389 gpm at peak hour flow		15,004

Component	Design Capacity			ERU Level of Service (gpd/ERU)	ERU Capacity
	Peak Hour Flow Basis (gpm)	Average Daily Flow Basis (gpm)[a]	Average Daily Flow Basis (gpd)		
Current UV System Configuration	1,097	521	750,240	200	3,751

a. Effluent peak hour flow is currently capped at 1,388 gpm as that is the pumping capacity of the existing permeate pumps (effluent peak hour factor = 2.11). Reevaluate removing the baffle wall when the existing permeate pumps are upsized with larger motors and/or new membrane trains are brought online.

b. As of 2023, City staff report the UV system is working well and there appears to be plenty of capacity available. This may be due to the conservativeness included by the manufacturer in the design of the equipment. For example, the design UV transmittance is 65% and it is anticipated the actual UVT is higher than this.

Reclaimed Water Infrastructure

Reclaimed Water Pump Station

The reclaimed water pump station consists of three 40HP vertical turbine pumps that were installed during the 2013 construction project with space for a fourth pump in the future. Two of the pumps are duty and one is standby. The capacity of each pump is 800 gpm at 135 feet of head. Currently, pump 1 delivers 810 gpm, pump 2 delivers 860 gpm, and pump 4 delivers 800 gpm. A spare slot is included for the future installation of pump 3. The table below provides the capacity of the pumping system for one, two and three pumps in operation with one pump always available as a standby. Occasionally 2 pumps operate simultaneously. In 2020, the lead pump typically operated 11.75 hours per day and the lag pump operated 1.25 hours per day. This indicates there is adequate capacity for the near future, but the 4th pump should be added if the third pump ever needs to operate in parallel with the other 2 pumps. This may occur when the permeate pumps are upsized and/or new membrane trains are brought online. The performance of the reclaimed water pump station will need to be reevaluated at that time.

Table G - 10: Reclaimed Water Pump Station Capacity Criteria[a]

Pumps	Flow Capacity (gpm)	ERU Capacity[b]
2 duty, 1 standby	1200	4,104
3 duty, 1 standby (Add the future pump)	1400	4,788
3 duty, 1 standby (Modify pump impellers or upsize pumps as flows approach capacity of 3 pumps operating simultaneously. Consider upsizing sections of 10" force main or install a parallel pipe.)	>1,400 gpm	>3,983

a. This analysis assumes that 100% of the reclaimed water flows through the existing 10-, 12- and 14-inch pipelines.
b. Actual peak flow to RWPS is limited due to capacity of existing permeate pumps (1,388 gpm). Consider adding additional reclaimed water pump when the permeate pumps are upgraded and/or new membrane trains are brought online.

Table G - 10 shows the capacity of the reclaimed water pump station as it is currently configured. It is recommended to install the future pump when the peak effluent rates approach 1,200 gpm.

Reclaimed Water Pipeline

The force main that previously conveyed sewage from the 420 West lift station to the lagoons is now the reclaimed water line. This line delivers pressurized Type I water from the reclaimed water pump station to the storage ponds. The majority of the existing reclaimed water line is 10 inch but portions of the line are 12 inch. As the flow increases beyond 1,770 gpm (2.55 MGD peak), the portions of the discharge pipe from the WRF to the existing storage ponds that are 10 inch will need to be upsized to reduce velocities (7 ft/sec) or a parallel pipe can be installed in these locations. Another option would be to construct an alternate storage/disposal location with new pipe routing or obtain a UPDES permit at the Strawberry Highline Canal. Alternatively, the pump impellers can be modified to produce more flow, or the pumps can be upsized to accommodate the increased friction loss due to higher pipe velocities. The table below shows the capacity of the existing reclaimed water pipeline.

Table G - 11: Reclaimed Water Pipeline Capacity

Pumps	Flow Capacity (gpm)	ERU Capacity
Existing 10" Reclaimed Water Pipeline (7 ft/sec)	1,770	6,051
Existing 12" Reclaimed Water Pipeline (7 ft/sec)	2,500	8,546

Once the capacity of this pipeline has been reached, one of the following solutions can be implemented:

- Install a parallel 10" pipe, or
- a new larger diameter pipe replaces the 10-inch, for example a single 14" transmission line can accommodate 3,350 gpm at approximately 7 ft/sec, or
- some water is sent to an alternate disposal location, or
- The pump impellers are modified to discharge additional flow, or
- The pumps are upsized.

Effluent Disposal

As growth in the city continues to occur and wastewater flow rates increase, the city will need to either construct additional winter storage ponds or utilize an alternative method of effluent disposal. These alternative methods include aquifer recharge (and recovery), direct potable reuse, or UPDES discharge. These effluent disposal alternatives were discussed with Utah Division of Water Quality (DWQ) staff in separate meetings conducted January 22, 2020 and January 18, 2023. Each of these alternatives is discussed in more detail below.

Reclaimed Water Storage Ponds

The State Engineer has approved the reuse of 5,302 acre-feet of Type 1 water from the Water Reclamation Facility. The table below shows the capacity of the reclaimed water storage ponds, which store water during the winter months for use as irrigation during the summer months. The ponds have a total storage capacity of 178 million gallons. The irrigation season is from April 15 – October 15 (6 months) and the remainder of the year the treated effluent needs to be stored.

For the 185-day non-irrigation season, 0.962 MGD can be stored in the winter storage ponds. Based on historic WRF effluent pumping data, which adds to the winter storage ponds, and pressure irrigation pumping data, which draws from the winter storage ponds, approximately 30% of the annual WRF effluent volume is lost to evaporation from the winter storage ponds. Approximately one-third of the evaporation and losses is estimated to occur during the 185-day non-irrigation season, totaling approximately 0.187 MGD. With evaporation and losses removed, the required storage for existing conditions is 0.876 MGD. As flows approach 0.962 MGD, alternate effluent disposal options will need to be implemented.

Table G - 12: Reclaimed Water Storage Capacity Criteria

Winter Storage	Storage Capacity (MG)
Pond #1	52
Pond #2	126
Total Available Storage	**178**

Table G - 13: Winter Storage Expansion Summary

Component	Design Capacity	Expansion	ERUs
Reclaimed Water Storage Ponds	178 MG (0.962 MGD for 185 days)	Construct additional winter storage or implement alternative discharge of reclaimed water when average daily flows approach 1.14 MGD (0.962 MGD of storage, plus evaporation and losses).	5,993

As flow increases, additional winter storage will be required. One option is to utilize the abandoned lagoon treatment cells for winter storage. There are 3 treatment cells available with a volume of 12 MGal each, for a total of 36 MGal. This would provide additional winter storage at a reduced cost, although it is not a long-term solution.

One concern about constructing additional winter storage ponds at the existing location is it may prove difficult to fully utilize all of the Type I water in the City's PI system. To help address this concern, Santaquin City will complete pressure irrigation projects in early 2023. These projects include the construction of a 10-acre-foot tank, booster pump station, and associated pipelines. These projects will allow for the use of reclaimed water in areas that have historically used culinary water for outdoor irrigation.

If new winter storage ponds are constructed, the existing PI pumps need to be upsized, replaced, or a new pump added to increase the flow out of the ponds.

Aquifer Recharge and Recovery (Indirect Potable Reuse)

The City has an approved aquifer recharge water right (RC007) from the State of Utah that allows for the recharge of Type 1 reclaimed water in the amount of 550 acre-feet per year (179 MGal/yr). This permitted volume essentially doubles the available effluent disposal capacity as compared to the existing storage and Type 1 reuse system. The permit requires the construction of shallow spreading ponds for additional filtration prior to aquifer storage. The following items were discussed with DWQ staff.

- To ensure the protection of water quality in Santaquin's Class 1A pristine aquifer additional treatment may be required. Zones of influence from area wells will need to be evaluated to determine if they may be impacted by the recharge site.

