WASTEWATER COLLECTION SYSTEM MASTER PLAN

(HAL Project No.: 260.50.100)

August 2020

HANSEN ALLEN & LUCE INC
ENGINEERS

SPRINGVILLE CITY

WASTEWATER COLLECTION SYSTEM MASTER PLAN

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8-26-2020

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August 2020

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Successful completion of this master plan was made possible by the cooperation and assistance of many individuals, including the Mayor of Springville City, Springville City Council, and City Personnel as shown below. We sincerely appreciate the cooperation and assistance provided by these individuals.

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INTRODUCTION

BACKGROUND AND PURPOSE

Springville is a rapidly growing city in Utah County, Utah. Located in central Utah Valley, between the southeastern edge of Utah Lake and the base of the Wasatch Mountains, Springville is a community that supports a wide range of residential, commercial, industrial, and recreational development, creating a strong economic vitality. Springville is a community that has become a center for the arts, with strong local support. This positive environment continues to attract many new residents and businesses, leading to rapid growth.

The rapid growth has caused increased loads on City resources, including the wastewater collection system. These loads consume available capacity of sewers, lift stations and force mains. Monitoring, planning, financing and constructing new facilities are necessary in order to provided needed capacity to new development.

Recognizing the need for wastewater collection system planning, Springville City retained Hansen, Allen & Luce, Inc. (HAL) to prepare a wastewater collection system master plan. The purpose of the master plan is to 1) estimate wastewater loading values for the existing system, 2) evaluate the existing system's ability to convey existing wastewater flows, 3) prepare growth projections, 4) predict growth areas with City input, 5) prepare future loading estimates based on growth, 6) evaluate future infrastructure needs and 7) recommended projects that will create the additional needed wastewater conveyance capacity.

The results of this study are limited by the accuracy of the development projections and other assumptions used in preparing the master plan. It is expected that the City will continue to review and update this master plan every 5-10 years, or more frequently if the assumptions included in this effort change significantly.

AUTHORIZATION

The Springville City Council and Administration authorized Hansen, Allen & Luce, Inc. to proceed with the wastewater collection system master plan in 2018.

SCOPE OF WORK

A summary of the scope of work is as follows:

1. Communication and coordination.
2. Attend a start-up meeting with the City personnel to discuss data and key issues.
3. Prepare population growth projections.
4. Compare GIS data to the existing system model.
5. Evaluate winter water use billing records to estimate water volumes due to indoor water demand. Use data to estimate infiltration values.
6. Evaluate wastewater treatment plant meter data.

7. Attend a planning meeting to discuss current and future land use.
8. Prepare an existing system model.
9. Prepare a future conditions model.
10. Use the models to identify deficiencies.
11. Develop a capital facilities list.
12. Attend a workshop with City personnel to present results and select preferred alternatives.
13. Evaluate the Westfields and 1500 West pump stations.
14. Prepare estimated construction costs and estimated schedules for project construction.
15. Prepare a draft report.
16. Review draft report with City.
17. Prepare a final master plan document.

PREVIOUS STUDIES

This master plan is part of a long-term on-going planning effort by Springville City. The City has prepared master plans, as needed, in the past to ensure that the wastewater collection system facilities are adequate to meet the community needs. Prior master plans include the following:

1. *Springville City - Wastewater Collection System Master Plan and Capital Facilities Plan*. Springville City Staff. May 2014.

2. *Springville City - Wastewater Collection System Master Plan*. Hansen, Allen & Luce, Inc. May 2006.

CHAPTER 2
EXISTING WASTEWATER SYSTEM

SERVICE AREA

The service area of Springville City's wastewater collection system includes the area within the municipal boundary. This boundary is provided on Figure 2-1. The City may expand the incorporated boundary at a future date, but the expansion schedule has not been identified. Therefore, the wastewater system evaluation and future planning is limited to the existing municipal boundary.

EXISTING WASTEWATER SYSTEM

The existing wastewater system consists of gravity pipes including laterals, collectors, interceptors and outfalls. The system also includes lift stations, force mains and the wastewater treatment plant (WWTP). This master plan evaluates the above items, except that the WWTP is being evaluated by Waterworks Engineers. The existing wastewater system is shown on Figure 2-1.

Source of Data

Data for the existing wastewater collection system was provided by the City. This data includes the following:

- *Wastewater Collection System Master Plan & Capital Facilities Plan*. Springville City. 2014
- Existing and future computer hydraulic models from the 2013 master plan in Autodesk Storm and Sanitary Analysis.
- GIS files of manholes, gravity pipes, lift station and force mains.
- The online Springville City GIS databased located at: https://maps.springville.org/emap/
- Data files of lift stations and completed projects.

Collection Network

The existing Springville City wastewater collection system consists of nearly 135 miles of pipeline and over 2,700 manholes. The pipe sizes range from 4-inch diameter to 36-inch diameter pipe. The system also has force main piping ranging from 2-inch diameter to 12-inch diameter pipe.

Wastewater Treatment Plant

The wastewater in the collection system flows to the Springville City Wastewater Treatment Plant (WWTP). Flows arrive at the WWTP via two outfalls. One is a 36-inch diameter gravity sewer that conveys flows from throughout the City. The second is a pressurized force main from the Nestle facility. This wastewater is pre-treated primarily to remove grease and oils. The WWTP has a permitted capacity of 6.6 MGD

Lift Stations

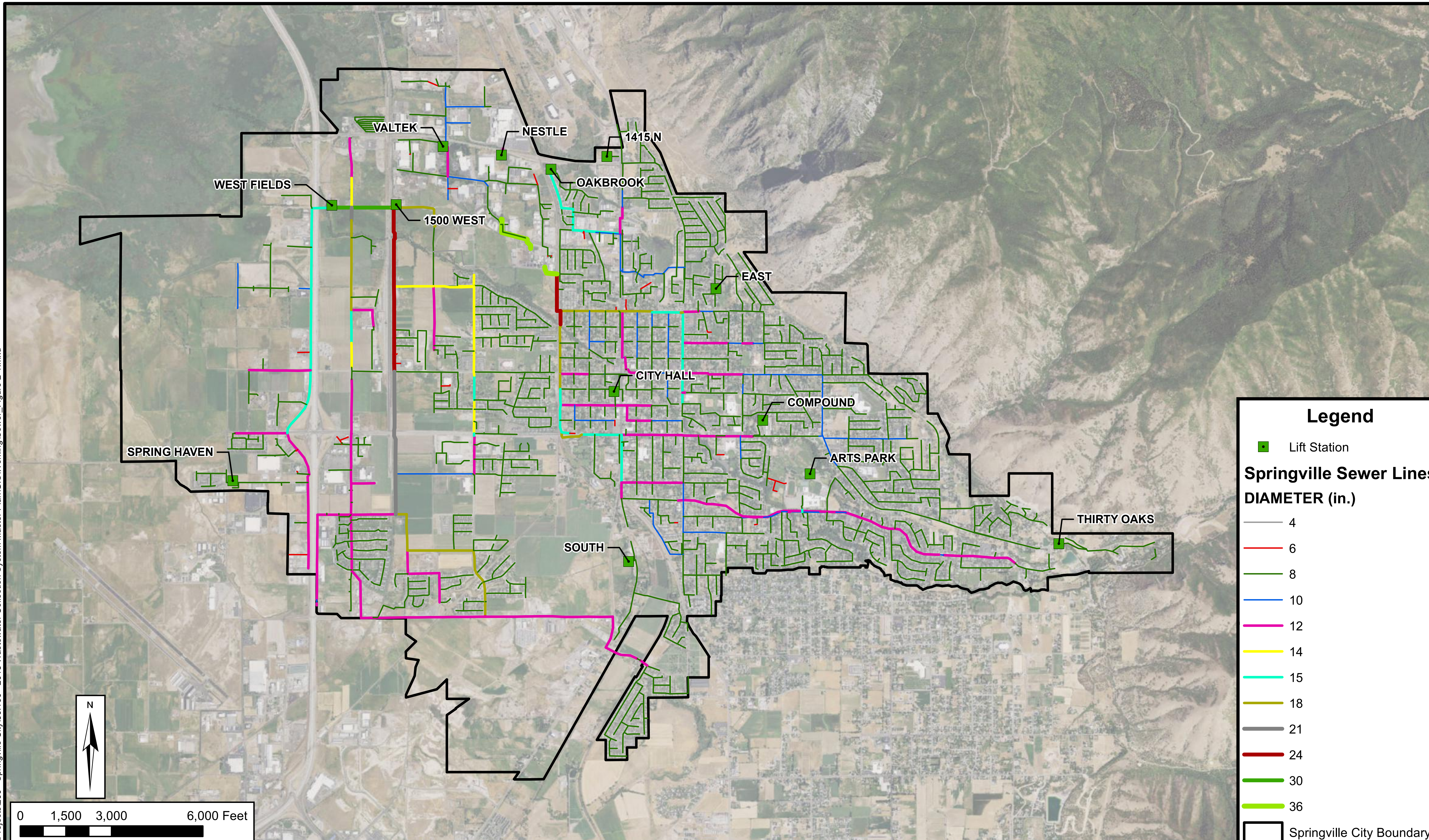
As a result of the relatively flat topography in portions of the City and as a result of the patterns of development growth, it has been necessary to use lift stations in some locations to provide wastewater service. Springville City uses twelve lift stations to convey wastewater to the WWTP. The locations of the lift stations are provided on Figure 2-1. Table 2-1 provides a list of the lift stations with key characteristics.

TABLE 2-1 PUMP STATION INVENTORY

NAME	ADDRESS	VFD	PUMP CAPACITY (GPM)	NO. OF PUMPS	BACKUP POWER
1500 West	1500 W 1000 N	N	1,400	2	Yes
Westfields	1780 W 1000 N	Y	1,800	4	Yes
Valtek	1375 N Industrial Cir.	Y	500	2	Yes
Oakbrook	1275 N Meadowbrook Ln.	Y	700	2	Yes
East	520 N 600 E	N	80	2	Yes
South	1270 So. Main	N	150	2	Yes
Spring Haven	2480 W. 700 So.	N	257	2	Yes
30 Oaks	2800 E. Canyon Rd	N	57	2	No
1415 North	1425 No. Main	N	57	2	No
City Hall	110 So. Main	N	50	2	No
4th South Compound	909 E. 400 So.	N	55	1	No
Arts Park	650 So. 1350 E.	N	55	1	No

Potential for Lift Station Removal or Flow Reduction

The City indicated a desire to eliminate lift stations, when possible, since this would reduce power and other operations and maintenance costs. The City commissioned a separate study to consider how key lift stations could be eliminated and to consider the costs and savings resulting from lift station removal. A copy of the study has been included as Appendix A.



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Springville City
Wastewater Collection System Master Plan

Existing Wastewater Collection System and Service Area Boundary

FIGURE 2-1

CHAPTER 3
FLOW MONITORING

FLOW MONITORING

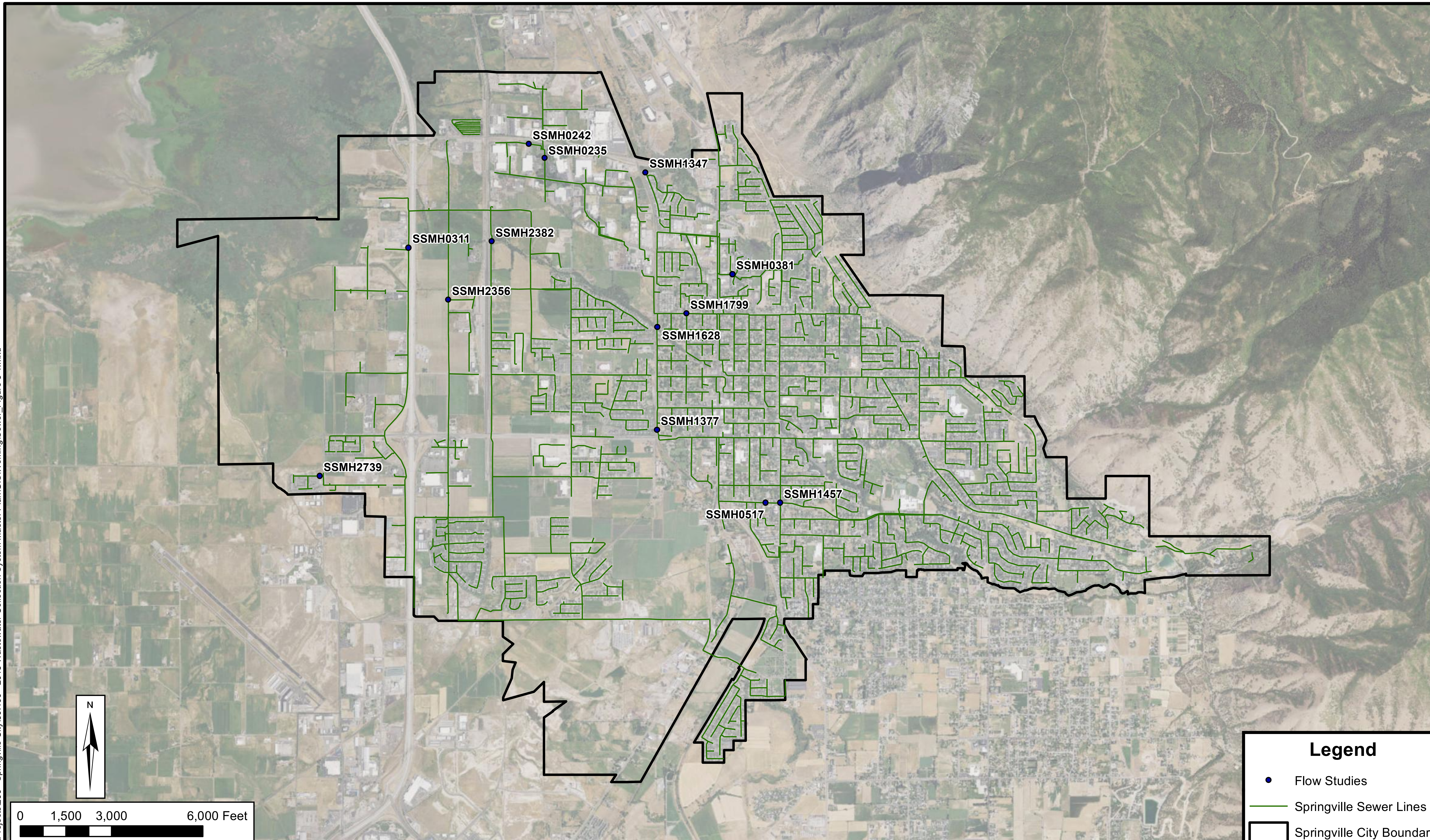
The purpose of flow monitoring is to obtain flow data at several locations throughout the City to provide the basis for flow characterization, including flow peaking factors, construction of a model, and calibration of the model to real values.

Local Flow Monitoring

Flow monitoring was previously completed at various sites throughout the city by City personnel between 2016 and 2017. The data was then provided to HAL for analysis. Each flow study provided about one to two weeks of flow data.

Springville City - Wastewater Treatment Plant Flow Monitoring

In addition to the flow studies, the City provided HAL with three years of metered influent flow data at the wastewater treatment plant headworks. The flows arriving at the treatment plant were analyzed in conjunction with precipitation data and the Nestle pre-treatment flows to determine possible inflow and infiltration values. The model was calibrated to match the assumed peak flow at the treatment plant, including inflow and infiltration. Graphs showing the recorded flow data are located in Appendix B. Flow study locations are shown on Figure 3-1.



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Springville City
Wastewater Collection System Master Plan

Flow Study Locations

FIGURE 3-1

CHAPTER 4
<u>FLOW CHARACTERIZATION</u>

METHODOLOGY

The purpose of flow characterization is to determine the flow patterns and variations that may be experienced by a wastewater system so that sewers, pump stations, and the treatment facility can be evaluated and sized appropriately. The flow characterization included evaluation of the following wastewater flow characteristics:

- Unit Flows
- Daily Flow Variation
- Annual Flow Variation
- Long Term Flow Variation
- Extraordinary Flows

UNIT FLOWS

Unit flows were estimated for Springville City and are expressed as Equivalent Residential Units (ERUs). An ERU is the average wastewater loading of residential units. The ERU is used to express all loadings by the same unit. Commercial, industrial and other types of development loading can be expressed by the same unit as residences. For example, a commercial development that produces a loading of 5 times the average residence will be designated with a 5 ERU loading.

In order to estimate the loading for an ERU, the amount of drinking water used during the winter was examined. Winter drinking water is mostly consumed indoors and can be identified by use type (i.e. residential) from the billing record codes. The amount of indoor water used is essentially the same as the amount of wastewater produced. It is therefore possible to estimate residential indoor wastewater use from the billing records.

Several years of City billing records were obtained and analyzed to determine current average indoor water usage for each equivalent residential unit (ERU) in the City. This resulted in an average indoor water usage of 172 gpd per ERU for 18,250 existing ERUs. Monthly production records and usage patterns were analyzed to determine the peak day indoor demand, which was determined to be 226 gpd per ERU. Water usage in the City has been decreasing over the past several years on a per ERU basis, but it is not known if this trend will continue, stabilize, or reverse. The peak day demand was increased to a level of service of 250 gpd per ERU to account for possible future variability above the current usage. It is assumed that all indoor water usage will be converted to wastewater flow, resulting in a system design wastewater flow of the following:

Hydraulic Loading / ERU = 250 gallons/day

DAILY FLOW VARIATION

Flow in a wastewater collection system varies continuously throughout the day. Data were provided for the WWTP headworks on a 15-minute interval from August 2015 through August 2018. From the data, it may be observed that the minimum flow generally occurs during the early morning between 3:00 AM and 5:00 AM. Maximum or peak flows typically occur during the evening between 8:00 PM and 9:00 PM, with a smaller peak in the morning around between 8:00 AM and 9:00 AM. Another peak occurs in the early morning between midnight and 2:00 AM. This peak is due to operations at the Nestle facility which discharges wastewater during the night, avoiding a coincident peak with the City-wide collections system.

Peaking Factors

Peaking factors were developed for the Springville wastewater collection system. The peaking factor is the ratio between the peak instantaneous flow and the average daily flow. These peaking factors were calculated based on the WWTP loading data and on the local flow studies that were conducted by Springville City personnel.

Flow monitoring data was collected by Springville City at locations downstream of residential, industrial, and mixed-use areas. These local flow studies provided data at key locations for a one to two week period. The peaking factors and flow patterns revealed in the flow studies were examined as part of the effort to establish peaking factors and patterns for the hydraulic model. The data from the flow studies were used to create a pattern of 15-minute increments. Based on this information, peaking factors were determined for the different land use types. The flow study data, peaking factors and patterns are provided in Figure 4-1.