- Utah Division of Drinking Water (DDW) and the Groundwater Division will have some involvement if shallow spreading ponds are utilized. If this is the case, a UPDES permit will be obtained from DWQ setting the infiltration rate and some effluent requirements. A concurrence letter would likely be provided by DDW. Other regulatory agencies would also need to be engaged.
- One major concern regarding Indirect Potable Reuse (IPR) is per Utah rules, a non-detect background is required. Therefore, if emerging contaminants such as pharmaceuticals or estrogen are introduced into the aquifer, it could force the advanced treatment facility to be shut down. No municipality in Utah has implemented a full scale IPR program, likely due to this concern.
- The groundwater standard is set at 500 mg/L Total Dissolved Solids (TDS). Santaquin's effluent TDS is 600 mg/L. There are 2 ways to reduce TDS – reverse osmosis and blending.
- For planning purposes, DWQ recommended to assume reverse osmosis followed by advanced oxidation to achieve TOC < 0.5 mg/L (likely range 0.5-3 mg/L) and nitrate < 2.5 mg/L. Basically this is a prescriptive standard used in other states to require that RO be specified. They also recommended to review the drinking water Maximum Contaminant Limits and assume proposed permit limits will be 25% of the MCL for all constituents. Currently the effluent has nitrates at 6-7 mg/L. Additional coordination with DWQ would be required to verify log removal requirements.
- There are several drawbacks to reverse osmosis, including capital cost, high energy requirements, and the need for brine disposal. Jordan Valley constructed a brine line into the Great Salt Lake. However, they do not have excess capacity in their pipeline. In Santaquin's case, it would likely be more cost effective to store the brine in an HDPE-lined pond and evaporate the water.
- A recover permit for recovery of recharged water is currently pending with the State of Utah, Division of Water Rights. Continued engagement is recommended with DWR regarding the status of the recover permit. It likely will be required to guarantee a minimum amount of groundwater travel time in the aquifer prior to recovery.
- Santaquin has adequate water rights for the near future, but does not have enough for buildout. It would be beneficial for the city to reduce the quantity of evaporation and seepage that occurs in the winter storage ponds. If a recover permit is not obtained, aquifer recharge would be less desirable for the city.
- DWQ recommended utilizing lower quality sources in the pressure irrigation system and higher quality sources for aquifer recharge. However, this approach will not address Santaquin's Type 1 water winter storage capacity concerns.

The treatment criteria for IPR as originally proposed by DWQ are stringent and will require expensive equipment with high capital and operations costs. However, it is anticipated that negotiations with DWQ will be iterative. Continued engagement may result in reduced treatment requirements as the project further develops and becomes more defined. For example, DWQ indicated they may be amenable to relaxed treatment requirements if the shallow spreading ponds were located downstream of all culinary water wells. Eventually DWQ will need to develop standards for IPR that can be utilized for design and continued engagement with them is recommended.

Direct Potable Reuse

Preliminary discussions with DWQ indicated that direct potable reuse (DPR) may entail the same additional treatment requirements as indirect potable reuse, potentially be less expensive, and eliminate the risk of contaminating the pristine drinking water aquifer. The following items regarding DPR were discussed with DWQ:

- DDW will have extensive involvement and permitting for direct injection into the aquifer or direct potable reuse.
- The technology for safe and reliable direct potable reuse already exists. Public perception is the biggest obstacle for DPR and can be overcome with extensive public outreach and education.
- Large scale DPR is currently being constructed in El Paso, TX.
- In Utah, Provo and Cedar City have recently investigated IPR and DPR but backed off due to the uncertain regulatory involvement.
- South Jordan City is currently running a DPR "proof of concept" pilot using effluent from the Jordan Basin MBR facility.

Depending on water quality requirements (including defining an acceptable concentration of total dissolved solids) other technologies may be utilized for potable reuse that are less complex and expensive than reverse osmosis. Some technologies used in other states include granular activated carbon, ion exchange, and emerging technologies. These processes may need to be followed by advanced oxidation processes such as hydrogen peroxide, ozone, or chlorine dioxide.

Also, it should be noted that effluent treatment for potable reuse would not be continuous; only a fraction of the effluent needs to be treated (during late winter after the effluent storage ponds reach capacity). Initially, a small portion of the effluent, for example 50-100 gpm, could be treated for potable reuse a couple months per year. The portion of the effluent that requires advanced treatment would increase over time as the city continues to grow.

The City toured the South Jordan City DPR pilot plant on January 18, 2023. This pilot is currently being utilized by DWQ to set DPR design and performance criteria for future use in the state. The 10 gpm pilot uses the following treatment train using MBR effluent (no reverse osmosis):

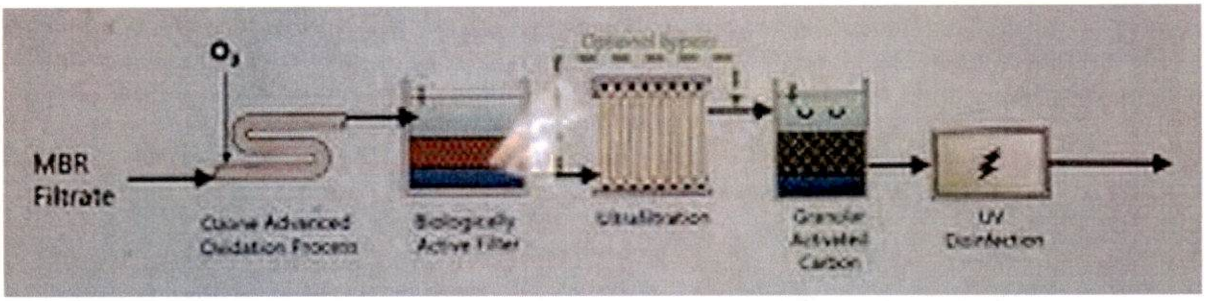


Figure G - 1: South Jordan DPR Pilot Process Train

UPDES Permit

The existing treatment facility was designed to allow for a gravity connection to the adjacent Strawberry Highline canal. Discharge to this canal would require a UPDES permit from DWQ. Eventually this water makes its way to local farms and to the Utah Lake watershed. The existing facility would be able to comply with all anticipated UPDES permit limits except for total phosphorus (TP). Preliminarily, effluent TP concentrations may be set at the technology-based phosphorus effluent limit (TBPEL) of 1 mg/L.

A Total Maximum Daily Load (TMDL) Study is currently being completed for Utah Lake. This study may recommend lower TP limits, potentially to the 0.1-0.5 mg/L range. These lower phosphorus limits could be achieved utilizing an alum dosing system to precipitate the phosphorus and remove it using the existing membranes.

It should be noted that only a small portion of the effluent would need to be discharged to the canal (as the winter storage ponds approach capacity) and only during the winter months when the canal is not being utilized for irrigation. During the irrigation season, all effluent would be pumped to the storage ponds and reused in the pressure irrigation system as is currently the case. As such, the argument could be made for an annual "load-based" UPDES permit limit, which would likely be higher than 1 mg/L TP and easily achievable.

This alternative likely represents the lowest cost option for effluent disposal. However, it is preliminarily understood that users of the Strawberry Highline canal are highly resistant to allowing discharge into the canal. Continued engagement and negotiation with the canal company is recommended. Perhaps they would be more amenable to the idea if they understood that discharge would not occur during the growing season. Alternatively, other locations for effluent discharge could be investigated including Summit Creek Reservoir Number 2 or an irrigation ditch located near the winter storage ponds.

It is recommended the City pursue a politically acceptable discharge location and obtain a UPDES discharge permit. Utah DWQ will provide a Waste Load Allocation (WLA) for the selected site which will inform the preliminary permit limits. It will cost the city approximately $3000 for DWQ to perform the WLA. The WLA will be based on the location of discharge, time of year, and volume of discharge. It is recommended to obtain the UPDES permit prior to finalization of the Utah Lake Total Maximum Daily Load (TMDL) study. This will ensure the city is provided a load allocation and has a "seat at the table". In addition, ongoing drought conditions may result in the regulatory agencies being more amenable to a new discharge to Utah Lake (which ultimately flows into the Great Salt Lake).