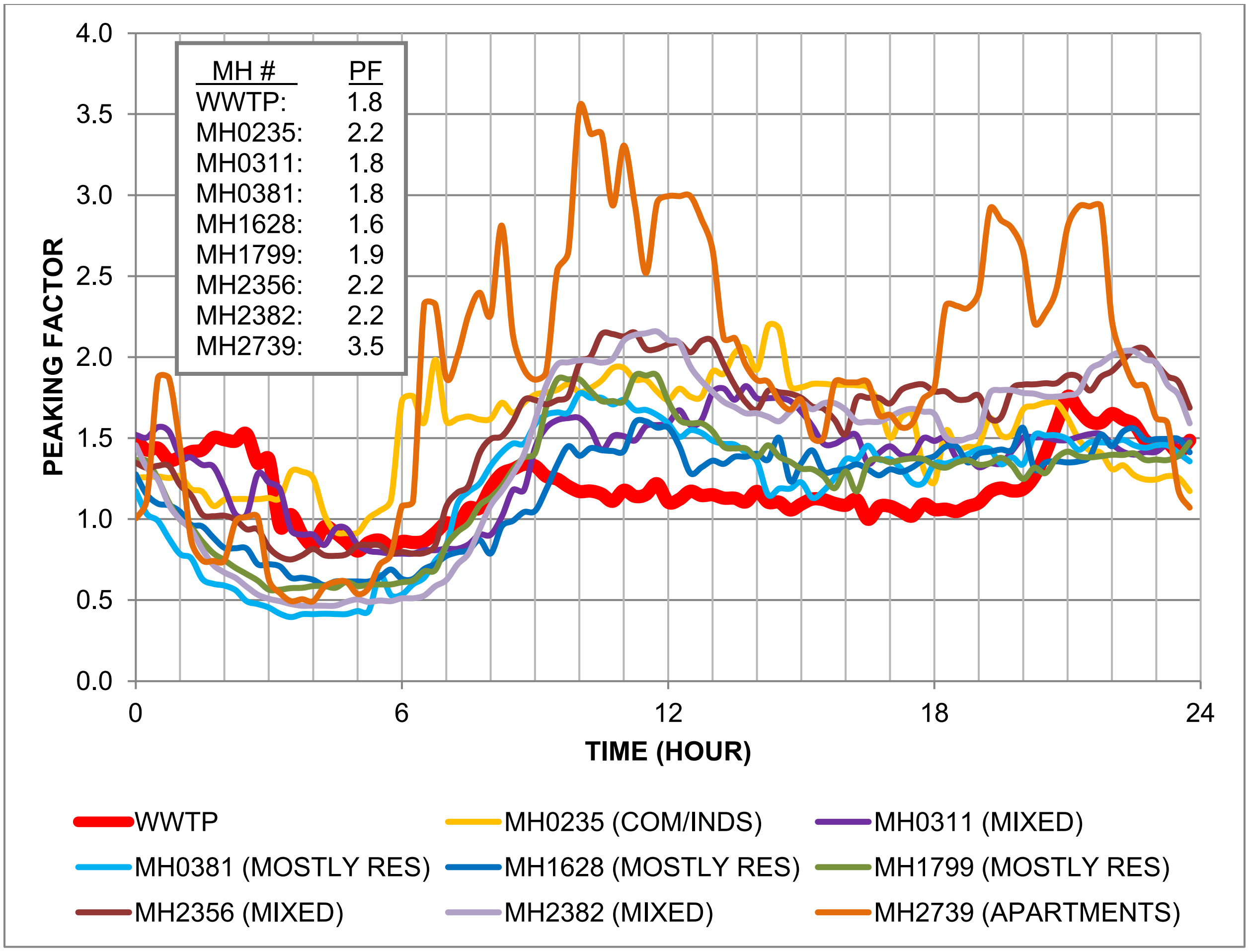


FIGURE 4-1 FLOW MONITORING SITE PEAKING FACTORS

In Figure 4-1, it may be observed that the flow meter data provides information with regard to peaking factor values. The residential, industrial, and mixed-use peaking factors of 2.0, 1.8, and 2.2 were derived from the flow studies. In determining the shape of the diurnal curves for use in the model, the City's recent and historic flow monitoring data were reviewed. It was decided that the shape of the curve used in the previous master plans has been effective and is consistent with the data. The curves were updated based on the new peaking factors. The diurnal curves which were used in the model are provided in Figure 4-2. Note that the shape of diurnal curves that were used in the model approximately match the shape of the WWTP inflow curve.

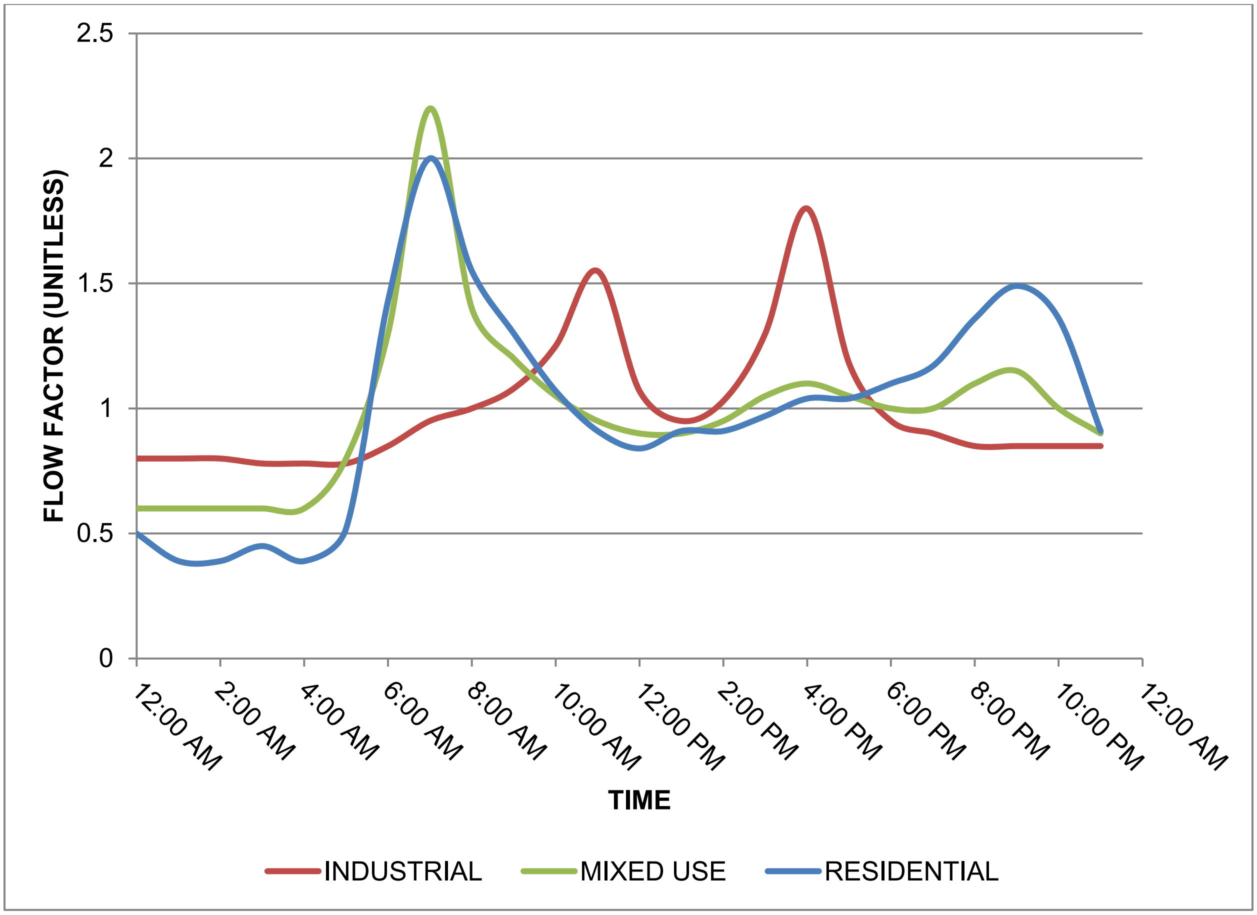


FIGURE 4-2 DIURNAL CURVES

HYDROGRAPHS

Hydrographs were developed for the existing condition, the 2038 projected population and the 2060 projected population. In each case, the wastewater hydrograph was developed using the hydraulic model. A diurnal curve patterns was assigned to hydraulic loadings in each collection area. Each collection area is designated as residential, industrial or mixed use. The model applies the loading to each collection area based on the pattern. An outflow hydrograph results for each collection area. The model also performs routing calculations to determine how the wastewater flows are routed to the WWTP.

SPRINGVILLE WASTEWATER TREATMENT PLANT METER DATA

The Springville wastewater collection system discharges to the wastewater treatment plant (WWTP). A flow meter is located at the treatment plant headworks. 15-minute flowrate data at the treatment plant were obtained from August 2015 through August 2018. The treatment plant flowrate is provided on Figure 4-3. Also, provided on the figure is the daily moving average wastewater flowrate (labeled as the 96 period moving average). This line on the figure shows the average flowrate for each day and helps with a comparison between peak, minimum and average flowrates.

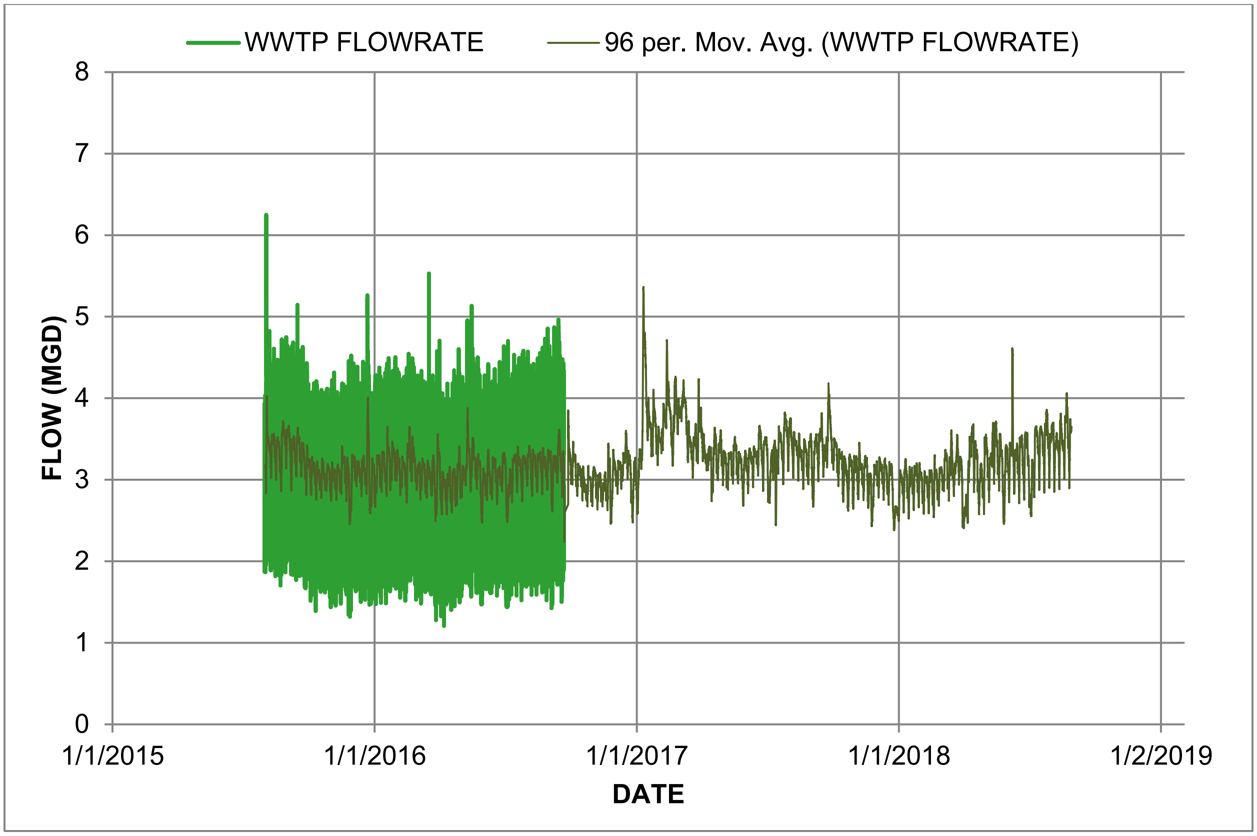


FIGURE 4-3 WWTP HEADWORKS FLOW INCLUDING PRE-TREATMENT

Figure 4-3 provides the total inflow to the Springville WWTP, including the pre-treatment flows from Nestle. It may be observed that flows have generally been in the same range and that a sustained identifiable changing trend is not occurring. However, as the population continues to growth, the wastewater production will inevitably increase.

Nestle Flowmeter Data

The Nestle food processing plant is a major contributor of wastewater to the WWTP. Since the Nestle waste is conveyed via a force main from the Nestle facility to the WWTP, it is not conveyed in the City's gravity sewer system. Therefore, while the Nestle flows are significant to the WWTP, they are independent of the collection system. It is also important to point out that the Nestle flows are not related to population growth and therefore are not expected to change as the City grows, unless significant production changes are made by Nestle.

During development of the flow projections and hydrographs, the Nestle flows have been removed from the analysis. Nestle flows are provided in Figure 4-4. It may be observed in Figure 4-4 that the Nestle peak flows have been consistent within the timeframe of available data, except for the latter portion of 2018. City personnel indicate that this increased flow is due to a maintenance issue at Nestle and flows are expected to be reduced to historic levels. In any case, a look at the data reveals that the peak flowrates typically occur between midnight and 2 am, which is an off peak time for the rest of the City. These flows have not contributed to the maximum peak flow rate due to this timing.

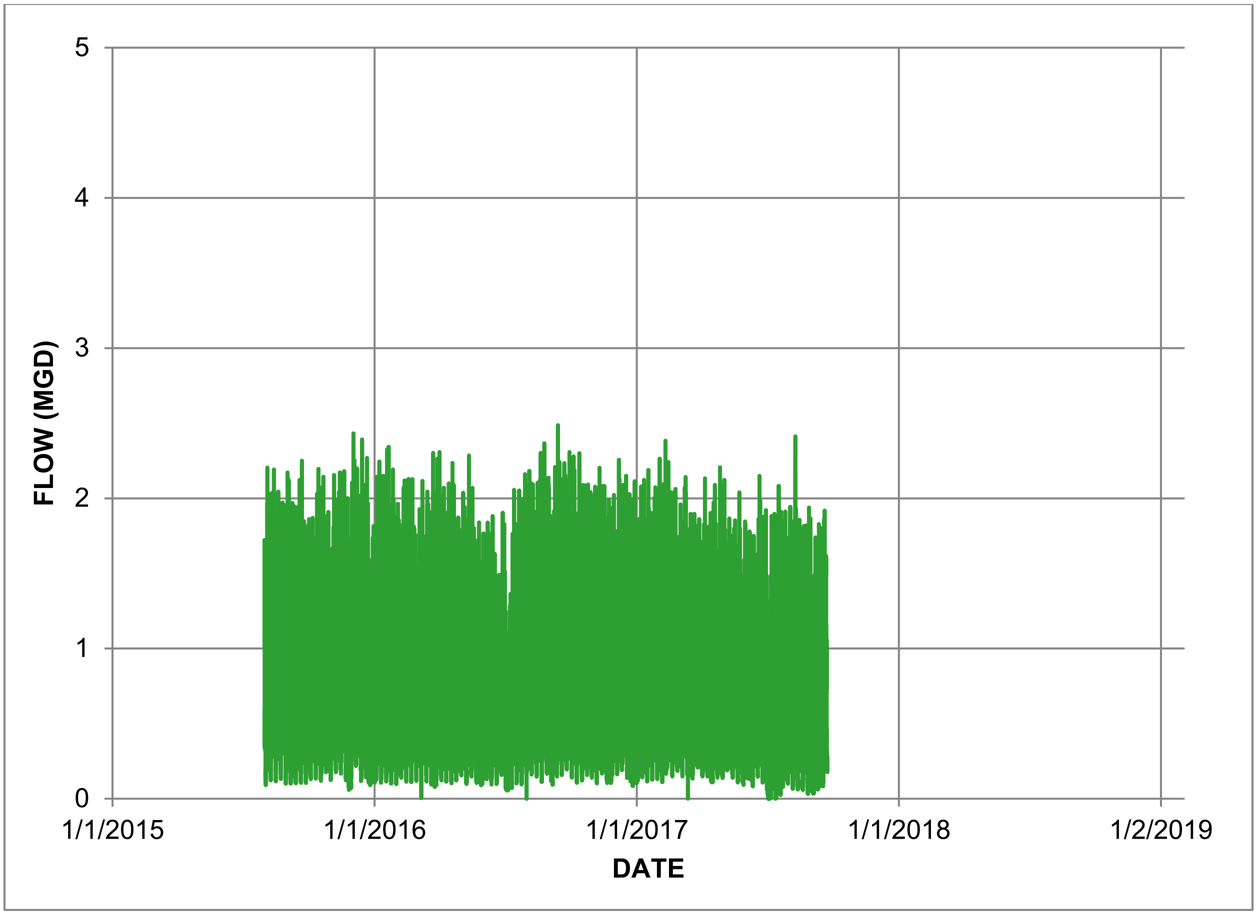


FIGURE 4-4 NESTLE PRE-TREATMENT FLOWS

Wastewater Treatment Plant Loading without Pre-Treatment Flows

The wastewater treatment plans loading was examined after the Nestle flow data was removed. This data is included as Figure 4-5. The average flowrate without the pre-treatment portion over the three years of flow data was 2.7 million gallon/day (MGD). Peak flows were generally less than 5 MGD, although a few peaks, possibly outliers, were higher.

An evaluation of indoor winter water use estimated an average daily flowrate of 2.5 MGD. This is slightly lower that the average WWTP meter data value of 2.7 MGD. The fact that the metered wastewater flow at the WWTP is higher than the water meter data is expected since inflow and infiltration occur.

After reviewing the data with the City, it was decided that an existing flow of 4.4 MGD would be assumed as the current peak loading value. This does not include inflow and infiltration which is discussed below.

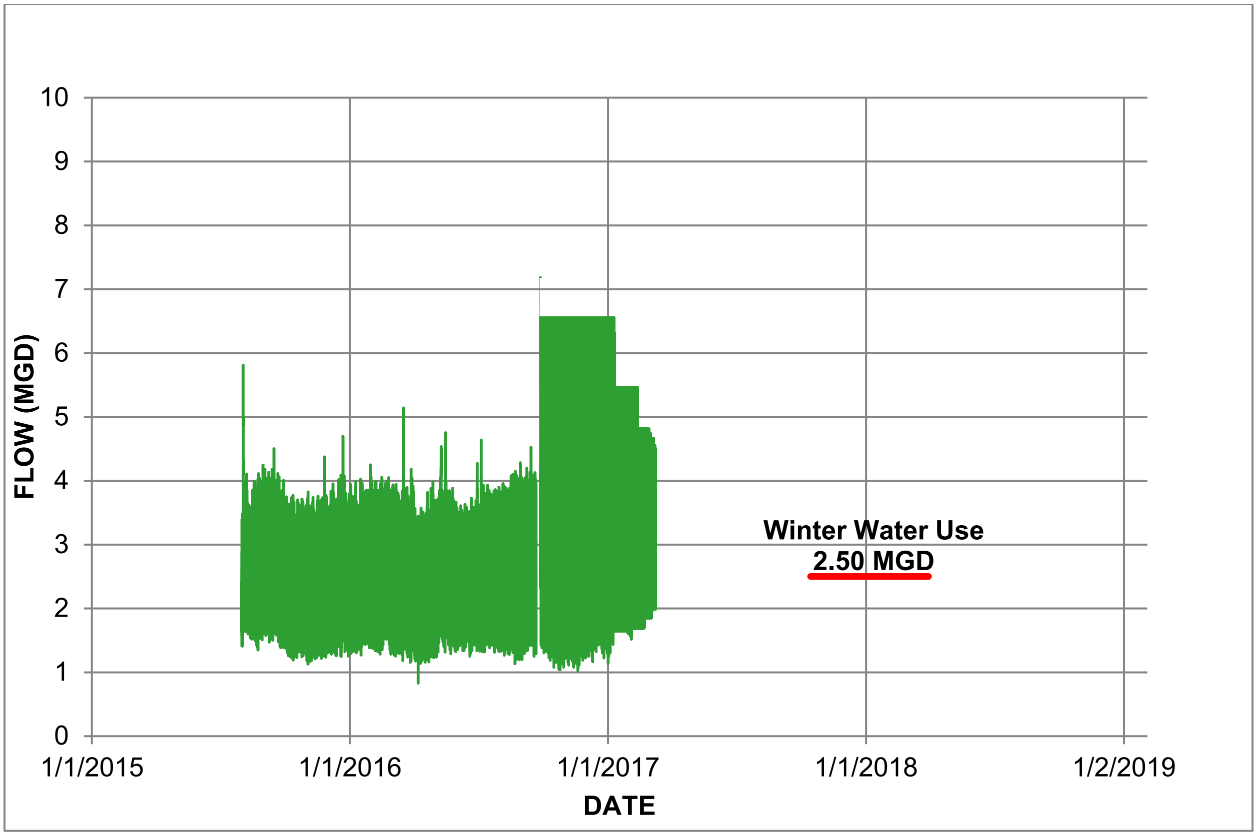


FIGURE 4-5 WWTP HEADWORKS FLOW (NO PRE-TREATMENT)

ANNUAL FLOW VARIATION

Wastewater systems can experience annual flow variation due to infiltration and other seasonal inflows such as irrigation or precipitation events.

Infiltration

Infiltration is defined as groundwater which enters a wastewater collection system through pipe joints, cracks in the pipe, and leaks in manholes or building connections. Infiltration may occur due to seasonal increases in groundwater level or may occur as the groundwater level increases due to a storm.

One indicator of infiltration is changes in the wastewater baseflow (minimum flow). In examining base flow of the study data set, it appears that base flow changes of about 0.4 MGD occurred in the flow record. These changes were discussed with Springville City, and it was decided that a flow of 0.4 MGD would be assumed for infiltration.

Inflow

Inflow is defined as surface water that enters a wastewater collection system (including building connections) through roof leaders, cellars, foundations, yards, area drains, cooling water discharges, manhole covers, cross connections from storm drains, culinary water main flushing, etc.

In order to estimate the amount of inflow, the WWTP data was compared to precipitation data. It was observed that during medium to large storm events, the WWTP flows would increase during or shortly after a rainfall event. One of the larger events occurred during a week in August 2018. The rainfall data and the WWTP flows were plotted together to observe the correlations. This comparison is found on Figure 4-6. A significant spike in flows arriving at the treatment plant can be seen following the storm event. Based on a comparison of peaks before and during the storm, it appears that a peak loading of 1.8 MGD higher than normal occurred at the WWTP due to the storm. Other similar storms showed similar results. It is possible that a larger storm event could cause a greater peak flow at the WWTP. This information was discussed with Springville City. It was decided that an inflow value of 2.0 MGD would be assumed.

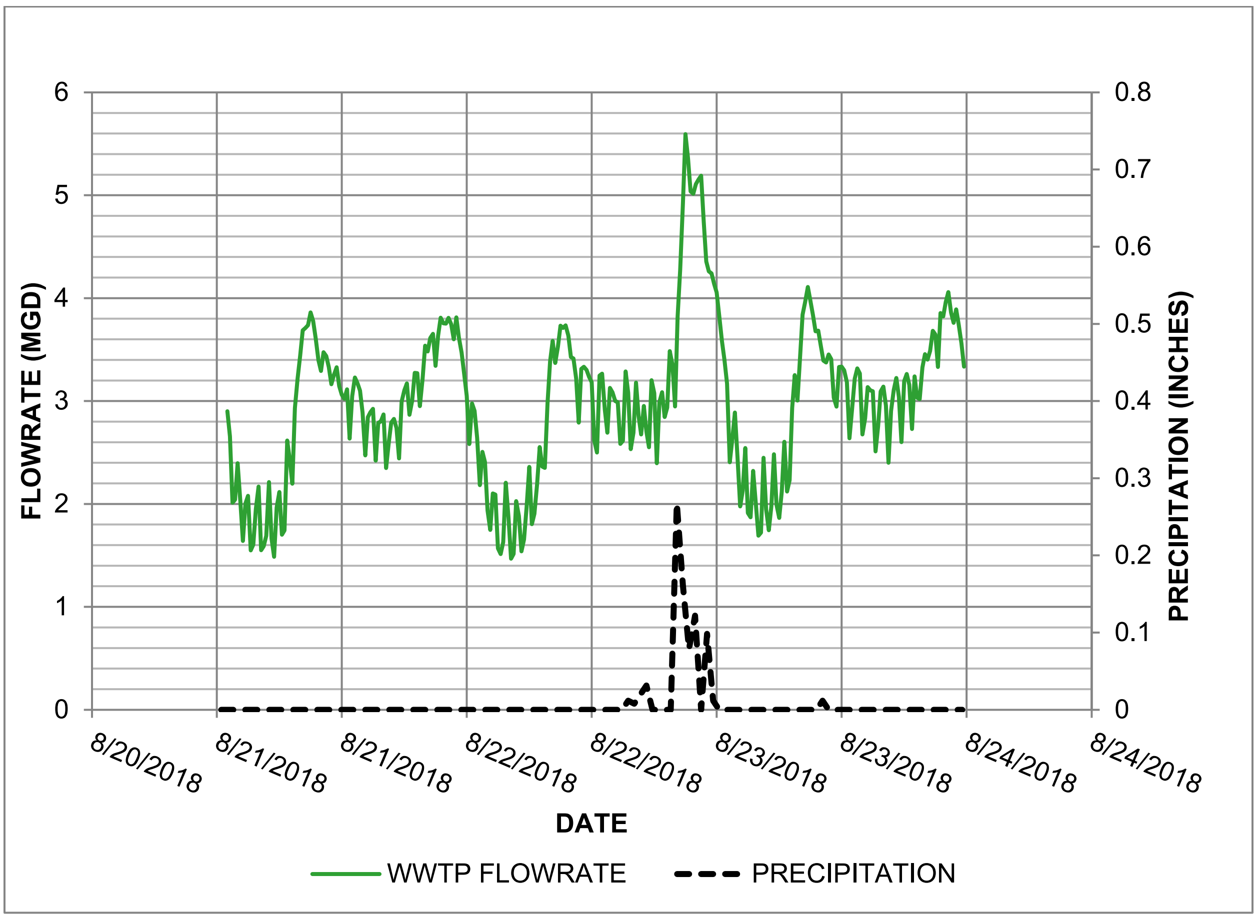


FIGURE 4-6 WWTP FLOW VS. PRECIPITATION

Existing Flow Summary and Modeling Application

Based on the above discussion, a prediction of existing conditions peak flows has been prepared. This summary is provided in Table 4-1.

TABLE 4-1 EXISTING PEAK FLOW SUMMARY

Flow Type	Flowrate (MGD)
Existing Development	4.4
Infiltration	0.4
Inflow	2.0
TOTAL	6.8

The existing flowrates provided in Table 4-1 were included in the hydraulic models. The portion for existing development was distributed in the model throughout the collection areas based on water meter demand data weighting. The infiltration and inflow data were distributed across the collection system in 20 different locations. The infiltration and inflow loading locations was based on an estimate of high water and the results of the local flow studies.

LONG TERM FLOW VARIATION

Average annual wastewater flows usually vary from year to year, although the variation between years is typically not extreme. The most predictable changes in average annual flows are typically associated with changes in population. Long term flow variations may also be caused by changes in weather patterns which may last several years.

Changes in weather patterns can result in changes in infiltration and water use patterns. Decreased precipitation results in lower groundwater levels and less infiltration. Water conservation measures implemented during droughts result in reduction in both indoor and outdoor water use. A reduction in indoor use results in less domestic wastewater. A reduction in outside use for watering lawns and gardens may lead to lowering of the groundwater table and less infiltration. Weather pattern changes are not expected to significantly impact the long-term flow rates of the Springville wastewater collection system.

Long term flow variations are difficult to predict, except those related to population growth. As noted previously, the WWTP flow data does not show a growth trend. However, as the City grows, increases in hydraulic loading values will occur. Otherwise, projected flowrates have not been increased in this study for long term flow variations.

EXTRAORDINARY FLOWS

Extraordinary flows may include flow anomalies such as holidays. Typically, Thanksgiving and Christmas are days with higher flowrates. No predictable extraordinary flow sources were identified during this study. Therefore, no special adjustments were made in the model. The sewer has been sized with some extra capacity to handle higher than expected flows.

CHAPTER 5
<u>WASTEWATER FLOW PROJECTIONS</u>

PLANNING PERIOD

The wastewater collection system master plan planning periods were established in consultation with Springville City. The periods that were modeled were the existing conditions, and projected demands through 2038 (20-year) and through 2060. Growth areas and growth projections were developed in cooperation with Springville City Administration, Engineering and Public Works Departments. Additionally, growth areas within the next ten years were also identified and modeled in isolated areas. This enabled the identification of projects that are needed within the 0-10 year timeframe. Cost estimations were assembled for all projects needed within 20 years. However, only projects needed within the next 10 years are eligible to include in the assessment of impact fees.

COLLECTION AREAS

A collection area is defined as a geographic area that contributes flow to a common point in the collection system. Collection areas were delineated in the 2013 master plan. Existing collections areas were based on the location of existing sewers and services. Future collection areas were based on the location of the existing system and based on likely areas of expansion. For this master plan, collection areas are mostly the same as the previous master plan, but have been updated to match current growth projections, sewer manholes, and topography. The collection areas were updated to reflect improvements to the collection system. The collection areas were also discussed and reviewed by the wastewater collection system operators. Collection areas are generally less than 150 acres and generally have an existing contribution less than 400 units. The delineated collection areas are shown on Figure 5-1.

GROWTH PROJECTIONS

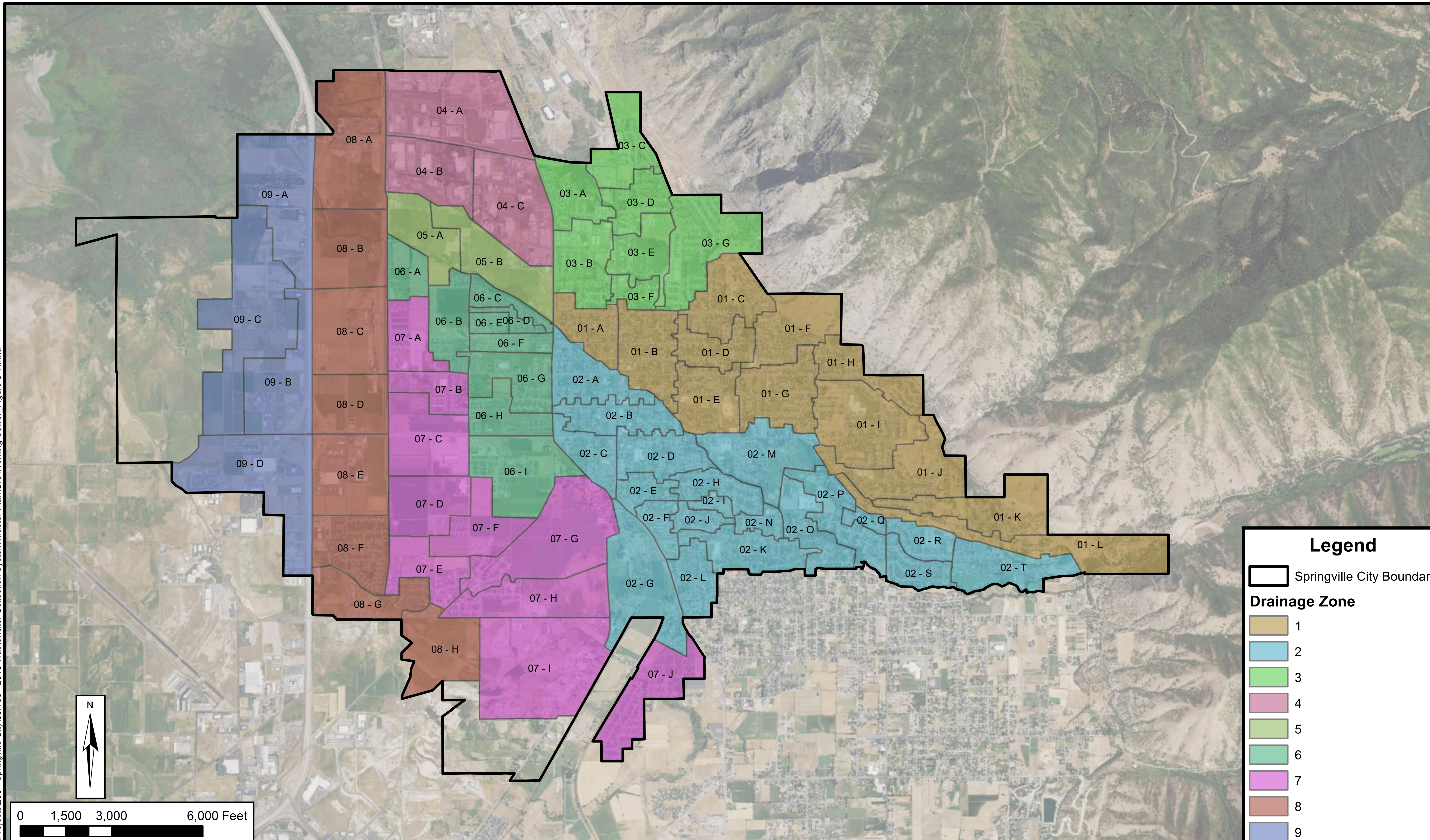
ERU estimates for the existing wastewater collection system and growth projections have been prepared for the planning periods. These estimates and projections are summarized in Table 5-1. A detailed list is provided in Appendix C.

TABLE 5-1 SYSTEM ERU PROJECTIONS

Approximate Year	Additional ERUs	Total ERUs	Description
2018	0	18,250	Existing System
2038	6,240	24,490	20-Year Development
2060	10,800	29,050	2060 Development

FLOW PROJECTIONS

For the 2038 and 2060 planning periods, the new ERUs provided in Table 5-1 were distributed to collection areas throughout the City. The specific distribution of ERUs was based on workshops and discussions with Springville City personnel. The property locations for development



HANSEN ALLEN & LUCE INC ENGINEERS

Springville City
Wastewater Collection System Master Plan

Wastewater Collection Areas

FIGURE
5-1

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applications as well as existing available water and wastewater infrastructure and transportation routes were considered in assigning the growth to areas within the City. Generally, most of the growth is expected to occur in the western portions of the City, with some growth occurring at other locations throughout the City. The City's general land use plan was reviewed to help predict the growth density. Table 5-2 provides a list of the land use types and assumed densities.

TABLE 5-2 ERU DENSITIES

Item	Land Use Type	Land Use Density ERUs/Acre
1	Agriculture	10
2	Commercial	5
3	Commercial/Residential Option	5
4	Industrial / Manufacturing	3
5	Low Density Residential	3
6	Medium Density Residential	10
7	Medium High Density Residential	15
8	Medium Low Density Residential	5
9	Medium Low Density Residential / Commercial	5
10	Mixed Use	5
11	Parks	2

For future loading projections, the loading per ERU (250 gpd) was multiplied by the land use density (ERUs/acre) and the area (acres). These average demands were loaded into the hydraulic models at key manholes. The models were used to apply peaking factors and predict future loading. The future models included 0.4 MGD for infiltration and 2.0 MGD for inflow the same as the existing model. The existing and future peak loadings are provided in Table 5-3.

TABLE 5-3 PROJECT PEAK HYDRAULIC LOADINGS

Planning Period	Peak Hydraulic Loading*
Existing Conditions	6.8
2038	9.3
2060	11.0

*Including infiltration (0.4 MGD) and inflow (2.0 MGD).

It may be observed in Table 5-3 that the projected peak hydraulic loading for 2038 is 9.3 MGD. This is approximately the current wastewater treatment plant design capacity.

Pump Station Flow Projections

The loading projections have been compared with the lift station capacities. Table 5-4 shows the capacities of the pump stations compared to the future projected flow rates to the pump stations.

TABLE 5-4 PUMP STATION FLOW RATE PROJECTIONS

Item	Pump Station	Capacity	Existing Modeled Peak Flow	2038 Modeled Peak Flow	2060 Modeled Peak Flow
1	Valtek	500 gpm	370 gpm	370 gpm	380 gpm
2	Westfields	1,800 gpm	740 gpm	1,650 gpm	**2,080 gpm**
3	1500 West	1,400 gpm	900 gpm	**1,670 gpm**	**2,270 gpm**
4	Oakbrook	700 gpm	630 gpm	640 gpm	**720 gpm**
5	Spring Point	360 gpm	76 gpm	**740 gpm**	**860 gpm**

It may be observed in Table 5-4 that the lift stations are predicted to have adequate capacity to meet existing needs. However, in about 10 to 15-years, the 1500 West lift station will need to be expanded. The 1500 West lift station was designed to be expanded and has space for additional pumps and other equipment. The Westfields and Oakbrook lift stations are predicted to be adequate until a period beyond 20-years.

CHAPTER 6
WASTEWATER COLLECTION SYSTEM EVALUATION

MODEL SELECTION

It was decided by HAL and Springville personnel to use the Autodesk Storm and Sanitary Analysis (SSA) Model Software for the master plan. The software was selected because it had performed adequately in the past, because the City already had an SSA license and because data from the previous master plan was in the SSA format. SSA was also used because of the model's ability to import GIS data, export models to EPA SWMM (free distribution), and because the model runs on an Autodesk platform.