Non-Potable Water System

The Non-Potable Water (NPW) pumps are contained in a package, skid-mounted system consisting of three centrifugal pumps and associated controls and valving. The NPW pumps utilize variable frequency drives in order to achieve an operator-adjustable discharge pressure setpoint (typically 80 psi to ensure adequate cleaning at the headworks screens). The 15 hp motors on each pump are rated to deliver 111 gpm at up to 269 feet of head (116 psi). Currently a single pump is adequate for all of the treatment facility's NPW needs, except for when staff is washing down equipment using the plant water hoses. When this occurs, typically two NPW pumps are activated. It is anticipated the NPW pump skid is adequately sized for the foreseeable future, at least until a new process building is constructed.

Table G - 14: Non-Potable Water System Expansion Summary

Component	Design Capacity (gpm)	Expansion
Non-Potable Water System	300	Consider adding additional pumping capacity when process and dewatering buildings are expanded.

Plant Drain Lift Station

The Plant Drain Lift Station consists of two pumps operated in a duty/standby configuration. The original duty point was 100 gpm and 30 TDH feet for each pump. However, when the new screw press was installed in 2019, the impellers were upgraded and the pumps now discharge 120 gpm each. After the impeller change out only one PDLS pump runs at a time. The plant drain pumps currently operate infrequently except for when the screw press is operating. It is anticipated that the Plant Drain Lift Station is adequately sized until a third screw press is added or the process building is expanded. If expansion is required in the future, a new PDLS could be constructed to serve the new facilities. Alternatively, the existing PDLS wet well could continue to be utilized and the existing pumps replaced with larger pumps.

Table G - 15: Plant Drain Lift Station Expansion Summary

Component	Design Capacity (gpm)	Expansion
Plant Drain Lift Station	120	Consider adding additional pumping capacity when process and dewatering buildings are expanded.

Solids Handling Processes

Biosolids Holding Tank

As flow rates increase in the future, the current biosolids holding tank will be reconfigured as the Train 3 process basin similar to Trains 1 and 2. When this occurs, a new biosolids holding tank will need to be constructed outside the current building.

Dewatering Feed Pumps

Two 7.5 HP rotary lobe dewatering feed pumps were provided to pump biosolids from the biosolids holding tank to the screw press dewatering system. The pumps are located inside "Kiva 2" in the membrane process building and operate in duty/standby mode. The pumps use variable frequency drives so they can match the optimum flow rate for the screw press. The pumps are each capable of discharging approximately 75 gpm (300 pounds per hour). It is recommended to install a 3rd (redundant) dewatering pump or upsize the existing pumps when the 3rd biological process train is implemented.

Screw Press Dewatering System

The City currently hauls biosolids to the landfill approximately 5 days/week. Originally, a single Huber screw press was installed for biosolids dewatering. This unit is capable of dewatering WAS at approximately 35 gpm. In recent years, operating times for this equipment had exceeded 40 hours per week, which was problematic for operations staff because of the need to haul biosolids to the landfill on weekends and after normal working hours. In 2019, a new FKC screw press was installed with a higher capacity. The second screw press also provides redundancy in the dewatering process.

Currently both screw presses are operating in parallel, 5 days per week and 5 hours per day. The original Huber screw press is running at 35 gpm and the newer FKC screw press is running at 50 gpm.

Due to the tight footprint and increased throughput inside the dewatering building with the 2 screw presses, it is recommended to install a dewatered cake conveyance system to the exterior of the dewatering building for improved cake removal.

In the future when both screw presses are each operating more than 40 hours per week, the City will need to expand the dewatering building to accommodate additional screw presses. Alternatively, the existing screw presses could be replaced with larger screw presses or belt filter presses that have a higher throughput.

Table G - 16: Solids Handling System Expansion Summary

Component	Design Capacity	Expansion	ERU Capacity
Biosolids Holding Tank	The Biosolids Holding Tank is adequately sized for sludge processing until it needs to be removed from service when the 3rd process train is required.	Construct new biosolids holding tank when a 3rd process train is required.	3,710
Dewatering Feed Pumps	75 gpm	Add a 3rd pump or upsize existing pumps when a 3rd screw press is added. The existing pumps may need to be modified or replaced when the 3rd process train is installed and the biosolids holding tank is removed from service.	3,710
Dewatering Screw Conveyor and Roll-Off	City discretion	Simplify operations by installing dewatered cake conveyor and roll-off bin outside the dewatering building.	3,565
Expand Dewatering Building	40 hours each/week	Expand the dewatering building and add a 3rd screw press when both presses are each operating 40 hours/week. Alternatively, replace the screw presses with larger screw presses that have a higher throughput or a belt filter press.	9,877

a. Biosolids holding tank and dewatering feed pump capacities correspond with the desire to add the 3rd process train so a redundant train is available during routine maintenance of the process basins.

Summary

Table G - 17 summarizes the capacity (in terms of ERUs) of each major component of the WRF.

Table G - 17: Summary Table

Component	Peak Hour Design Capacity (gpm)	AADF Design Capacity (gpd)	ERU Capacity (gpd/ERU)	ERU[a]
Center Street Lift Station Upgrades - new pump and parallel force mains	1,409		200	4,524
Headworks Building (including screens, building, and electrical)	--	--	200	8,920
Drum Screens	2,778		200	8,920
Biological Process (total capacity)		1,484,000	200	7,420
Biological Process (firm capacity, 1 train down for maintenance)		742,000	200	3,710
Membrane Process (total capacity)		1,070,000	200	5,352
Membrane Process (1 train down for maintenance)		802,500	200	4,014
Treatment Building	--	--	200	7,420
Permeate Pumps (total capacity)	1,388	892,000	200	4,460
Permeate Pumps (1 train down for maintenance)	1,041	669,000	200	3,345
UV Disinfection	*1,097*		*200*	*3,750*
UV Disinfection with Baffle Wall Removed	2,194		200	7,500
UV Disinfection - Both Channels Populated	4,389		200	15,004
Reclaimed Water Pumping	*1,200*		*200*	*4,104*
Reclaimed Water Pumping (including future pump)	1,400		200	4,788
Reclaimed Water Pipeline	1,770		200	6,051
Reclaimed Water Storage		1,150,000	200	5,750
Reclaimed Water Pump Station Building	--	--	200	7,420
Construct Biosolids Holding Tank		742,000	200	3,710
Solids Loadout Improvements		742,000		3,710
Dewatering Building	--	--	200	9,913
Expand Dewatering Building (3rd Screw Press)		1,982,588	200	9,913

a. Peak hour demand is converted to annual average day flow (AADF) using the 2.24 peaking factor, then converted to ERUs by dividing by 200 gpd/ERU.

b. *Peak flows to the UV system and Reclaimed Water Pump Station are capped by the existing capacity of the permeate pumps. These systems do not need to be upgraded until the permeate pumps are upsized and/or additional membrane trains are brought online.*

As the capacity of each component approaches, Santaquin City should plan to increase the capacity. Table G - 18 shows the ERU count and approximate year when capacity is 100% of flow.

Table G - 18: ERUs when Capacity is 100% of Flow

Component	Capacity (in ERUs)	Approx. Year when Capacity is 100% of Flow
Center Street Lift Station Upgrades - new pump and parallel force mains	4,524	2023/2024[a]
Headworks Building (including screens, building, and electrical)	8,920	2035
Drum Screens	8,920	2035
Biological Process (total capacity)	7,420	2031
Biological Process (firm capacity, 1 train down for maintenance)	3,710	2023/2024[a]
Membrane Process (total capacity)	5,352	2025
Membrane Process (1 train down for maintenance)	4,014	2023/2024[a]
Treatment Building	7,420	2031
Permeate Pumps (total capacity)	4,460	2023/2024[a]
Permeate Pumps (1 train down for maintenance)	3,345	2023/2024[a]
UV Disinfection	3,750	2023/2024[a]
UV Disinfection with Baffle Wall Removed	7,500	2031
UV Disinfection - Both Channels Populated	15,004	2049
Reclaimed Water Pumping	4,104	2023/2024[a]
Reclaimed Water Pumping (including future pump)	4,788	*2023*
Reclaimed Water Pipeline	6,051	2027
Reclaimed Water Storage	5,750	2027[b]
Reclaimed Water Pump Station Building	7,420	2031
Construct Biosolids Holding Tank	3,710	2023/2024[a]
Solids Loadout Improvements	3,710	2023/2024[a]
Dewatering Building	9,913	2037
Expand Dewatering Building (3rd Screw Press)	9,913	2037

[a]The City has been collecting impact fees to address the project need and has been monitoring existing demands and future needs to determine how much additional capacity will be needed as part of the improvement.

[b]Accounts for evaporation and losses from the storage ponds.

a. Peak flows to the UV system and Reclaimed Water Pump Station are capped by the existing capacity of the permeate pumps. These systems do not need to be upgraded until the permeate pumps are upgraded and/or additional membrane trains are brought online.
b. See Table G - 19 through Table G - 22 for anticipated/approximate dates for when projects are needed.

Timeline and Opinions of Probable Costs

The cost opinions associated with the required upgrades are described below, as well as a timeline for the proposed improvements. Note that all costs include the following.

- Contractor Mob., Insurance, Bonding, OH&P (20%)
- Program Costs, Engineering, Legal, Administrative (15%)
- Contingency (25%)

Cost opinions will need to be updated during design to incorporate inflation and other market conditions.

Table G - 19: Near-Term Upgrades (prior to 2022)

Component	Capital Cost	Comment
T-01: Upgrade Permeate Pumps	$75,000	Replace 10HP motors with 15 HP for all permeate pumps.
T-02: Process Train #3 and New Biosolids Holding Tank- Convert Train 3 to BNR Process and Replace Solids Holding Tank and Pumps	$4,221,000	Outfit third process train to provide a redundant process basin to allow for basin maintenance, diffuser replacement, etc. This triggers a series of upgrades for the solids holding tank and other dewatering infrastructure that is currently occupying the third process train.
T-03: Reclaimed Water System Add 4th Pump	$245,000	Install additional pump. When the permeate pumps are upgraded and a new membrane train is brought online, the RWPS system will see additional flow during peak flow events.
T-04: Outfit Membrane Tank 5 and Flow Channel	$2,463,000	Provides needed treatment capacity and redundancy in case one basin goes down for maintenance.
T-05: Center Street Lift Station & FM- Add Third Pump and Add Parallel Force Main	$1,589,000	Triplex arrangement with parallel 10" force main to railroad tracks and parallel 12" to WRF
T-06: Solids Loadout Facility	$600,000	Improve solids disposal operations by conveying the dewatered cake to the exterior of the building
TOTAL NEAR-TERM UPGRADES	**$9,193,000**	

Table G - 20: Medium-Term Upgrades (2023-2027)

Component	Capital Cost	Comment
T-07: Convert Backpulse Tank and Outfit Membrane Train 6	$2,496,000	Increases treatment capacity and provides redundancy in case one basin goes down for maintenance. A back pulse tank would not be required at this point due to the higher permeate flows available for use.
T-08: Reclaimed Water System Add Parallel FM	$2,581,000	Install parallel 10" reclaimed water pipeline
T-09: UV System Upgrades- Populate First Channel	$479,000	When the permeate pumps are upgraded and/or new membrane trains are added, the UV disinfection system will see additional flow during peak flow events.
T-10: Grit Removal System	**$2,025,000**	Install grit removal system as grit buildup has become a concern due to higher flowrates.
TOTAL MEDIUM-TERM UPGRADES	**$7,581,000**	

The existing winter storage ponds will approach capacity during this time frame. There are several alternatives available to address this issue. The lowest cost alternative is likely obtaining a UPDES permit, but continued negotiations with DWQ and owners of potential receiving water bodies is required to ensure this is a feasible alternative. Other options include indirect potable reuse (aquifer recharge) and direct potable reuse. There are uncertainties associated with all of the above effluent discharge alternatives including political and public perception issues.

The one alternative that does not require any regulatory oversite or have any political complications is the continued expansion of winter storage ponds. As such, new winter storage costs are included in the table below. These costs are included for the next 10 years until 2032. It is anticipated after 2032 the city will still utilize winter storage / pressure irrigation for effluent disposal, but when the winter storage capacity is exceeded excess flows will be disposed of using a UPDES discharge permit, IPR, or DPR.

Table G - 21: Effluent Disposal/Storage Options (2023-2027)

Component	Capital Cost	Comment
S-01: Winter Storage Pond-Convert Existing Treatment Lagoons	$3,675,000	Convert the existing three treatment lagoons to single winter storage pond, ~36 MG
S-02: Winter Storage Pond-New Winter Storage Near Existing	$31,633,000	Construct new winter storage pond near existing ponds, including PI Pumping Station. This winter storage pond will be sized to provide capacity until 2032. After 2032 it is anticipated an alternative effluent disposal option will be utilized for excess flows (UPDES permit, IPR, or DPR).
TOTAL EFFLUENT DISPOSAL/STORAGE OPTIONS	**$35,308,000**	

Table G - 22: Longer-Term Upgrades (2028-2032)

Component	Capital Cost	Comment
T-11: New 1.5 MGD MBR WRF	$37,500,000	'Mirror' existing WRF liquid train. Assume common biosolids processing facility. Outfit half of MBR basins/capacity at startup.
T-12: Upsize Headworks Drum Screens	$2,570,000	Add larger screens to accommodate peak flow of 6 MGD.
T-13: Biosolids Expansion	$3,526,000	When both screw presses are running 40 hrs/wk, expand building and add 3rd screw press or a belt filter press for more capacity.
T-14: UV System Upgrades	$1,220,000	Populate second channel.
TOTAL LONGER-TERM UPGRADES	**$44,816,000**	

Condition Assessment of Existing Equipment and Asset Management

The Santaquin WRF started up in 2013 and the majority of the equipment at the treatment facility is now 10 years old. Wastewater is a harsh environment and treatment equipment is typically anticipated to last 20 years or less. The City should include equipment replacement costs in their annual wastewater operating budget. It was originally assumed the membranes would need to be replaced after 10-15 years; fortunately, they are still performing well at this time. The buildings and yard piping on the site have an estimated life of 50-75 years.

In the coming years, the City may want to commission a detailed Condition Assessment study to evaluate the treatment equipment and prioritize replacement and upgrades. The following tasks are included in a Condition Assessment Study:

- Evaluate wear based on visual inspection
- Evaluate reliability based on the historical cost of corrective maintenance
- Evaluate existing performance compared to original design criteria
- Estimate the remaining useful life of each asset at the WRF
- Prioritize replacement and upgrading of assets using a criticality assessment
    - Determine how critical an asset is to the proper operation of the plant and magnitude of the impact its failure will have on the continued operation of the facility
    - Prioritize replacement based on the following criteria: safety, permit compliance / process reliability, redundancy, flexibility, and operational impacts

APPENDIX

Membrane Bioreactor Capacity Summary at Increased Flux Rate (14 deg C)