SYSTEM LAYOUT

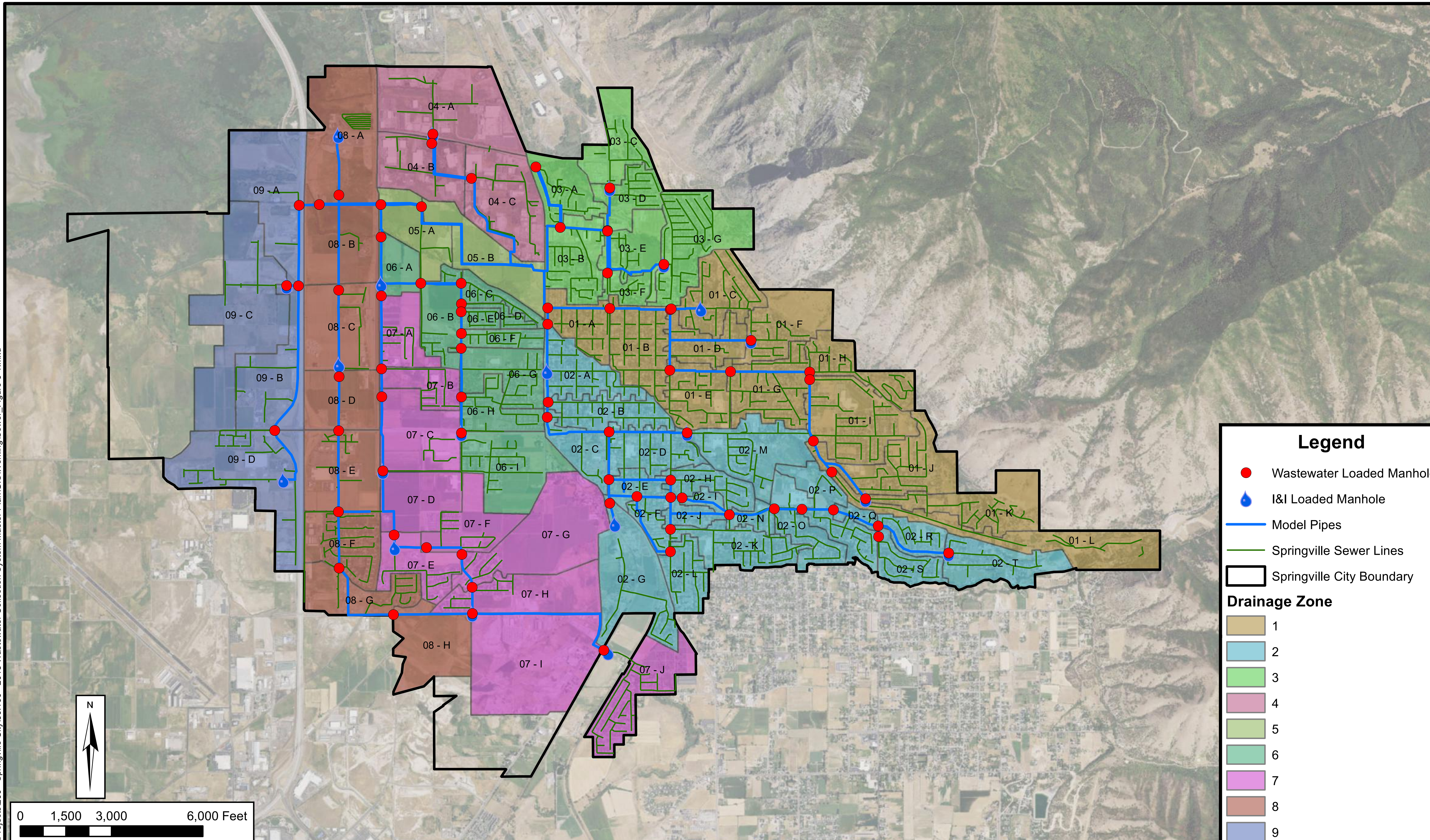
The wastewater collection system layout was provided by Springville in a GIS data format. Copies of the SSA models from the previous master plan were also provided. A map of the Springville wastewater collection system, wastewater and I&I loading, as included in the model, is shown on Figure 6-1. Wastewater loading allocation within the model was performed using GIS and model data. Inflow and infiltration loads were determined using flow data from the wastewater treatment plant and precipitation data. As questions came during model creation, HAL and Springville City personnel coordinated to correct identified errors or to add newly available data to the model.

MODELING CRITERIA

A range of potential modeling criteria and values were suggested by HAL and reviewed by Springville. The criteria and values adopted for this modeling effort are included in Table 6-1.

TABLE 6-1 MODELING CRITERIA

CRITERIA	VALUE OR ASSUMPTION
System Loading	Existing system loading was developed using winter water use data for each water meter and inflow/infiltration based on the tributary area of each manhole with flow data for collection areas. Future loading was developed based on growth projections.
Daily Flow Variation	Diurnal curves were developed from flow monitoring.
Peak Flow	Peaking factors were developed with diurnal curves and peak flows were developed from the AutoCAD SSA model.
Inflow and Infiltration	Inflow and infiltration values were determined by reviewing WWTP data and precipitation values. Infiltration and inflow values were distributed throughout the City.
Planning Period	Years 2038 and 2060.
Land Use & Population Projections	Provided by Springville in 2018.
Pipe Capacity	Roughness Coefficient = 0.013 Manning's n City Selected Maximum d/D = 0.75 for all pipes
Pump Stations	Pump capacities were provided by Springville City. One pump was assumed to be redundant.



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Springville City
Wastewater Collection System Master Plan

Model System Layout

FIGURE 6-1

MODEL CALIBRATION

Model calibration included comparing hydrographs generated by the model with actual flows measured in the collection system, followed by making adjustments to the model to better reflect measured flows. As discussed in Chapter 3, flow data observations at the wastewater treatment plant were used to calibrate the model. The flow studies were also included in the calibration process. The peaked maximum design flow with inflow and infiltration was found to be 6.8 MGD. After the SSA model was calibrated, the peak flow was 6.77 MGD. Flow monitoring locations can be seen on Figure 6-1.

MODEL SCENARIOS

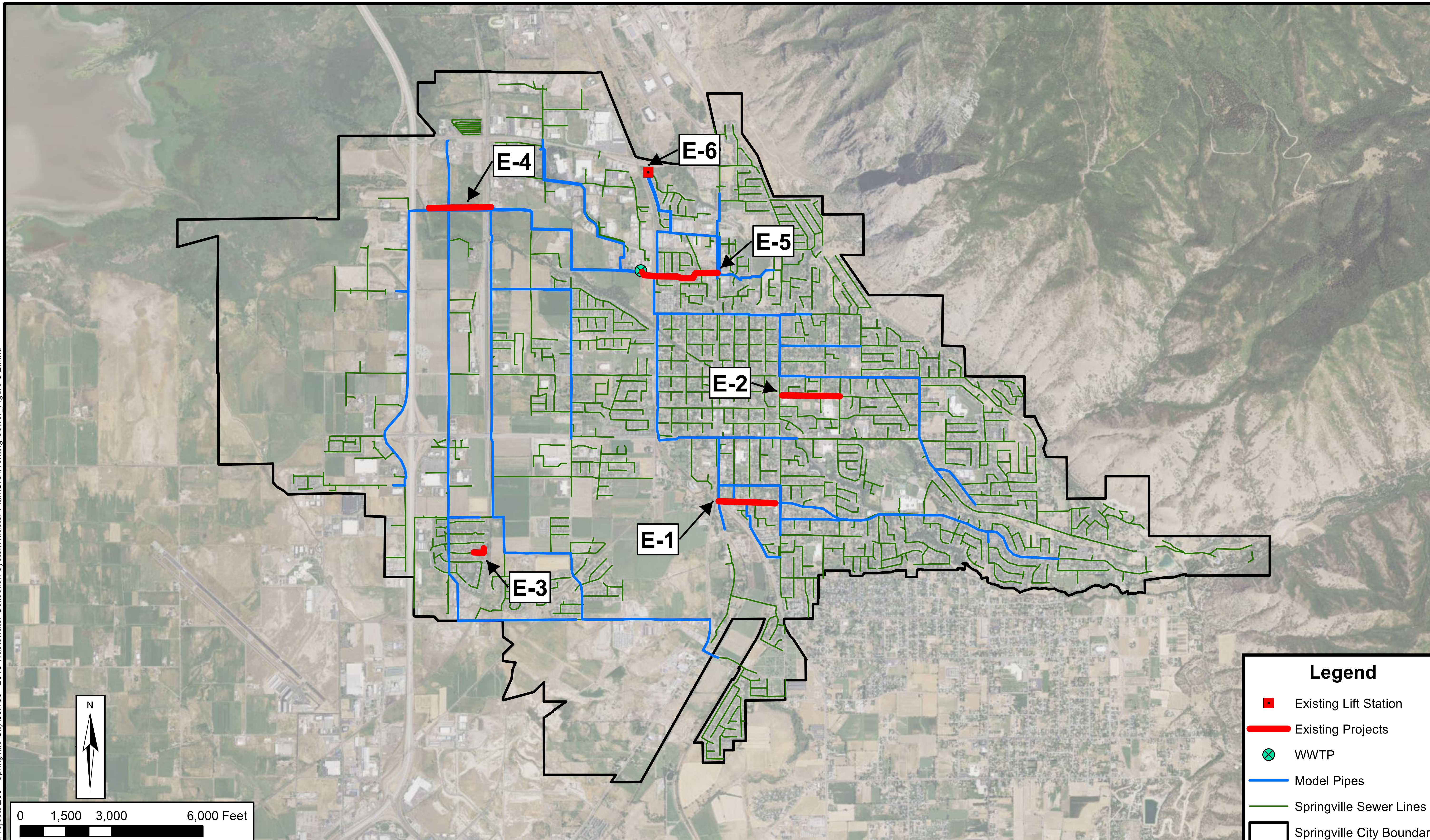
Six modeling scenarios were developed and evaluated for the Springville wastewater collection system as shown in Table 6-2.

TABLE 6-2 MODEL SCENARIOS

SCENARIO	DESCRIPTION
Existing	The Existing scenario was used to identify deficiencies in the wastewater collection system, and to establish a baseline for evaluation of future conditions.
Existing Corrected	The Corrected scenario reflects system improvements that resolve all existing deficiencies.
2038	The 2038 (20-Year) scenario was used to identify deficiencies in the wastewater collection system under 2038 development conditions.
2038 Corrected	The Corrected scenario reflects system improvements that resolve all 2038 (20-Year) deficiencies.
2060	The 2060 scenario was used to identify deficiencies in the wastewater collection system under 2060 development conditions.
2060 Corrected	The Corrected scenario reflects system improvements that resolve all 2060 deficiencies.

EXISTING DEFICIENCIES

The maximum depth ratio is the ratio of the maximum depth in the pipe and the diameter of the pipe (d/D). Deficiencies were identified as pipes in the model that exceeded a d/D of 0.75 during peak flow conditions. Pipe capacity deficiencies identified in the Existing Scenario model are summarized in Table 6-3. Additional operation and maintenance projects, as defined by the City, have also been included with existing deficiencies. Existing deficiencies are shown on Figure 6-2.



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Springville City
Wastewater Collection System Master Plan

Existing Projects

FIGURE 6-2

TABLE 6-3 EXISTING PIPE CAPACITY DEFICIENCIES AND SOLUTIONS

ID (SSA Model ID)	LOCATION	ISSUE	SOLUTION
E-1	From 400 E to Main Street along 800 S	Pipe exceeds capacity because d/D > 0.75 (0.82)	Remove and upgrade existing 8" gravity line to a 1,900 ft 12" gravity line. MH01634 to MH00516.
E-2	From 400 E to 800 E along 100 S	City identified capital facility project	Replace 1,900 ft of existing 8" gravity line. Make connection with 4 way connection to be able to divert flow as needed for maintenance. MH02510 to MH00627.
E-3	1120 S 1510 W	City identified capital facility project	Replace 500 ft of existing 8" gravity line. MH00655 to MH00653.
E-4	Between Westfields Lift Station and 1500 W Lift Station along 1000 N	City identified capital facility project	Install 2,150 ft of new 18" low-head pressurized line to connect wet wells of the Westfields and 1500 W Lift Stations.
E-5	Between Main St. and 450 W along 700 N	City identified capital facility project	Install 2,650 ft of new 12" gravity line. SSMH02204 to SSMH00288
E-6	Oakbrook Lift Station Near Sandy Brook Ln and 400 W	City identified capital facility project	Modify existing wet well of the Oakbrook Lift Station to increase storage volume to 20,000 gallons.

FUTURE IMPROVEMENTS

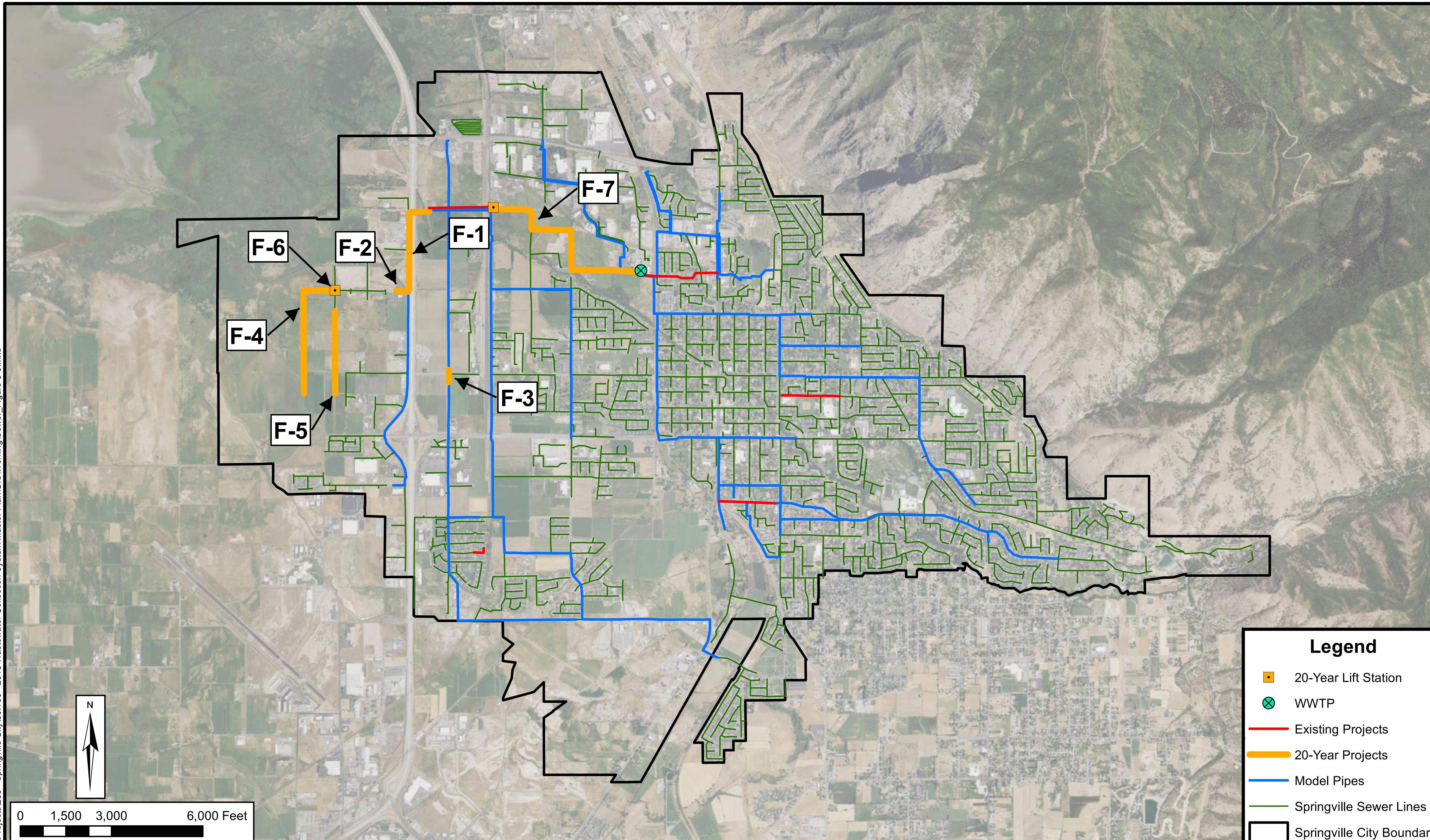
The improvements identified in the future scenarios are predicted problems that will occur if development occurs as projected by the City without system improvements. Future improvements were determined from the 2038 (20-Year) and 2060 modeling scenarios. Pipe capacity improvements identified in the future scenarios are shown on Figure 6-3 and Figure 6-4, and are summarized in Table 6-4. All of the previously identified existing deficiencies would remain problems in the future scenarios if improvements are not implemented. The maximum depth ratios of future improvements are often larger than existing deficiencies due to increased flow from future redevelopment.

TABLE 6-4 FUTURE IMPROVEMENTS

ID (SSA Model ID)	LOCATION	ISSUE	SOLUTION
20-Year Improvements			
F-1 (From SSMH1731 to SSMH00308)	From 500 N to 1000 N along 2000 W	Pipe exceeds capacity because d/D > 0.75 (1.0)	Install 3,300 ft of parallel 15" gravity line next to existing 15" gravity line from SSMH01731 to SSMH00308. A bore crossing is required at the canal and at I-15.

ID (SSA Model ID)	LOCATION	ISSUE	SOLUTION
F-2 (SSP01262)	Along 500 N near 2000 W	Pipe exceeds capacity because d/D > 0.75 (1.0)	Remove and upgrade existing 10" gravity line to a 400 ft 15" gravity line.
F-3 (SSP01356)	From 75 S to 25 N along 1750 W	Pipe exceeds capacity because d/D > 0.75 (0.91)	Remove and upgrade existing 8" gravity line to a 400 ft 12" gravity line.
F-4 (N/A)	From Anderson Development to Spring Point Lift Station	No infrastructure to convey future flows	Install 4,500 ft of 10" gravity line to connect new developments to sewer collection system. A bore crossing is required at the canal.
F-5 (N/A)	Along the east side of the 2400 W drain toward Spring Point Lift Station	No infrastructure to convey future flows	Install 2,700 ft of 10" gravity line to connect new developments to sewer collection system.
F-6 (Spring Point)	Spring Point Lift Station 2500 W 500 N	Modeled flow exceeds future pumping capacity of 360 gpm by 380 gpm.	Construct an additional lift station to increase pump capacity to 900 gpm and maintain one redundant pump.
F-7 (1500W)	1500 W Lift Station 1500 W 1000 N	Modeled flow exceeds existing pumping capacity of 1,400 gpm by 340 gpm.	Install additional 1,500 gpm pump to increase pump capacity to 3,000 gpm and maintain one redundant pump. Install 6,800 ft of 16" force main pipe from lift station to WWTP. Re-construct headworks inlet manhole to accommodate 16" force main pipe.
2060 Improvements			
F-8 (From SSMH00660 to SSMH01929)	From 500 S to 25 N along 1750 W	Pipe exceeds capacity because d/D > 0.75 (1.0)	Install 2,600 ft of parallel 15" gravity line next to existing 12" gravity line from SSMH00660 to SSMH01929.
F-9 (From SSMH02458 to SSMH00149)	From 1325 S to 1150 S along 950 W	Pipe exceeds capacity because d/D > 0.75 (0.89)	Install 910 ft of parallel 12" gravity line next to existing 12" gravity line from SSMH02458 to SSMH00149.
F-10 (SSP01582)	Intersection of Main St. and 800 S	Pipe exceeds capacity because d/D > 0.75 (0.82)	Remove and upgrade existing 8" gravity line to a 260 ft 10" gravity line.
F-11 (Westfields)	Westfields Lift Station West of 1750 W along 1000 N	Modeled flow exceeds existing pumping capacity of 1,800 gpm by 280 gpm.	Remove and construct new lift station with a pumping capacity of 2,500 gpm plus redundant pumps. Switch force main from existing 10" pipe to existing 12" pipe.
F-12 (SSP02515)	WWTP Headworks	Pipe exceeds capacity because d/D > 0.75 (0.75)	Remove and upgrade existing 36" gravity line to a 100 ft 42" gravity line.

ID (SSA Model ID)	LOCATION	ISSUE	SOLUTION
F-13 (From SSMH02550 to SSMH00313)	Along 2000 W near 500 N	Maintenance to remove an adverse pipe alignment.	Replace 570 ft of existing 15" gravity line with 15” gravity line at new grade. A bore crossing is required at the canal.



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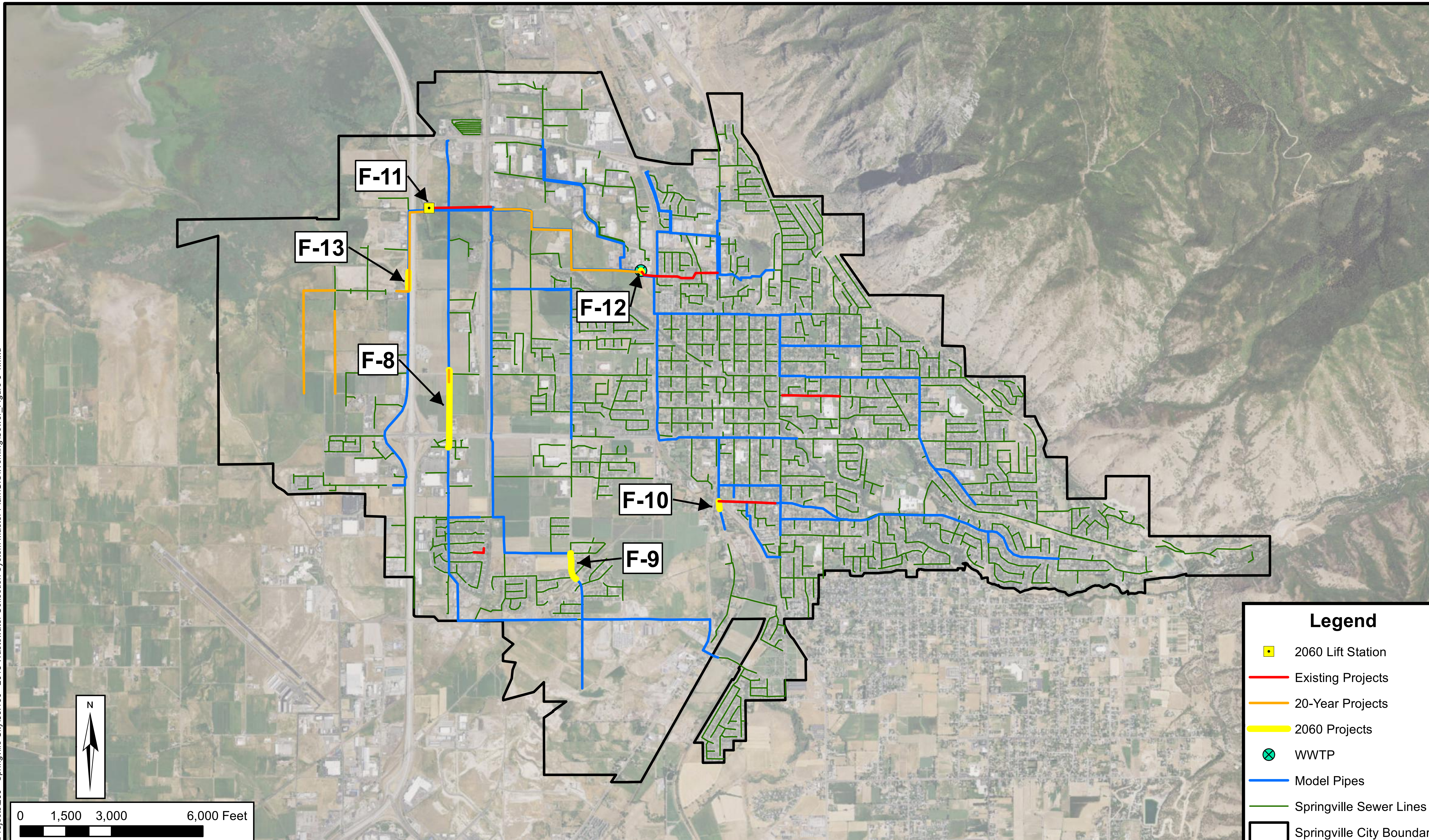
Springville City
Wastewater Collection System Master Plan

20-Year Capacity Improvement Projects

FIGURE 6-3



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Springville City
Wastewater Collection System Master Plan

2060 Capacity Improvement Projects

FIGURE
6-4

CHAPTER 7
OPERATIONS AND MAINTENANCE ALTERNATIVES

Recommendations for key operations and maintenance procedures have been developed. Many of these recommendations are a continuation of procedures already in effect. A discussion is included below, along with a recommendation for continued practice. These items are as follows:

SYSTEM AGING

Pipe age can be used to identify areas that might require more repairs. The typical design life for a sanitary sewer is between 50 and 100 years. Factors affecting design life may include pipe material, soil conditions and quality of construction. Because of the variability of these factors, it is difficult to determine the condition of the wastewater collection system based on age alone. Springville uses sewer video inspection technology to evaluate the structural integrity of the pipes in the sewer network. Sewer video inspection is very useful at identifying cracks, holes, offset joints, erosion, low points in pipes, and significant inflow/infiltration. It is recommended that the City continue the system video schedule and use the inspection to plan for future repair projects.

PIPELINE IMPROVEMENTS

The following improvement alternatives are typically considered when addressing pipeline deficiencies.

Cleaning

If the slope of the pipe is insufficient to provide adequate flow velocity, deposition of solids will occur. Solids deposition lessens pipe capacity. Many locations in Springville are relatively flat where sewers have slopes less than desired. It is recommended that Springville continue cleaning pipes in the system on a regular schedule. Problem areas should be cleaned more frequently.

Clean outs are sometimes installed to clean sewer pipes. However, cleanouts are easily buried or often become unusable. Access manholes are preferred for cleaning and maintenance purposes. It is recommended that access manholes be considers for at clean out locations on the wastewater collections system for cleaning and maintenance purposes (not including small private cleanouts).

Replacement Sewers

Historically, where pipe capacity has been identified as being insufficient, the typical solution has been to provide additional capacity by replacing the existing sewer with a larger sewer. Portions of the recommended projects are replacement projects.

Bypass Sewers/Re-routing Flows

While replacement of an existing sewer may be appropriate when the existing sewer is structurally inadequate, construction of a bypass or parallel sewer to supplement the capacity of the existing sewer is generally a less expensive alternative.

New Sewers

New sewers are often the only option to collect flows from future development or previously inaccessible areas. Because future growth in Springville is expected to occur in areas of the City without existing sewer networks, new sewer networks are expected to be constructed in the foreseeable future.

Alternative Construction Technologies

Within the last few years, several alternative technologies have become popular when sewers need to be replaced, when pipeline capacity needs to be increased, or when there are significant constraints to more conventional construction methods. Typical alternative technologies include:

<u>New Construction</u>

- Steered Auger Boring (Directional Drilling)
- Micro-tunneling

<u>Sewer Pipe Rehabilitation</u>

- Cured-in-Place Pipe
- Slip Lining
- Pipe Bursting
- Pipe Eating
- Thermoforming (Fold and Form)

COMPARISON OF IMPROVEMENT ALTERNATIVES

Sewers

For the purposes of this report, most of the sewer replacements were assumed to be open-cut to provide conservative cost estimates for budgeting purposes. Locations where alternative construction methods were assumed are specified.

Pump Stations

Some of the City's pump stations do not have sufficient capacity to meet the modeled flows determined from the future scenarios. These pump stations were included in the list of future improvements.

Future Considerations

During design of the recommended improvements, the City will review all assumptions, compare improvement alternatives, and will decide on the most cost-effective and appropriate improvement method at that time.

CHAPTER 8
CAPITAL IMPROVEMENTS PLAN

Recommendations have been prepared based on the findings described in the previous chapters. These recommendations include the correction of existing deficiencies as soon as practical and the implementation of future improvements corresponding with population growth. Cost estimates have been prepared for recommended improvements of existing deficiencies and for future improvements through 2038.

PROJECT COST ESTIMATES

Typical representative unit costs were used to development the project construction cost estimates. Sources of typical unit costs included HAL's bid tabulation records for similar recent projects in Utah, and the RS Means Heavy Construction Cost Index. Project cost estimates and related material are included in Appendix D.

ACCURACY OF COST ESTIMATES

When considering cost estimates, there are several levels or degrees of accuracy, depending on the purpose of the estimate and the percentage of detailed design that has been completed. The following levels of accuracy are typical:

Type of Estimate	Accuracy
Master Plan	-50% to +100%
Preliminary Design	-30% to +50%
Final Design or Bid	-10% to +10%

For example, at the master plan level (or conceptual or feasibility design level), if a project is estimated to cost $1,000,000, then the accuracy or reliability of the cost estimate would typically be expected to range between approximately $500,000 and $2,000,000. While this may not seem very accurate, the purpose of master planning is to develop general sizing, location, cost and scheduling information on a number of individual projects that may be designed and constructed over a period of many years. Master planning also typically includes the selection of common design criteria to help ensure uniformity and compatibility among future individual projects. Details such as the exact capacity of individual projects, the level of redundancy, the location of facilities, the alignment and depth of pipelines, the extent of utility conflicts, the cost of land and easements, the construction methodology, the types of equipment and material to be used, the time of construction, interest and inflation rates, permitting requirements, etc., are typically developed during the more detailed levels of design.

At the preliminary design level, some of the aforementioned information will have been developed. Major design decisions such as the size of facilities, selection of facility sites, pipeline alignments and depths, and the selection of the types of equipment and material to be used during construction, will typically have been made. At this level of design, the accuracy of the cost estimate for the same $1,000,000 project would typically be expected to range between approximately $700,000 and $1,500,000.

After the project has been completely designed, and is ready to bid, all design plans and technical specifications will have been completed and nearly all of the significant details about the project should be known. At this level of design, the accuracy of the cost estimate for the same $1,000,000 project would typically be expected to range between approximately $900,000 and $1,100,000.

RECOMMENDED IMPROVEMENT PROJECTS

Development of the recommended improvement projects includes consideration of a number of factors including the following:

- Input by City sewer system operation personnel regarding their experience with, and opinions regarding, the deficiency and potential solutions.
- Input from City management regarding a wide range of issues including: development schedules, budgeting issues, coordination with other public works projects, etc.
- Priority indicated by the modeling efforts and by the operational personnel's experience with the repair projects
- Project cost estimates

Table 8-1 identifies the recommended improvement projects to correct deficiencies and Table 8-2 identifies the recommended improvement projects to prevent pipe deficiencies in the wastewater system and the estimated cost associated with each project.

TABLE 8-1 EXISTING IMPROVEMENT PROJECT COST ESTIMATES

PROJECT ID	DESCRIPTION	COST[1]
E-1	Remove and upgrade existing 8" diameter gravity line to a 1,900 ft 12" gravity line.	**$ 870,000**
E-2	Replace 1,900 ft of existing 8" diameter gravity line. Make connection with 4 way connection to be able to divert flow as needed for maintenance.	**$ 795,000**
E-3	Replace 500 ft of existing 8" diameter gravity line.	**$ 210,000**
E-4	Install 2,150 ft of new 18" low-head pressurized line to connect wet wells of the Westfields and 1500 W Lift Stations.	**$1,150,000**
E-5	Install 2,650 ft of new 12" gravity line. SSMH02204 to SSMH00288	**$1,230,000**
E-6	Modify existing wet well of the Oakbrook Lift Station to increase storage volume to 20,000 gallons.	**$ 110,000**
	TOTAL	**$4,365,000**

[1] All costs include 35% for engineering, administrative costs, and contingencies. Costs are shown in 2019 dollars. 100% of project costs will be covered by the City.

TABLE 8-2 FUTURE IMPROVEMENT PROJECT COST ESTIMATES

PROJECT ID	DESCRIPTION	COST[1]
F-1 (From SSMH01731 to SSMH00308)	Install 3,300 ft of parallel 15" diameter gravity line next to existing 15" diameter gravity line from SSMH01731 to SSMH00308. Bore 150 ft under canal. Bore 230 ft under Interstate 15.	**$2,365,000**
F-2 (SSP01262)	Remove and upgrade existing 10" diameter gravity line to a 400 ft 15" diameter gravity line.	**$ 200,000[2]**
F-3 (SSP01356)	Remove and upgrade existing 8" gravity line to a 400 ft 12" diameter gravity line.	**$ 190,000[3]**
F-4 (N/A)	Install 4,500 ft of 10" diameter gravity line to connect new developments to sewer collection system. Bore 60 ft under canal.	**$2,085,000**
F-5 (N/A)	Install 2,700 ft of 10" diameter gravity line to connect new developments to sewer collection system.	**$1,205,000**
F-6 (Spring Point)	Construct an additional lift station to increase pump capacity to 900 gpm and maintain one redundant pump.	**$1,060,000**
F-7 (1500 W)	Install additional 1,500 gpm pump to increase pump capacity to 3,000 gpm and maintain one redundant pump. Install 6,800 ft of 16" force main pipe from lift station to WWTP. Re-construct headworks inlet manhole to accommodate 16” force main pipe.	**$ 880,000**
	TOTAL	**$7,985,000**

[1] All costs include 35% for engineering, administrative costs, and contingencies. Costs are shown in 2019 dollars. 100% of costs will be paid for by impact fees, except where noted, because the projects are associated with growth.
[2] 10% ($20,000) of the project cost will be paid for by the City and the remaining 90% ($180,000) will come from impact fees due to growth.
[3] 63% ($119,700) of the project cost will be paid for by the City and the remaining 37% ($70,300) will come from impact fees due to growth.

TABLE 8-3 IMPROVEMENT PROJECT COST ESTIMATES SUMMARY

PROJECT IDs	PROJECTS	COST
E-1 to E-4	Existing Recommended Improvement Projects	**$4,365,000**
F-1 to F-6	Future Recommended Improvement Project	**$7,985,000**
	TOTAL	**$12,350,000**

WASTEWATER COLLECTION SYSTEM CLEANING

Wastewater collection system maintenance problems can occur in sewers with flatter slopes, sewers with root problems, and sewers with grease problems. Costs for maintenance and replacement of these sewers should be included in the sewer budget.

UTAH SEWER MANAGEMENT PROGRAM

The State of Utah Water Quality Board has developed a Utah Sewer Management Program (USMP) to reduce sanitary sewer overflows (SSO) by giving added emphasis to collection system maintenance, collection system analysis and program documentation. The USMP is intended to meet forthcoming Capacity, Management, Operation, and Maintenance requirements (CMOM) of the Environmental Protection Agency (EPA). The USMP prohibits SSOs, outlines enforcement, and guidelines for reporting SSOs when they occur. It requires all public agencies that own or operate sanitary sewer collection systems in Utah to enroll for coverage with the Utah State Division of Water Quality (DWQ) under the USMP. The enrollees are required to provide a plan and schedule to properly manage, operate, and maintain all parts of the sanitary sewer system to help reduce and prevent SSOs as well as mitigate any SSOs that do occur. Enrollees must prepare, submit, and certify this Sewer System Management Plan (SSMP) to the DWQ within the time period specified in the USMP after its adoption. Enrollees must then take all feasible steps to comply with the conditions of the USMP and follow their own SSMP including: report SSOs, submit an annual report as part of the Utah Municipal Wastewater Planning Program, and resubmit an updated SSMP at least every five years (R317-801). It is recommended that SSLC enroll in and comply with the USMP.

ELIMINATE UNNECESSARY WASTEWATER

One way to increase capacity in the wastewater collection system is to identify and eliminate the unnecessary generation of wastewater. Wastewater is made up of inflow, infiltration, and direct sewage. An effort should be made to reduce inflow and infiltration because the sewer system experiences a significant amount of inflow and infiltration. Eliminating unnecessary wastewater will not only increase the capacity of the system, but it will also lower the expected treatment costs.

Direct Sewage

Another example of eliminating unnecessary wastewater is to offer incentives to homeowners for replacing older water wasting fixtures and appliances with new water efficient models. Not only do efficient fixtures and appliances save drinking water, they also reduce wastewater flow. It is recommended that Springville offer incentives for installing water wise fixtures and appliances.

FUNDING OPTIONS

Funding options for the recommended projects, in addition to sewer use fees, could include the following options: general obligation bonds, revenue bonds, State/Federal grants and loans, and impact fees. In reality, the City may need to consider a combination of these funding options. The following discussion describes each of these options.

Sewer Service Fees

The sewer service fee is used to pay for the operation and maintenance of the sewer system. As part of the maintenance of the sewer system, it is recommended that sewer systems set aside a part of the budget (including depreciation) into a capital facilities replacement account.

General Obligation Bonds

This form of debt enables the City to issue general obligation bonds for capital improvements and replacement. General Obligation (GO) Bonds would be used for items not typically financed through the Revenue Bonds. GO bonds are debt instruments backed by the full faith and credit of the City which would be secured by an unconditional pledge of the City to levy assessments, charges or ad valorem taxes necessary to retire the bonds. GO bonds are the lowest-cost form of debt financing available to local governments and can be combined with other revenue sources such as specific fees, or special assessment charges to form a dual security through the City's revenue generating authority. These bonds are supported by the City as a whole, so the amount of debt issued for the sewer system is limited to a fixed percentage of the real market value for taxable property within the City.

Revenue Bonds

This form of debt financing is also available to the City for utility related capital improvements. Unlike GO bonds, revenue bonds are not backed by the City as a whole, but constitute a lien against the sewer service charge revenues of a Sewer Utility. Revenue bonds present a greater risk to the investor than do GO bonds, since repayment of debt depends on an adequate revenue stream, legally defensible rate structure and sound fiscal management by the issuing jurisdiction. Due to this increased risk, revenue bonds generally require a higher interest rate than GO bonds, although current interest rates are historically very low. This type of debt also has very specific coverage requirements in the form of a reserve fund specifying an amount, usually expressed in terms of average or maximum debt service due in any future year. This debt service is required to be held as a cash reserve for annual debt service payment to the benefit of bondholders. Typically, voter approval is not required when issuing revenue bonds.