Parameter	Units	Phase	Phase	Phase	Phase	Phase
		1	2	2A	3A	4A
Number of Trains		3	4	4	5	6
Module area	sf	370	370	370	370	370
Modules/Cassette		48	48	48	48	48
Max modules/Cassette		48	48	48	48	48
Cassettes/Train		2	2	2	2	2
Minimum Design WW Temperature	degC	10	10	14	14	14
Net Flux		Flux Estimates at Each Phase				
AADF	gfd	6.10	6.12	7.53	7.53	7.53
Max Month	gfd	6.76	6.78	8.34	8.34	8.34
Max month in clean (one train out; N-1 condition)	gfd	10.14	9.05	11.13	10.43	10.01
Peak Day-All cassettes	gfd	7.98	8.01	9.85	9.85	9.85
Peak Day (24 hour, one cassette out - N* Condition)	gfd	9.57	9.15	11.26	10.95	10.75
Peak Flow -All Cassettes	gfd	14.08	15.68	19.28	19.28	19.28
Peak Flow (4 hour; one cassette out - N* condition)	gfd	16.89	17.92	22.03	21.42	21.03
GPM Flow per Train		Permeate Pump Flow Rates				
@ AADF	gpm/train	150.5	151.0	185.8	185.8	185.8

@ ADMM	gpm/train	166.7	167.3	205.8	205.8	205.8
Max month in clean (one train out; N-1 condition)	gpm/train	250.0	223.1	274.4	257.3	247.0
@ Pk Day	gpm/train	196.7	197.5	243.0	243.0	243.0
@ peak hour all cassettes running	gpm/train	347.2	386.6	475.5	475.5	475.5
Flow in the trains with two cassettes on	gpm/train	416.6	441.9	543.5	528.4	518.8
Flow in the train with one cassette on	gpm/train	208.3	220.9	271.7	264.2	259.4
Design Flows						
AADF	mgd	0.65	0.87	1.07	1.34	1.61
ADMM (PF 1.108)	mgd	0.72	0.96	1.19	1.48	1.78
Peak Day (PF 1.308)	mgd	0.85	1.14	1.40	1.75	2.10
Peak Hour (PF raised from 2.308 to 2.56 per recent flow data)	mgd	1.5	2.23	2.74	3.42	4.11

APPENDIX H
GREY CLIFFS DEVELOPMENT SANITARY SEWER IMPACT EVALUATION

MEMORANDUM

PROFESSIONAL ENGINEER No. 11767034-2202 MICHAEL JAMES COPE 01/09/2023 STATE OF UTAH

DATE: January 9, 2023

TO: Norm Beagley, P.E.

CC:

FROM: Michael J. Cope, P.E.

SUBJECT: Grey Cliffs Development Sanitary Sewer Impact Evaluation

Background

South Valley Holdings plans to develop 350.56 acres of land in the northeast area of Santaquin City. J-U-B Engineers, Inc. (J-U-B) has contracted with South Valley Holdings in the past to evaluate the impacts of the Grey Cliffs development on Santaquin City's sanitary sewer system. Since the completion of the most recent evaluation, South Valley Holdings and Santaquin City have established a development agreement for the Grey Cliffs development.

Due to the topography of the development area, only the eastern and southern portions of the development will be able to gravity flow to the south to the collection system in Cherry Lane. The development agreement contains a temporary arrangement that will allow the developer to construct a development-specific lift station that will pump sanitary sewer flows from the northern portion of the development to the south until future infrastructure is in place to gravity flow the pumped areas to the north. In conjunction with the Santaquin City 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update, Santaquin City asked J-U-B to complete an evaluation of the impacts of the Grey Cliffs development on the City's existing sanitary sewer system, with all flows from the development being routed to the south to the collection system in Cherry Lane, as per the temporary arrangement in the development agreement.

Collection System Level of Service

Santaquin City's Sanitary Sewer Master Plan defines the level of service for sewer pipes in the form of this ratio:

$$\frac{Maximum\ flow\ in\ the\ pipe\ during\ peak\ hour\ (q)}{Capacity\ of\ the\ pipe\ flowing\ full\ (Qfull)}$$

The established level of service for q/Qfull is 0.85, meaning that pipes with a q/Qfull value above 0.85 are considered to be deficient. However, their level of service also says that in some areas of the City where pipes have no service or mainline connections, a q/Qfull value above 0.85 may be acceptable.

Approach

To determine the development's impact on Santaquin City's sanitary sewer system, J-U-B modeled the sanitary sewer flows from the Grey Cliffs development in the existing (2022) model using Innovyze's InfoSWMM® modeling software. We used the model that J-U-B created and recently updated for Santaquin City as part of the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update. We updated the sanitary sewer loading for the Grey Cliffs development based on the most recent development plan and assigned the loading to the gravity sewer pipe in Cherry Lane. Our analysis included three separate model scenarios:

1. Existing (2022) System without Grey Cliffs Development Flows,
2. Existing (2022) System with Grey Cliffs Development Flows, and
3. Existing (2022) System with Grey Cliffs Development Flows and Needed System Improvements.

Criteria

We used the same per-unit flow criteria, temporal distribution for the flow, and peaking factors that were used in the model for the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update. It includes the following criteria:

1. Each residential unit is considered to be one ERU (equivalent residential unit).
2. Commercial land use is assigned 8.54 ERUs per developed acre.
3. The total flow on the peak day is 200 gallons per ERU.
4. Peaking factors for residential ERUs and non-residential ERUs are 2.16 and 1.4, respectively. This means that the flowrate during the peak hour is 216% of the average flowrate during the day for residential ERUs and 140% of the average flowrate during the day for non-residential ERUs. These peaking factors were established during the model

calibration efforts for the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update.

Using the same criteria as the 2022 model means the units in the development area were treated the same way as similar units in the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update, and that the evaluation provides a fair representation of the impacts of the new development on the sanitary sewer system.

Evaluation

J-U-B used the Grey Cliffs development plan provided by the City to determine the number of ERUs to add to the model for the evaluation. There are 215 residential units in the development plan, which equate to 215 ERUs, and 26.28 acres of commercial land, which equate to 224 ERUs, for a total of 439 ERUs. The existing (2022) model did not contain any ERUs within the Grey Cliffs development area. Therefore, it was not necessary to remove any ERUs from the model prior to adding the planned 439 ERUs associated with the Grey Cliffs development. The current development plan, which was prepared by Berg Civil Engineering and provided by the City, can be found at the end of this memo.

Table 1 provides a summary of the modeled development characteristics for the land use types within the Grey Cliffs development that will contribute sanitary sewer flows to the City's collection system.

Table 1: Modeled Development Characteristics by Land Use Type

Land Use Type	ERUs per Developed Acre[1]	Acreage	ERUs	Peak Hour Flowrate (gpm)
Residential	--	76.48	215	69.7
Commercial	8.54	26.28	224	47.0
Total		102.76	439	

[1]Taken from the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update

While we did not assess the buildout system as part of this evaluation, we did assess the buildout system as part of the 2022 Sanitary Sewer System Master Plan and Capital Facilities Plan update. Based on Santaquin City's 2022 General Plan land uses, the Grey Cliffs development area consists of two land use types: commercial and neighborhood-with-open-space. Based on existing developments with these two land use types, commercial areas have an average density of 8.54 ERUs per developed acre and neighborhood-with-open-space areas have an average density of 4.80 ERUs per developed acre. In the buildout model scenario, which is based on the General Plan land uses and their associated densities, the Grey Cliffs development area contains approximately 473 ERUs, which is slightly higher than the 439 ERUs from the development plan. Therefore, the Grey Cliffs development does not contribute more ERUs to the buildout system than those which are based on the General Plan land uses.

Effect of the Grey Cliffs Development on Pipe Capacity

The following paragraphs describe the results of the three model scenarios associated with the Grey Cliffs development.

Model Scenario 1: Existing (2022) System without Grey Cliffs Development Flows

The first of the three model scenarios depicts Santaquin City's existing (2022) sanitary sewer system without any loading from the Grey Cliffs development. Map A, which can be found at the end of this memo, displays the results of this scenario.

There is one area that has a pipe that is shown in red with a q/Qfull value greater than 0.85, or 85%. The pipe located near 50 West 770 North has a very flat slope, which can result in partial blockage and backup during low flows. To reduce the potential for pipe blockage at this location, the City made an operational decision to divert a majority of the flows to the west at the manholes located near 200 East 730 North and 50 West 770 North, which results in higher flows through the pipe with the flat slope. Therefore, the pipe shown in red is not considered to be deficient and the existing collection system has no deficiencies.