State/Federal Grants and Loans

Historically, both local and county governments have experienced significant infrastructure funding support from state and federal government agencies in the form of block grants, direct grants in aid, interagency loans, and general revenue sharing. Federal expenditure pressures and virtual elimination of federal revenue sharing dollars are clear indicators that local government may be left to its own devices regarding infrastructure finance in general. However, state/federal grants and loans should be further investigated as a possible funding source for needed sewer system improvements.

It is also important to assess likely trends regarding federal/state assistance in infrastructure financing. Future trends indicate that grants will be replaced by loans through a public works revolving fund. Local governments can expect to access these revolving funds or public works trust funds by demonstrating both the need for and the ability to repay the borrowed monies, with interest. As with the revenue bonds discussed earlier, the ability of infrastructure programs to wisely manage their own finances will be a key element in evaluating whether many secondary funding sources, such as federal/state loans, will be available to the City.

Rocky Mountain Power Energy Incentive

Rocky Mountain Power will provide financial incentives for utilities to reduce energy use.

Impact Fees

Impact fees can be applied to water related facilities under the Utah Impact Fees Act. The Utah Impacts Fees Act is designed to provide a logical and clear framework for establishing new development assessments. It is also designed to establish the basis for the fee calculation which the City must follow in order to comply with the statute. However, the fundamental objective for the fee structure is the imposition on new development of only those costs associated with providing or expanding water infrastructure to meet the capacity needs created by that specific new development.

REFERENCES

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Utah Division of Administrative Rules. 2019. *Utah Administrative Code, R317-3*. The Department of Administrative Services.

APPENDIX A

Lift Station Technical Memorandum

TECHNICAL MEMORANDUM

HANSEN ALLEN & LUCE INC ENGINEERS

DATE:	August 26, 2020
TO:	Mr. Jeff Anderson, P.E. Springville City Engineer 110 S Main St. #5741 Springville, Utah 84663
FROM:	Benjamin D. Miner, P.E. Jacob Nielsen, Engineer Hansen, Allen & Luce, Inc. (HAL) 859 W. South Jordan Parkway, Ste. 200 South Jordan, Utah 84095
SUBJECT:	Sanitary Sewer Lift Station Analysis
PROJECT NO.:	260.50.100

8-26-2020

PROFESSIONAL ENGINEER
BENJAMIN D. MINER
No. 318761-2202
STATE OF UTAH

INTRODUCTION

Springville City (the City) operates 12 sewer lift stations throughout the City. Generally, the City prefers to avoid the use of lift stations because of maintenance and power requirements. City crews dedicate large amounts of labor to cleaning and maintaining the lift stations.

At times, lift stations are the only way to service low lying areas of the City in that they allow development of areas that are lower in elevation than existing gravity operated sewers. However, with new development and the related sewer construction, and as funding becomes available, lift stations can sometimes be taken out of service.

The City has identified three lift stations that are candidates to be taken out of service. These are the East Lift Station, the Thirty Oaks Lift Station and the South Lift Station. Additionally, the City desires to reduce the amount of flow that is being pumped at the Oakbrook Lift Station.

ELEVATION DATA

The evaluation of the lift stations has relied on elevation data provided in the Springville City GIS database, including rim and flowline elevations and including the 2012 Lidar Data. Prior to the design and construction of a project, it will be necessary to confirm the elevations with a land survey.

BACKGROUND, METHODOLOGY, AND COST ESTIMATING

Sewer flow demands assumed for each lift station analyzed either came from the SSA model used to develop the 2019 Sewer Master Plan, or were calculated by estimating the average daily sewer demand. This was done by counting the number of Equivalent Residential Units (ERU) and multiplying by the level of service estimated to be 250 gallons per day per ERU. Inflow and infiltration (I&I) were also added to represent the peak day demand. From the master plan, I&I was estimated to account for 35% of the peak day flow at the treatment plant. The sewer demands arriving at the lift stations were also scaled up by 35%.

Operation and maintenance costs were provided by the City. Materials and equipment used to repair or maintain all of the City's lift stations was $42,027 in the fiscal year 2019. The annual labor, excluding weekly cleanings and inspections, was 300 hours billed at $38/hour. This equates $11,400. These annual costs ($53,427) were proportionally allocated to each lift station based on the pumping capacity of each facility. Each lift station was also assumed to have a weekly cleaning or inspection requiring 2 city personnel for 2 hours, again billed at $38/hour. The annual cost of cleanings and inspections assumed for each lift station is $7,904.

Power costs were also provided by the City. The City pays $0.0865/kWh with an assumed $25.63/month as a service charge for each lift station. The annual energy used by each lift station was provided by the City in order to calculate the annual cost to operate each lift station.

The feasibility of taking these sewers out of service has been evaluated and is described below.

East

The East Lift Station is located at 520 North 600 East. This lift station serves about 61 lots. The lift station is currently necessary since the surrounding neighborhood is located in a low-lying area. The potential pipe alignment that could facilitate the removal of the lift station is shown in Figure 1. This alternative is to connect a new 8-inch diameter sewer to SSMH01139 and route the sewer through residential lots to 450 East. The sewer would then be connected to SSMH01117 at the intersection of 450 East and 550 North. The economic feasibility of removing this lift station is shown in Table 1.

Table 1: East Lift Station Cost Estimates

Item	Description	Cost	Savings
Annual Power			
	11,087 kWh @ $0.0865/kWh		*$959.03*
	12 months @ $25.63		*$307.56*
	Total Annual Power		$1,266.59
Annual O&M			
	Weekly Cleaning/Inspections		*$7,904.00*
	Materials and Equipment		*$828.17*
	Total Annual O&M		$8,732.17
Annual Total	Annual Power and O&M		$9,998.75
20-Year Total	$9,998.75 x 20		$199,975.01
	Summary		
	Capital Project Cost (910 ft of 8" pipe @ $308.11/LF)	**$380,000.00***	
	20-Year Savings		**$199,975.01**
	Project Net Cost	**$180,024.99**	

*Cost reflects 35% for engineering and contingency.

It is important to note that one of the City goals has been to reduce the amount of wastewater reaching the Oakbrook Lift Station. While the re-routing scenario described above eliminates the East Lift Station, it increases the flow to the Oakbrook Lift Station.

Thirty Oaks

The Thirty Oaks lift station is located at 2800 East Canyon Road. It currently serves about 20 lots. It is feasible to eliminate this lift station and re-route wastewater along the side or back of lots along Canyon Road and provide sewer service to properties that are currently on septic systems. The alignment, shown in Figure 2, would tie into SSMH02366 on 1100 S. The economic feasibility of removing this lift station is shown in Table 2.

Table 2: Thirty Oaks Lift Station Cost Estimates

Item	Description	Cost	Savings
Annual Power			
	3,740 kWh @ $0.0865/kWh		*$323.51*
	12 months @ $25.63		*$307.56*
	Total Annual Power		$631.07
Annual O&M			
	Weekly Cleaning/Inspections		*$7,904.00*
	Materials and Equipment		*$590.07*
	Total Annual O&M		$8,494.07
Annual Total	Annual Power and O&M		$9,125.14
20-Year Total	$9,125.14 x 20		$182,502.75
	Summary		
	Capital Project Cost (950 ft of 8" pipe @ $308.11/LF)	**$400,000.00***	
	20-Year Savings		**$182,502.75**
	Project Net Cost	**$217,497.25**	

*Cost reflects 35% for engineering and contingency.

South

The South Lift Station is located at 1270 South Main. It currently serves about 115 lots. A solution to remove the lift station and allow the wastewater to gravity flow all the way to the WWTP was evaluated and found to not be feasible. The feasible solution discussed here provides a gravity line through the fields on the west side of State Road 51 and tying in at SSMH00205 on 1375 S. However, this solution routes flows to the 1500 W Lift Station, which pumps to the WWTP at a higher head than the South Lift Station. The proposed capital project is shown in Figure 3 and the economic feasibility of removing this lift station is shown in Table 3.

Table 3: South Lift Station Cost Estimates

Item	Description	Cost	Savings
Annual Power			
	18,883 kWh @ $0.0865/kWh		*$1,633.38*
	12 months @ $25.63		*$307.56*
	South Lift Station Annual Power		$1,940.94
	Transfer Energy to 1500 W		
Before	*128,920 kWh @ $0.0865/kWh*	*$11,151.58*	
***After	*175,318 kWh @ $0.0865/kWh*	*$15,165.03*	
	Net Additional Cost at 1500 W	$4,013.45	
	Total Annual Power	$2,072.51	
Annual O&M			
	Weekly Cleaning/Inspections		*$7,904.00*
	Materials and Equipment		*$1,552.81*
	Total Annual O&M		$9,456.81
Annual Total	Annual Power and O&M**		$7,384.30
20-Year Total	$7,384.30 x 20		$147,686.05
	Summary		
	Capital Project Cost (3,550 ft of 8" pipe @ $308.11/LF)	**$1,480,000.00***	
	20-Year Savings		**$147,686.05**
	Project Net Cost	**$1,332,313.95**	

*Cost reflects 35% for engineering and contingency.

**In comparing annuals costs, the Total Annual Power is a net loss to the project. Therefore, it is subtracted from the Annual Total.

***Energy used is proportional to head being pumped. The energy used at the South Lift Station would be transferred to the 1500 W Lift Station. The head at the 1500 W Lift Station is about 2.45 times higher than the head at the South Lift Station. The 18,883 kWh was multiplied by 2.45 and added to the 1500 W usage (128,920 kWh).

Oakbrook

The Oakbrook Lift Station is located at 1275 North Meadowbrook Lane. Most of the sewer north of 400 N and east of 400 W flows to the Oakbrook Lift Station. A capital project was explored to identify the feasibility of diverting some of the flow directly to the WWTP and reduce the amount of wastewater reaching the Oakbrook Lift Station. The solution identified reduces the flow being received at Oakbrook by approximately 60%. The alignment starts on the east side of Main Street at SSMH02204 and runs through private property and along 650 North until it reaches the headworks of the WWTP. The proposed capital project is shown in Figure 4 and the economic feasibility of removing this lift station is shown in Table 4.

Table 4: Oakbrook Lift Station Cost Estimates

Item	Description	Cost	Savings
Annual Power			
	Energy Reduction at Oakbrook		
Before	*64,960 kWh @ $0.0865/kWh*	*$5,619.04*	
***After	*39,639 kWh @ $0.0865/kWh*	*$3,428.75*	
	Net Annual Energy		$2,190.29
	12 months @ $25.63		No Change
	Total Annual Power		$2,190.29
Annual O&M			
	Weekly Cleaning/Inspections		No Change
	Materials and Equipment		No Change
	Total Annual O&M		No Change
Annual Total	Annual Power and O&M		$2,190.29
20-Year Total	$2,190.29 x 20		$43,805.75
	Summary		
Capital Project Cost (2,650 ft of 12" pipe @ $343.37/LF)		**$1,230,000.00***	
	20-Year Savings		**$43,805.75**
	Project Net Cost	**$1,186,194.25**	

*Cost reflects 35% for engineering and contingency.

***Energy used is proportional to flow being pumped. The flow pumped at the Oakbrook Lift Station would be reduced because of the capital project to divert flow directly to the WWTP. The projected flow at the Oakbrook Lift Station is about 61% less than the current estimated flow at the Oakbrook Lift Station. The 64,960 kWh was multiplied by 0.61 to estimate the future annual energy usage (39,639, kWh).

ADDITIONAL FLOW STUDIES

The alternatives presented herein appear to be feasible based on the available flowrate and elevation data. However, prior to design and construction it is recommended that flow monitoring be performed at the list stations and at key sewers so that final design data can be obtained.

Date: 9/27/2019
Document Path: H:\Projects\260 - Springville City\50.100 - 2018 Wastewater Collection System Master Plan\GIS\Lift Station Analysis\Sewer_LiftStationAnalysis_East.mxd

HANSEN ALLEN & LUCE INC ENGINEERS

Springville City
East Lift Station Bypass Project (Conceptual)

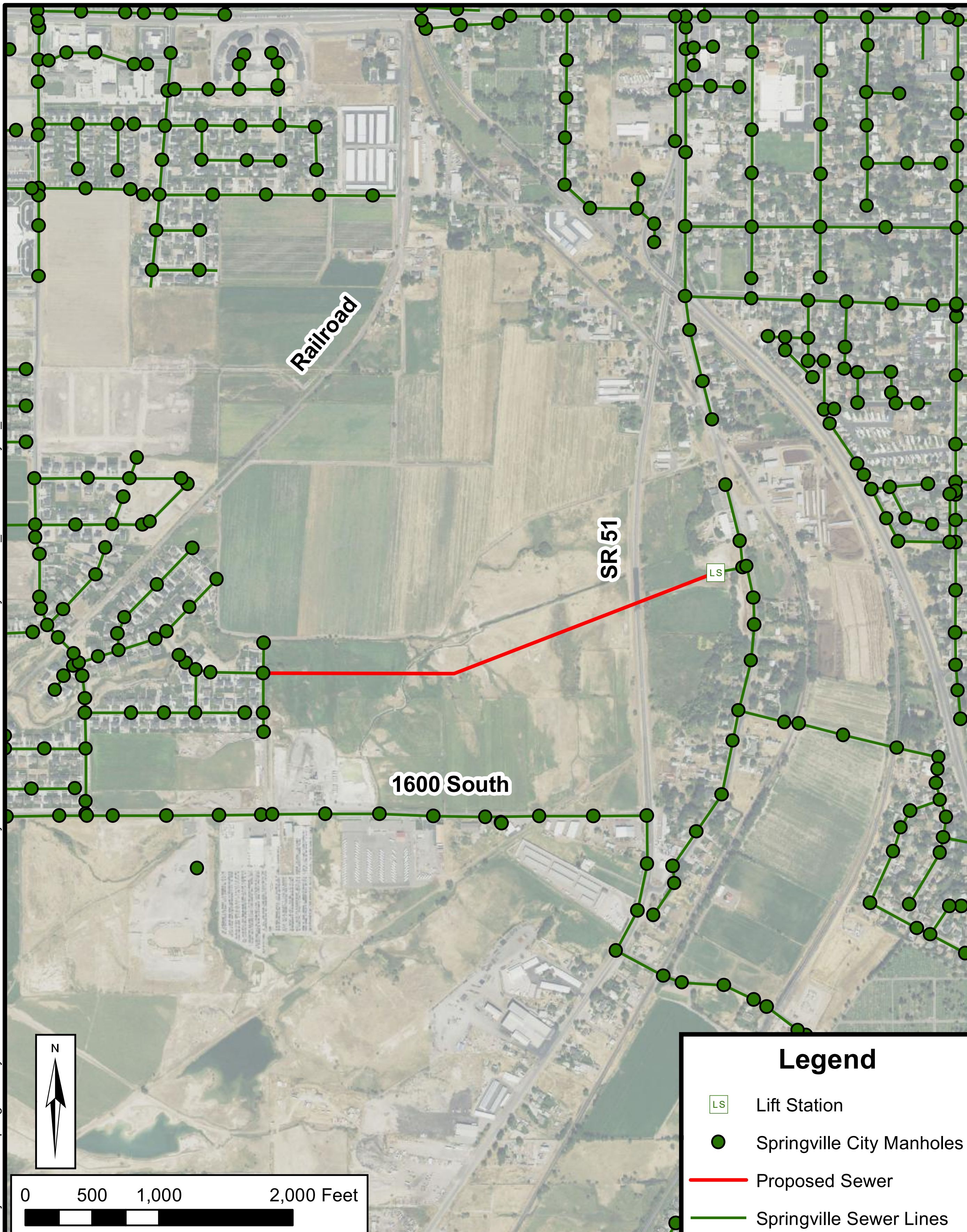
FIGURE 1

Date: 9/27/2019
Document Path: H:\Projects\260 - Springville City\50.100 - 2018 Wastewater Collection System Master Plan\GIS\Lift Station Analysis\Sewer_LiftStationAnalysis_Thirty Oaks.mxd

HANSEN ALLEN & LUCE INC ENGINEERS

Springville City
Thirty Oaks Lift Station Project (Conceptual)

FIGURE 2

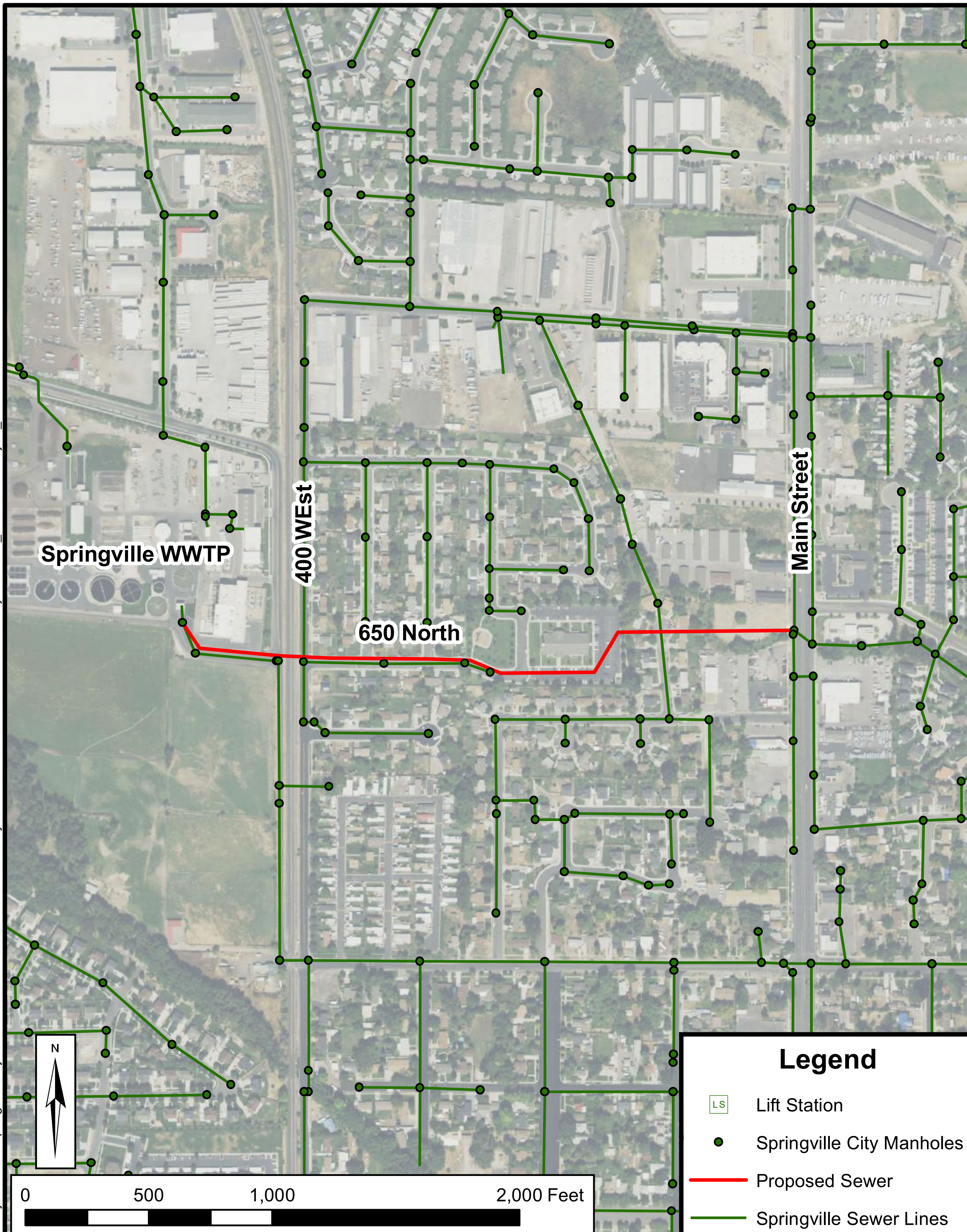


HANSEN ALLEN & LUCE INC ENGINEERS

Springville City
South Lift Station Project (Conceptual)

FIGURE 3

Date: 9/27/2019
Document Path: H:\Projects\260 - Springville City\50.100 - 2018 Wastewater Collection System Master Plan\GIS\Lift Station Analysis\Sewer_LiftStationAnalysis_South.mxd



Date: 9/27/2019
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HANSEN ALLEN & LUCE INC ENGINEERS

Springville City
Oakbrook Lift Station Project (Conceptual)

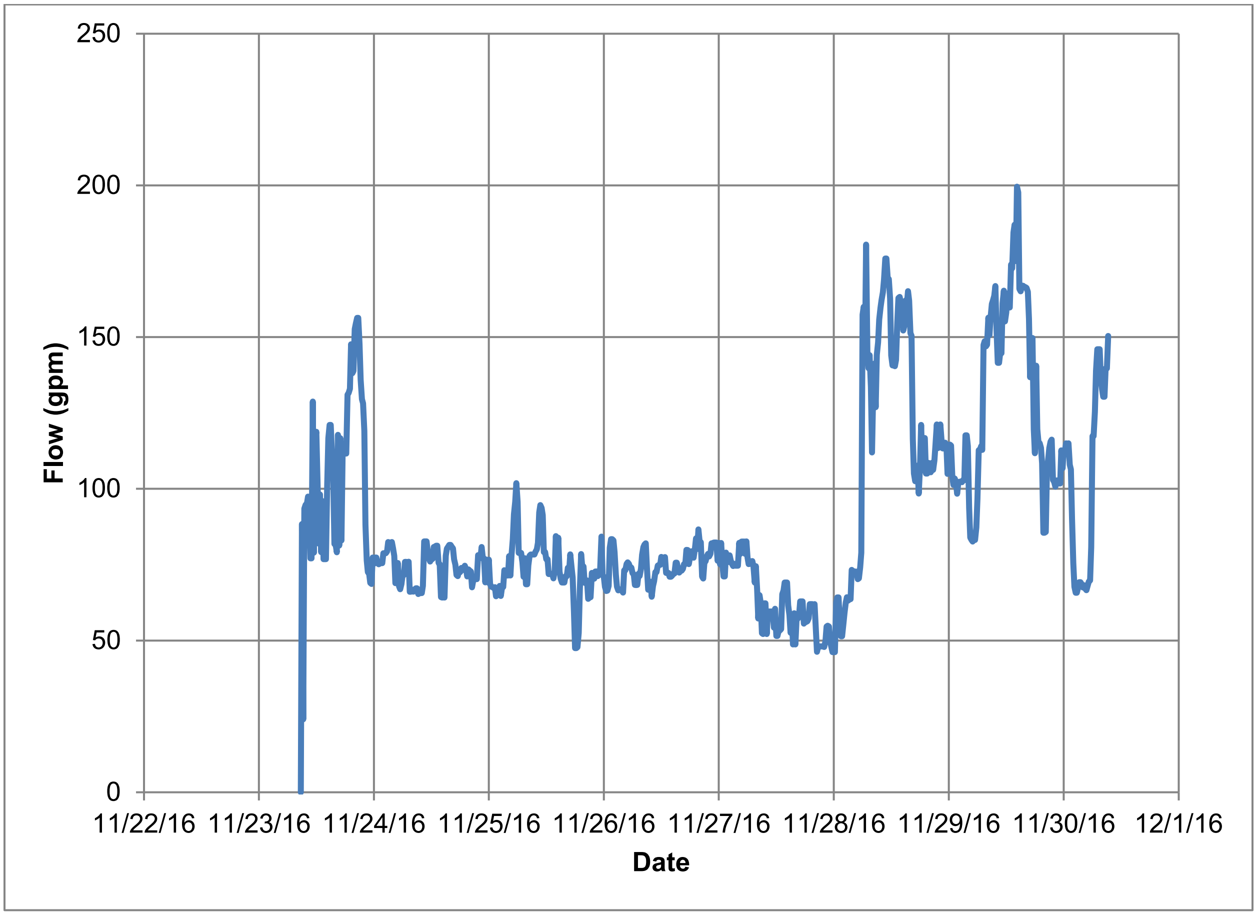
FIGURE 4

APPENDIX B

Flow Study Results

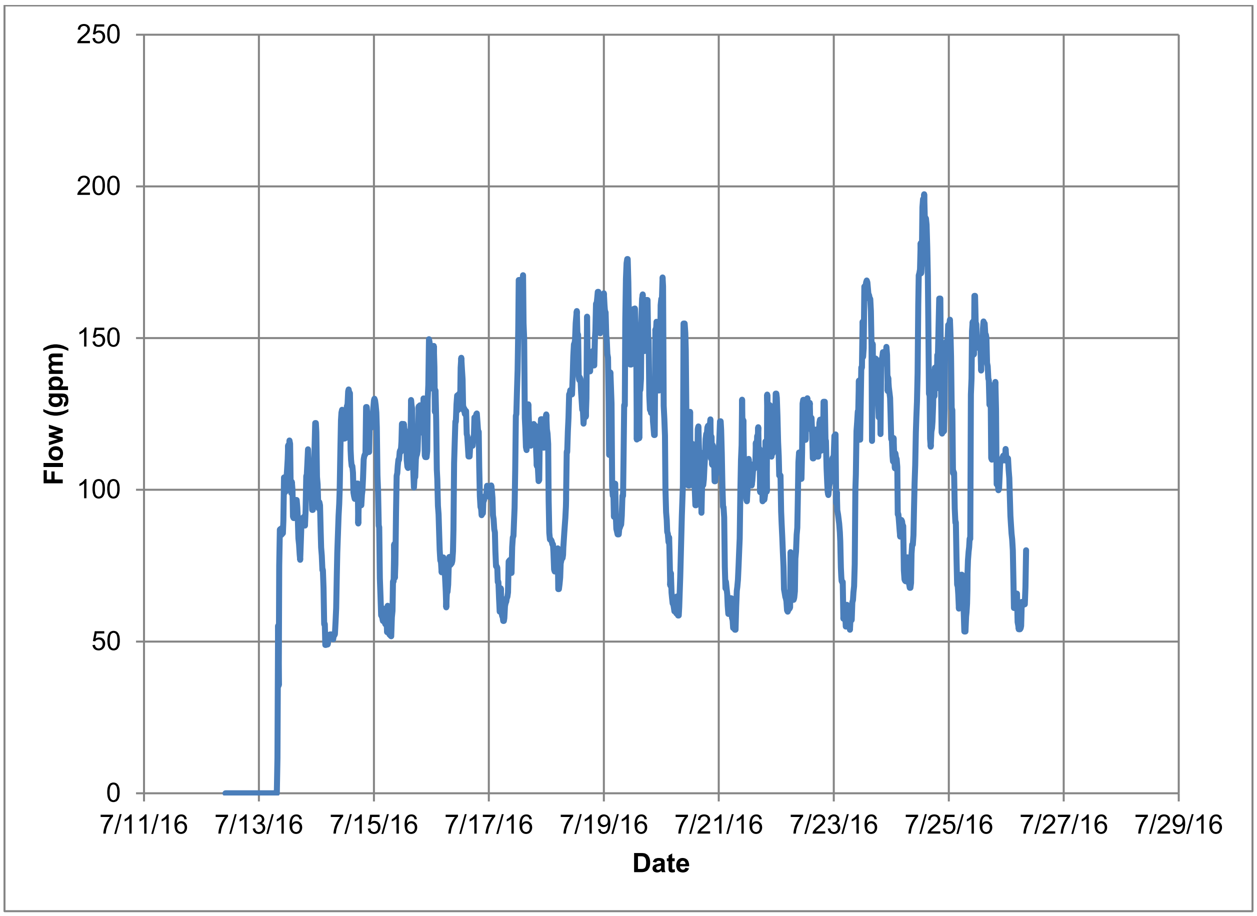
SSMH0235

Site Location: W Industrial Circle and 1100 W
Maximum Flow: 200 gpm
Minimum Flow: 24 gpm
Average Flow: 91 gpm
Peaking Factor: 2.2



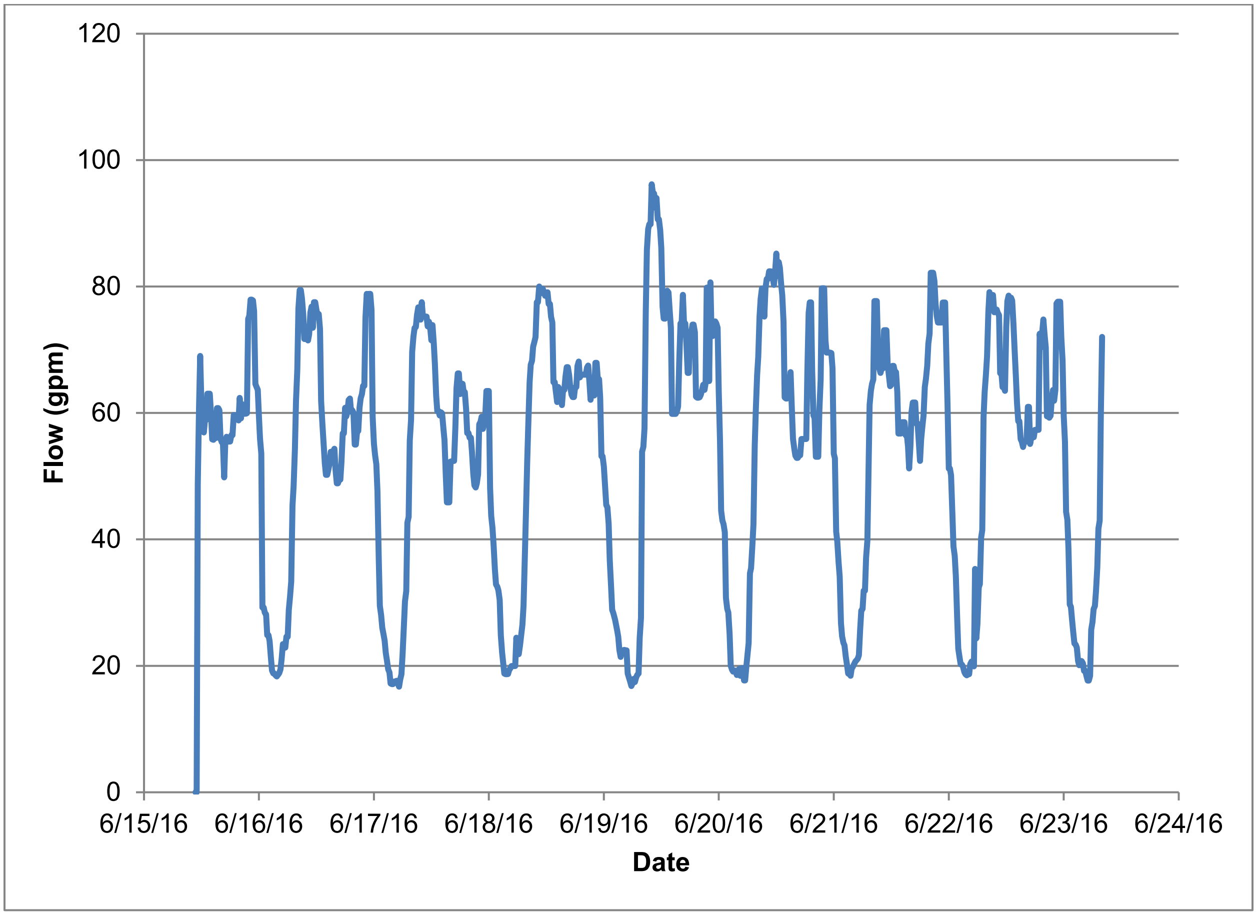
SSMH0311

Site Location: 800 N and 200 W
Maximum Flow: 197 gpm
Minimum Flow: 12 gpm
Average Flow: 108 gpm
Peaking Factor: 1.8



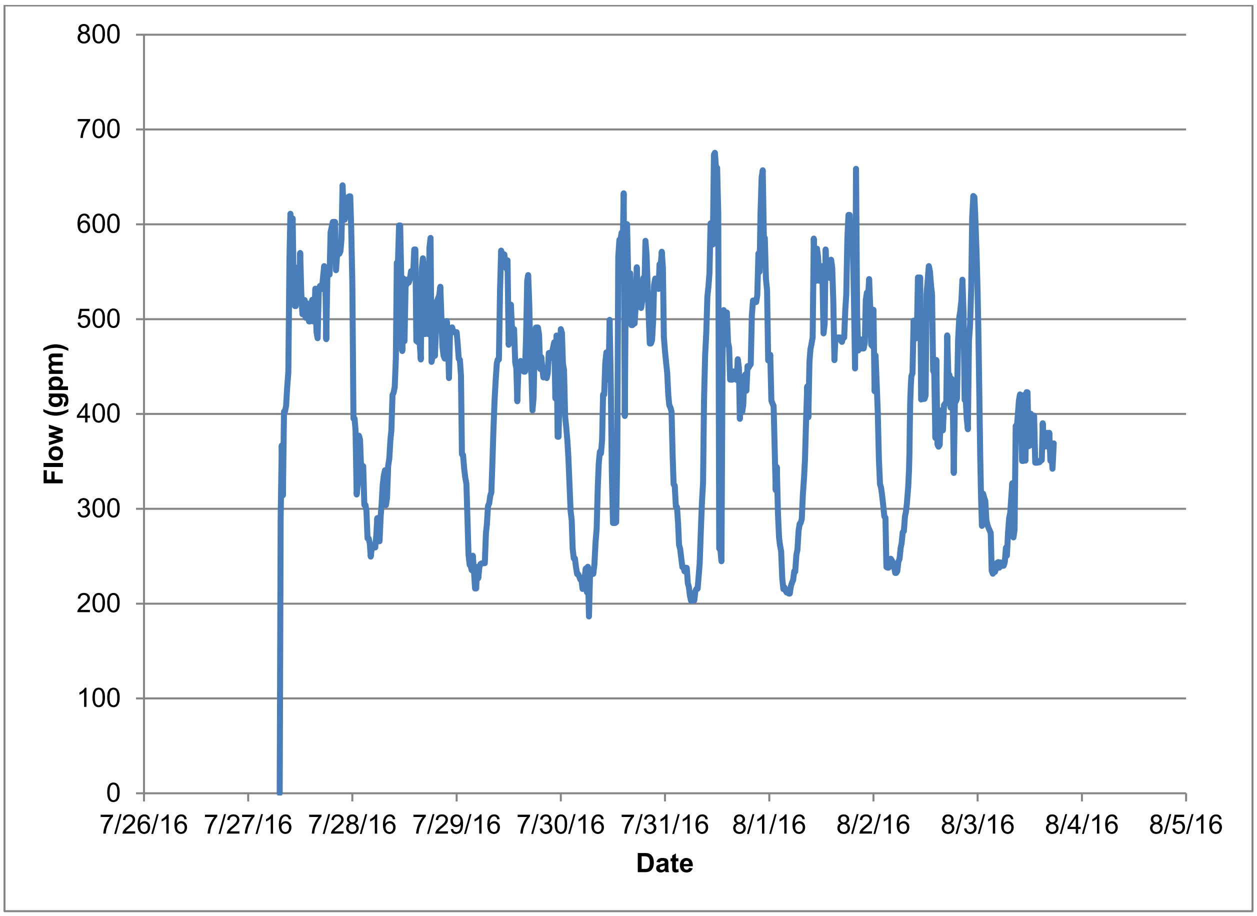
SSMH0381

Site Location: 700 N Main Street
Maximum Flow: 96 gpm
Minimum Flow: 17 gpm
Average Flow: 54 gpm
Peaking Factor: 1.8



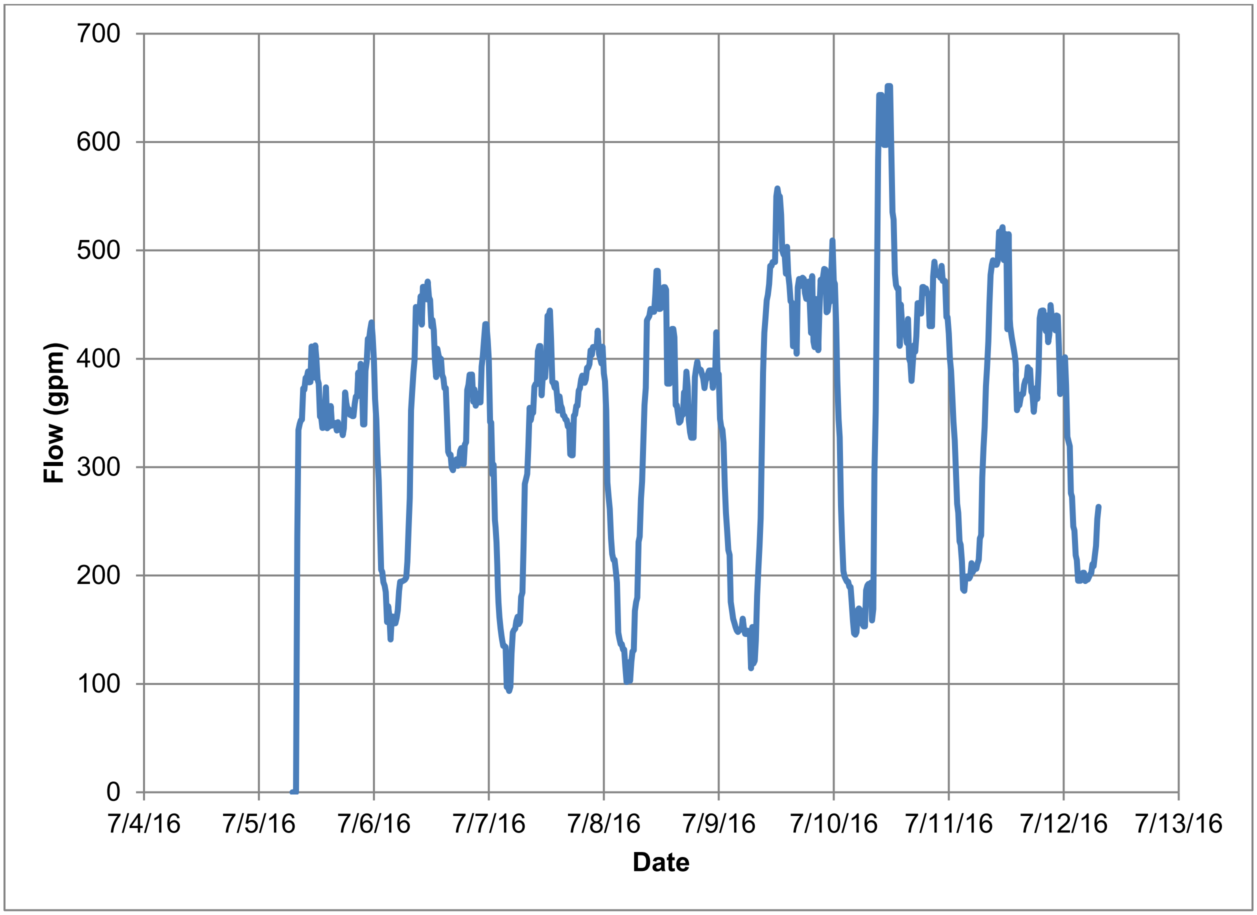
SSMH1628

Site Location: 300 N and 400 W
Maximum Flow: 676 gpm
Minimum Flow: 187 gpm
Average Flow: 421 gpm
Peaking Factor: 1.6