Model Scenario 2: Existing (2022) System with Grey Cliffs Development Flows

The second of the three model scenarios depicts Santaquin City's existing (2022) sanitary sewer system with loading from the Grey Cliffs development. Map B, which can be found at the end of this memo, displays the results of this scenario.

Within this scenario, all flows from the Grey Cliffs development were added to the existing collection system in Cherry Lane. As a result of the additional flows, the pipe in 730 North from 200 East to 150 East exceeds the level of service, with a q/Qfull value of 0.996. This pipe is connected to one of the manholes that diverts a majority of the flows to the west by means of a spillover lip to reduce the potential for pipe blockage in the pipe with a flat slope.

Model Scenario 3: Existing (2022) System with Grey Cliffs Development Flows and Needed System Improvements

The third of the three model scenarios depicts Santaquin City's existing (2022) sanitary sewer system with loading from the Grey Cliffs development and system improvements to mitigate the impacts of the development. Map C, which can be found at the end of this memo, displays the results of this scenario.

This model scenario is based on Model Scenario 2, with the addition of a single system improvement to mitigate the impacts of the Grey Cliffs development on the pipe in 730 North from 200 East to 150 East. By lowering the spillover lip in the manhole at 200 East 730 North by approximately 1.5 inches, which allows additional flow to be routed to the north, the q/Qfull value of the pipe in 730 north drops to 0.827, which is within the level of service.

Conclusions and Recommendations

J-U-B concludes that the Grey Cliffs development has a minor impact on Santaquin City's existing (2022) sanitary sewer collection system, with one area at 730 North from 200 East to 150 East that will exceed the level of service due to the additional sanitary sewer flows at Cherry Lane. If the land develops as currently anticipated, J-U-B makes the following recommendation:

1. If the Grey Cliffs development fully develops prior to the installation of future infrastructure that would allow flows from the northern portion of the development to gravity flow to the north, the spillover lip in the manhole at 200 East 730 North should be lowered by approximately 1.5 inches to allow additional flow to be routed to the north.

Attachments: Grey Cliffs Development Plan, Model Result Maps

VICINITY MAP

DENSITY TABULATIONS

ZONING		R-10 / C-1
RESIDENTIAL LOTS		
PHASE A		22 LOTS
PHASE B		29 LOTS
PHASE C		31 LOTS
PHASE D		29 LOTS
PHASE E		33 LOTS
PHASE F		71 LOTS
TOTAL		215 LOTS
COMMERCIAL LOTS		4 LOTS
DENSITY	(215+4) / 340.50	0.64 DU/AC

AREA CALCULATIONS

PROJECT ACREAGE	= 340.56 AC (100.0%)
RESIDENTIAL LOTS (SINGLE FAMILY)	= 76.48 AC (22.5%)
COMMERCIAL LOTS	= 26.28 AC (7.7%)
STREET DEDICATIONS	= 25.52 AC (7.5%)
PRIVATE CONSERVATION EASEMENTS / SENSITIVE LANDS OVER 30% SLOPE	= 24.83 AC (7.3%)
HOA PARCEL (FAMILY CAMP)	= 18.19 AC (5.3%)
PUBLIC NATURAL OPEN SPACE / SENSITIVE LANDS OVER 30% SLOPE	= 154.97 AC (45.5%)
TOTAL SENSITIVE LANDS	= 197.99 AC (58.1%)
PUBLIC IMPROVED OPEN SPACE	= 14.42 AC (4.2%)

HILLSIDE OVERLAY

PROJECT ACREAGE	= 340.56 AC (100%)
TOTAL SENSITIVE LANDS	= 197.99 AC (58.1%)
NET DEVELOPABLE AREA	= 142.57 AC (41.9%)
OPEN SPACE REQ'D (10% NET AREA)	= 14.26 AC
IMPROVED OPEN SPACE PROVIDED	= 14.42 AC

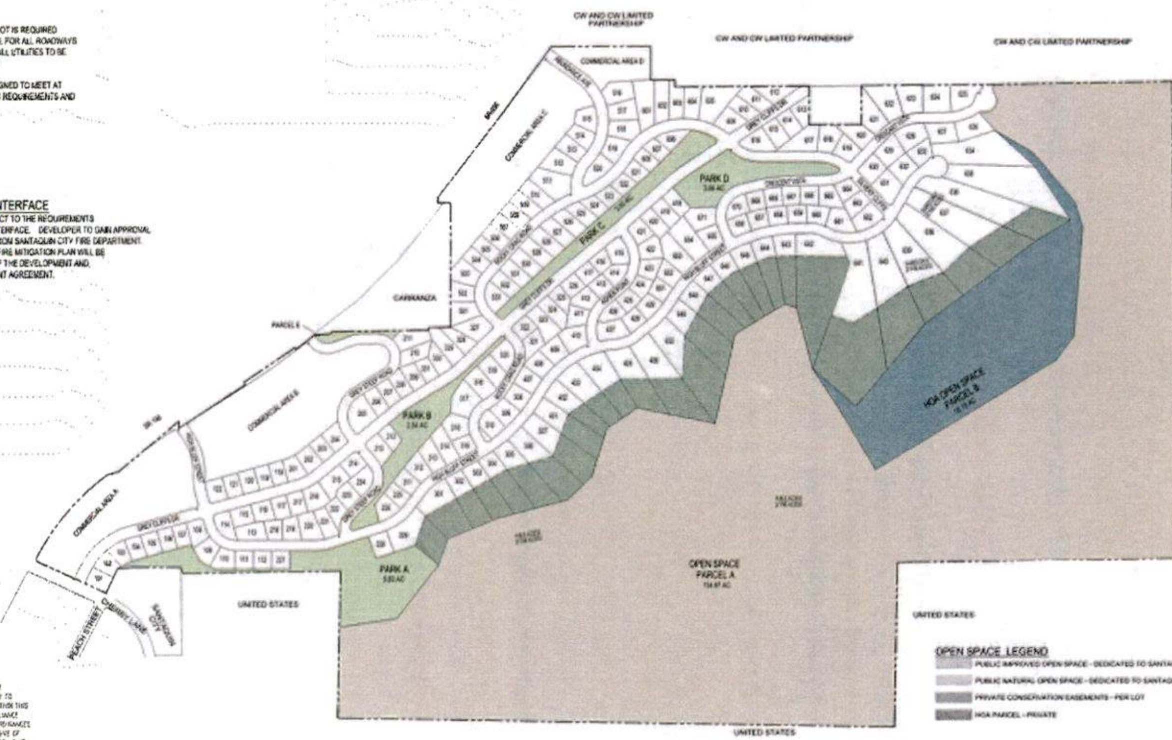
UDOT SR 198

WRITTEN APPROVAL FROM UDOT IS REQUIRED BEFORE FINAL PLAT APPROVAL FOR ALL ROADWAYS CONNECTING TO SR-198 AND ALL UTILITIES TO BE CONSTRUCTED WITHIN SR-198

THE PROJECT HAS BEEN DESIGNED TO MEET AT UDOT INTERSECTION SPACING REQUIREMENTS AND UTILITY LOCATIONS.

WILDLAND / URBAN INTERFACE

THIS DEVELOPMENT IS SUBJECT TO THE REQUIREMENTS OF THE WILDLAND / URBAN INTERFACE. DEVELOPER TO GAIN APPROVAL OF A FIRE MITIGATION PLAN FROM SANTAQUIN CITY FIRE DEPARTMENT. THE REQUIREMENTS OF THIS FIRE MITIGATION PLAN WILL BE NOTED ON ALL FINAL PLATS OF THE DEVELOPMENT AND DETAILED IN THE DEVELOPMENT AGREEMENT.



OPEN SPACE LEGEND

- PUBLIC IMPROVED OPEN SPACE - DEDICATED TO SANTAQUIN CITY
- PUBLIC NATURAL OPEN SPACE - DEDICATED TO SANTAQUIN CITY
- PRIVATE CONSERVATION EASEMENTS - PER LOT
- HOA PARCEL - PRIVATE

THE DEVELOPER AND THE GENERAL CONTRACTOR UNDERSTAND THAT IT IS HIS/HER RESPONSIBILITY TO ENSURE THAT ALL IMPROVEMENTS INSTALLED WITHIN THIS DEVELOPMENT ARE CONSTRUCTED IN FULL COMPLIANCE WITH ALL STATE AND SANTAQUIN CITY CODES, ORDINANCES AND STANDARDS. THESE PLANS ARE NOT INCLUSIVE OF ALL MINIMUM CODES, ORDINANCES AND STANDARDS. THIS FACT DOES NOT RELIEVE THE DEVELOPER OR GENERAL CONTRACTOR FROM FULL COMPLIANCE WITH ALL MINIMUM STATE AND SANTAQUIN CITY CODES, ORDINANCES AND STANDARDS

SHEET INDEX

DEVELOPMENT

GreyCliffs ESTATES

760 N SR198

SANTAQUIN, UTAH COUNTY, UT

DEVELOPER

GREY CLIFFS LLC.

935 W. CENTER

LINDON, UT 84042

801.785.8456

SCALE: 1"= 300'

0 150 300 600 900

berg CIVIL ENGINEERING

REVISIONS | SEAL

ACTION: PRELIMINARY PLAN | DATE: 4/21/2022

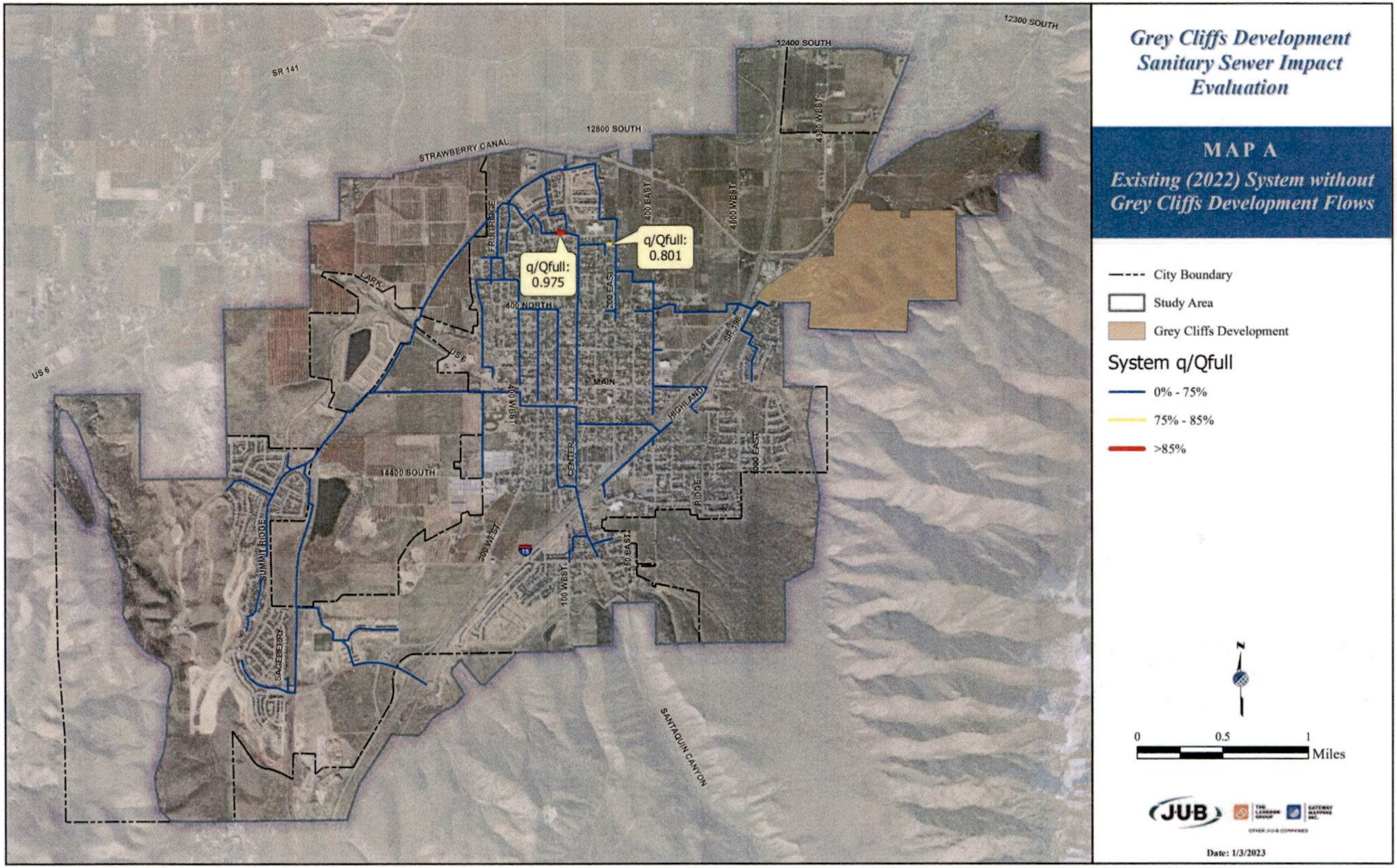
PROJECT

GreyCliffs ESTATES

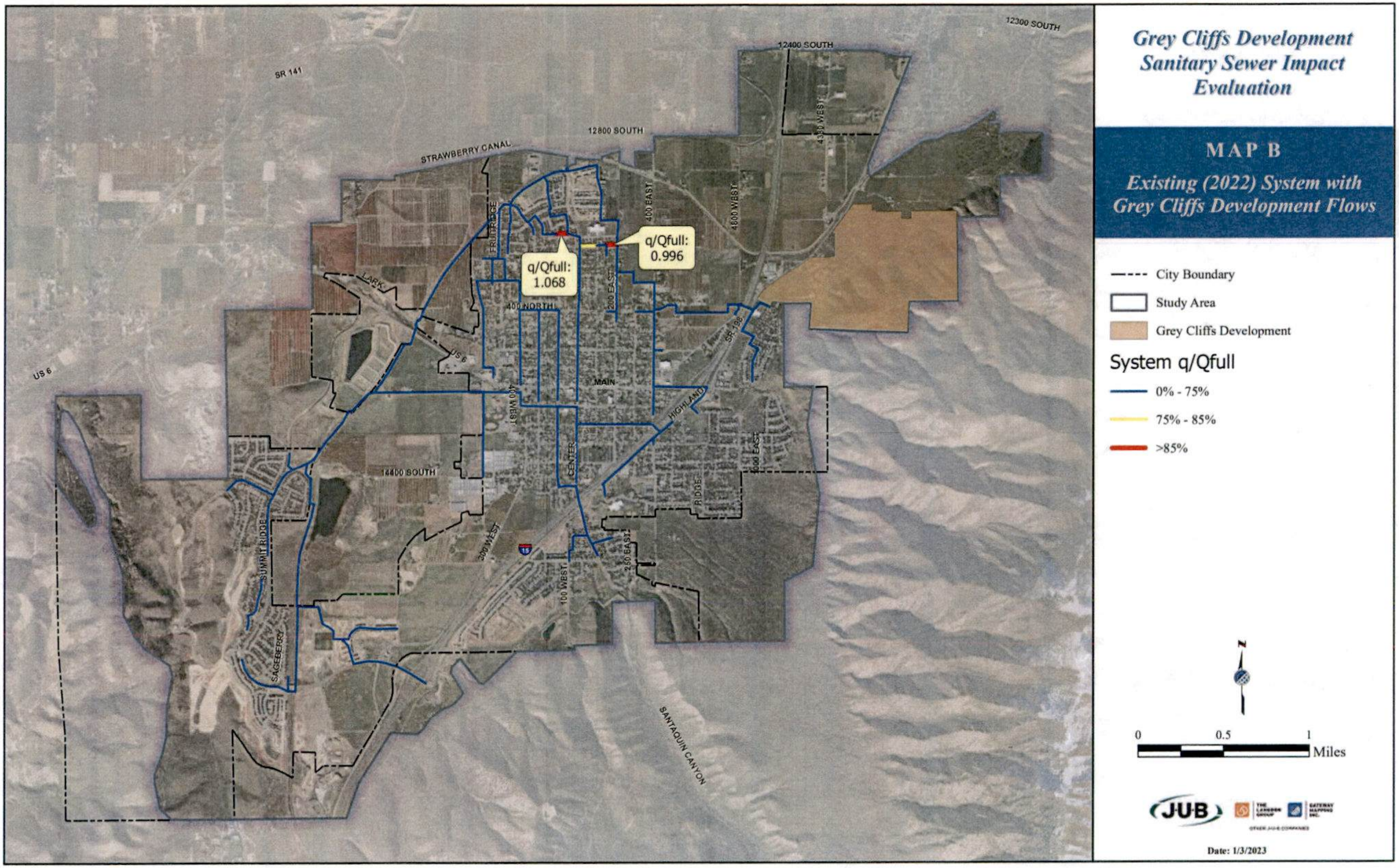
DESCRIPTION

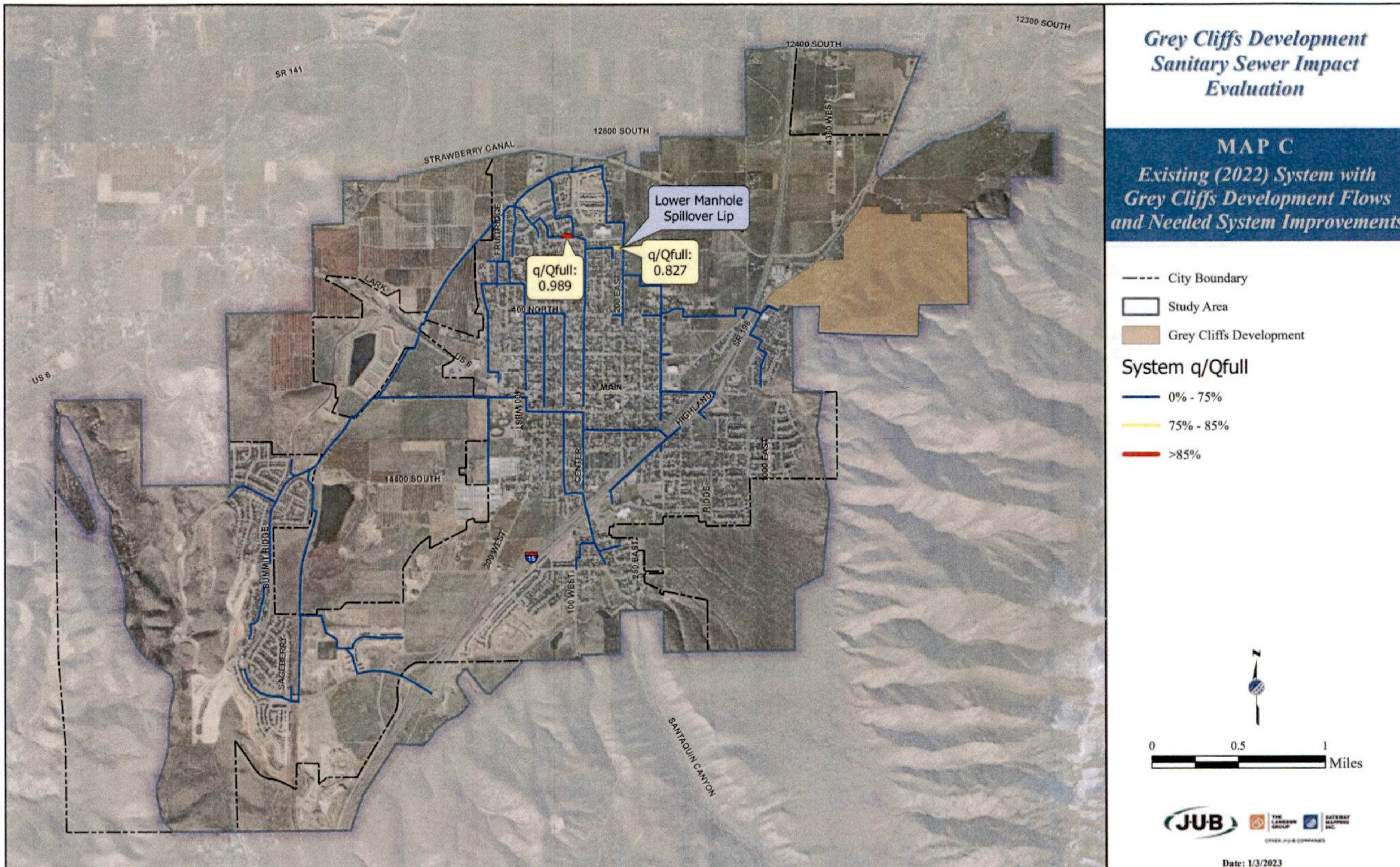
PRELIMINARY PLAN

SHEET NAME: COVER | SHEET NUMBER: C0



Grey Cliffs Development Sanitary Sewer Impact Evaluation
MAP A
Existing (2022) System without Grey Cliffs Development Flows
City Boundary
Study Area
Grey Cliffs Development
System q/Qfull
0% - 75%
75% - 85%
>85%
0
0.5
1
Miles
Date: 1/3/2023
q/Qfull: 0.975
q/Qfull: 0.801
12300 SOUTH
12400 SOUTH
SR 141
12800 SOUTH
STRAWBERRY CANAL
FRUITRIDGE
400 EAST
4800 WEST
4300 WEST
LARK
400 NORTH
200 EAST
SR 198
US 6
MAIN
400 WEST
HIGHLAND
CENTER
14400 SOUTH
RIDGE
1000 EAST
SUMMIT RIDGE
SAGEBERRY
300 WEST
100 WEST
250 EAST
SANTAQUIN CANYON


Grey Cliffs Development Sanitary Sewer Impact Evaluation
MAP B
Existing (2022) System with Grey Cliffs Development Flows
City Boundary
Study Area
Grey Cliffs Development
System q/Qfull
0% - 75%
75% - 85%
>85%
0
0.5
1
Miles
N
JUB
Date: 1/3/2023
q/Qfull: 1.068
q/Qfull: 0.996
12300 SOUTH
12400 SOUTH
SR 141
12800 SOUTH
STRAWBERRY CANAL
4330 WEST
4600 WEST
400 EAST
200 EAST
FRUITRIDGE
LARK
400 NORTH
US 6
SR 198
MAIN
400 WEST
HIGHLAND
CENTER
14400 SOUTH
300 WEST
100 WEST
250 EAST
500 EAST
RIDGE
SUMMIT RIDGE
SAGEBERRY
SANTAQUIN CANYON
15



Grey Cliffs Development
Sanitary Sewer Impact
Evaluation
MAP C
Existing (2022) System with
Grey Cliffs Development Flows
and Needed System Improvements
City Boundary
Study Area
Grey Cliffs Development
System q/Qfull
0% - 75%
75% - 85%
>85%
0
0.5
1
Miles
N
Date: 1/3/2023
Lower Manhole
Spillover Lip
q/Qfull:
0.989
q/Qfull:
0.827
12300 SOUTH
12400 SOUTH
SR 141
12800 SOUTH
STRAWBERRY CANAL
4330 WEST
FRUITRIDGE
LARK
400 NORTH
200 EAST
SR 198
US 6
MAIN
HIGHLAND
400 WEST
CENTER
1000 EAST
13800 SOUTH
RIDGE
SUMMIT RIDGE
300 WEST
250 EAST
100 WEST
SAGEBERRY
SANTAQUIN CANYON