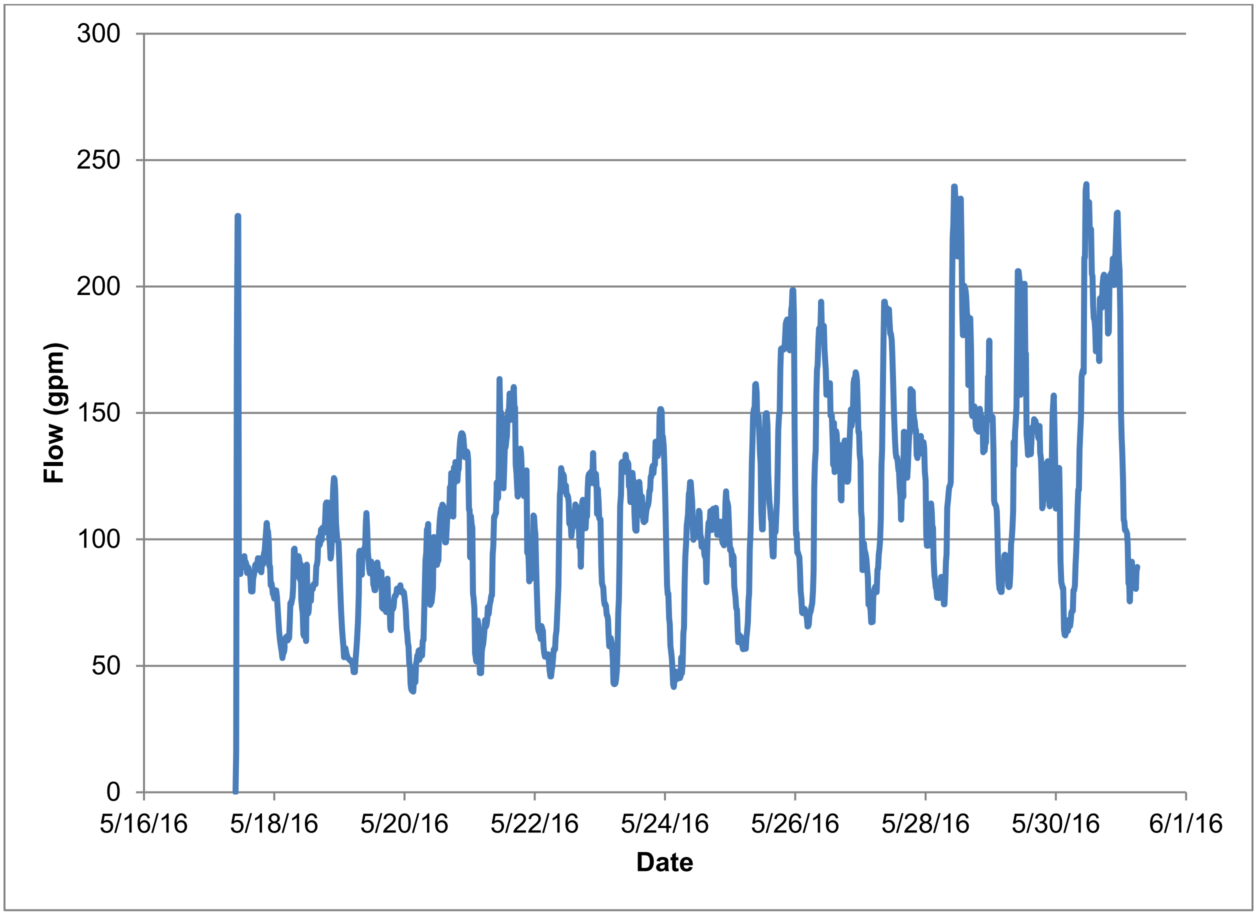
SSMH1799

Site Location: 400 N and 200 W
Maximum Flow: 652 gpm
Minimum Flow: 93 gpm
Average Flow: 345 gpm
Peaking Factor: 1.9



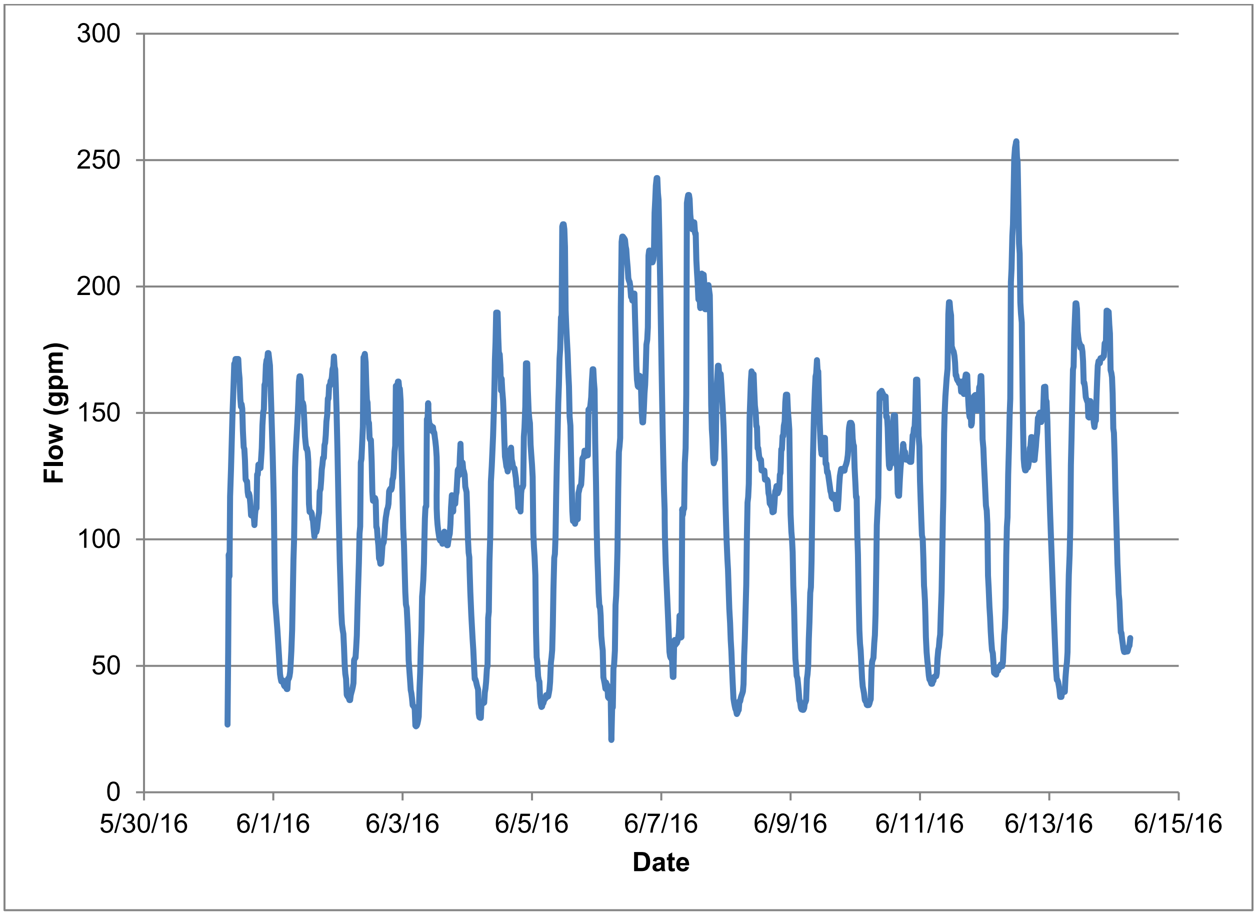
SSMH2356

Site Location: 500 N and 1750 W
Maximum Flow: 241 gpm
Minimum Flow: 16 gpm
Average Flow: 112 gpm
Peaking Factor: 2.2



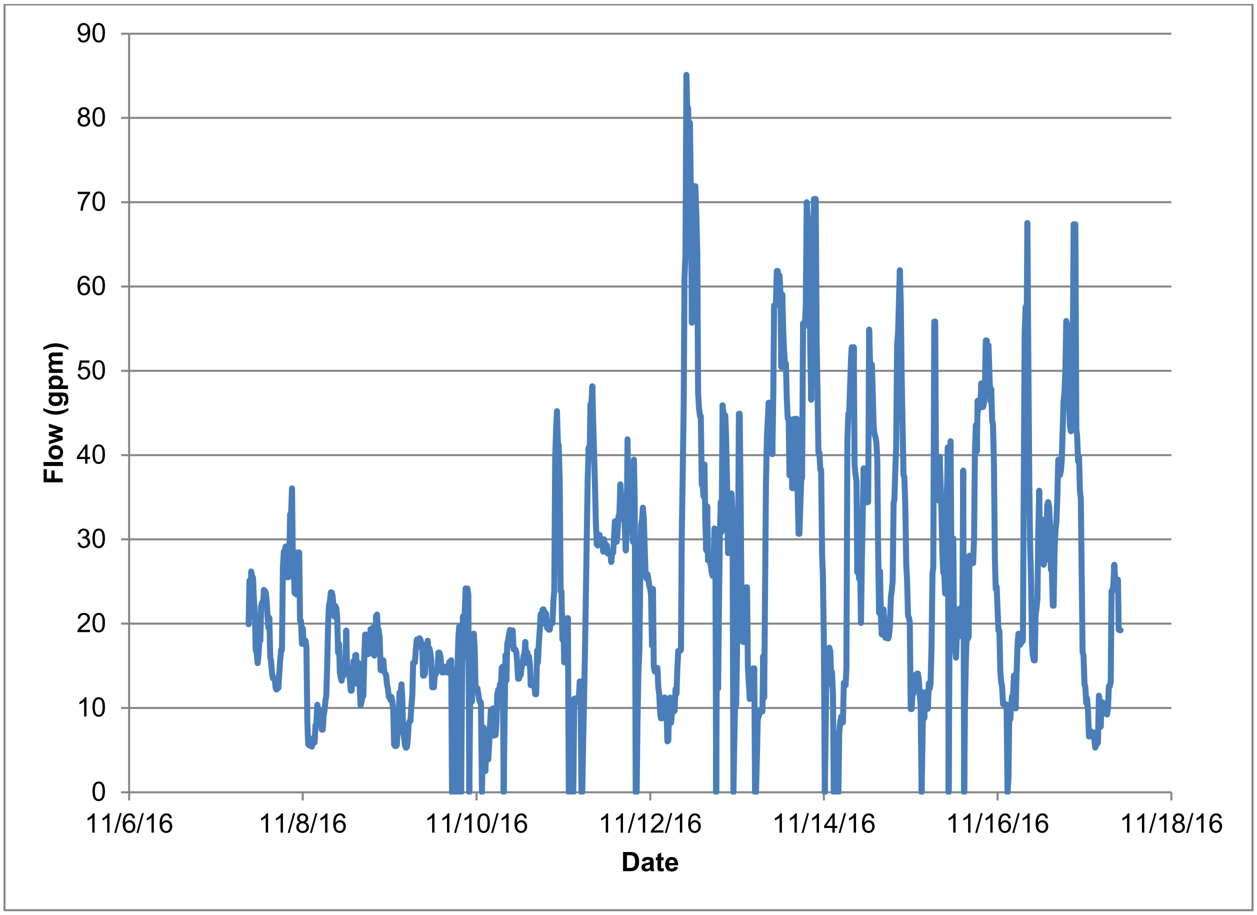
SSMH2382

Site Location: 850 N 1500 W
Maximum Flow: 257 gpm
Minimum Flow: 21 gpm
Average Flow: 119 gpm
Peaking Factor: 2.2



SSMH2739

Site Location: 650 S 2600 W
Maximum Flow: 85 gpm
Minimum Flow: 2 gpm
Average Flow: 24 gpm
Peaking Factor: 3.5



APPENDIX C

Growth Projections and Projected ERUs

Growth Projections and Projected ERUs

Year	Projected ERUs				Annual ERU Growth
	Residential	Other	Nestlé	Total	
2018	10,140	4,710	3,400	18,250	-
2019	10,374	4,819	3,400	18,593	1.9%
2020	10,614	4,930	3,400	18,944	1.9%
2021	10,821	5,026	3,400	19,247	1.6%
2022	11,032	5,124	3,400	19,556	1.6%
2023	11,247	5,224	3,400	19,871	1.6%
2024	11,466	5,326	3,400	20,192	1.6%
2025	11,690	5,430	3,400	20,520	1.6%
2026	11,918	5,536	3,400	20,854	1.6%
2027	12,150	5,644	3,400	21,194	1.6%
2028	12,387	5,754	3,400	21,541	1.6%
2029	12,629	5,866	3,400	21,895	1.6%
2030	12,875	5,980	3,400	22,255	1.6%
2031	13,057	6,065	3,400	22,521	1.2%
2032	13,241	6,150	3,400	22,791	1.2%
2033	13,427	6,237	3,400	23,064	1.2%
2034	13,617	6,325	3,400	23,342	1.2%
2035	13,809	6,414	3,400	23,623	1.2%
2036	14,003	6,505	3,400	23,908	1.2%
2037	14,201	6,596	3,400	24,197	1.2%
2038	14,401	6,689	3,400	24,490	1.2%
2039	14,604	6,784	3,400	24,788	1.2%
2040	14,810	6,879	3,400	25,089	1.2%
2041	14,960	6,949	3,400	25,308	0.9%
2042	15,111	7,019	3,400	25,529	0.9%
2043	15,263	7,090	3,400	25,753	0.9%
2044	15,417	7,161	3,400	25,979	0.9%
2045	15,573	7,234	3,400	26,207	0.9%
2046	15,730	7,307	3,400	26,437	0.9%
2047	15,889	7,381	3,400	26,670	0.9%
2048	16,050	7,455	3,400	26,905	0.9%
2049	16,212	7,530	3,400	27,142	0.9%
2050	16,376	7,606	3,400	27,382	0.9%
2051	16,486	7,658	3,400	27,544	0.6%
2052	16,597	7,709	3,400	27,707	0.6%
2053	16,709	7,761	3,400	27,871	0.6%
2054	16,822	7,814	3,400	28,036	0.6%
2055	16,935	7,866	3,400	28,202	0.6%
2056	17,050	7,920	3,400	28,369	0.6%
2057	17,165	7,973	3,400	28,538	0.6%
2058	17,280	8,027	3,400	28,707	0.6%
2059	17,397	8,081	3,400	28,878	0.6%
2060	17,514	8,135	3,400	29,050	0.6%

APPENDIX D
Cost Estimates

Project #	Pipe Diameter (in)	Length (ft)	Pipe Unit Cost ($/ft)	Project Cost
E-1_Pipe	12	1,865	$343.37	$640,381.05
E-1_MH	5		$500.00	$2,500.00
F-3_Pipe	12	400	$343.37	$137,347.14
F-3_MH	1		$500.00	$500.00
F-1	15	3,300	$364.16	$1,201,732.37
F-1_Canal Bore	24	150	$1,440.00	$216,000.00
F-1_I-15 Bore	24	230	$1,440.00	$331,200.00
F-2	15	400	$364.16	$145,664.53
F-9	10	260	$329.67	$85,715.31
F-9_Bore	18	260	$1,080.00	$280,800.00
F-4	10	4,500	$329.67	$1,483,534.19
F-4_Bore	16	60	$960.00	$57,600.00
F-5	10	2,700	$329.67	$890,120.51
F-6_Pipe	16	6,800	$100.00	$680,000.00
F-6_LS				$70,000.00
F-6_Headworks				$35,000.00
F-7_LS				$650,000.00
O&M-1_Pipe	8	1,900	$308.11	$585,412.50
O&M-1_MH	6		$500.00	$3,000.00
O&M-2_Pipe	8	500	$308.11	$154,055.92
O&M-2_MH	1		$500.00	$500.00
E-4_Pipe	18	2,150	$383.48	$824,474.04
E-4_MH	5		$500.00	$2,500.00
E-4_Connection	2		$10,000.00	$20,000.00
E-5_Pipe	12	2,650	$343.37	$909,924.82
E-6	20,000		$4.00	$80,000.00
Total				**$7,650,563.52**

Project	Project Cost	Engineering, Admin, and Contingency	City Percent	Growth Percent	City Cost	Growth Cost	Total Cost	City Cost	Growth Cost	
E-1	$642,881.05	$225,008.37	100%	0%	$867,889.42	$0.00	$867,889.42	$870,000.00	$0.00	$870,000.00
E-2	$588,412.50	$205,944.37	100%	0%	$794,356.87	$0.00	$794,356.87	$795,000.00	$0.00	$795,000.00
E-3	$154,555.92	$54,094.57	100%	0%	$208,650.49	$0.00	$208,650.49	$210,000.00	$0.00	$210,000.00
E-4	$846,974.04	$296,440.92	100%	0%	$1,143,414.96	$0.00	$1,143,414.96	$1,150,000.00	$0.00	$1,150,000.00
E-5	$909,924.82	$318,473.69	100%	0%	$1,228,398.50	$0.00	$1,228,398.50	$1,230,000.00	$0.00	$1,230,000.00
E-6	$80,000.00	$28,000.00	100%	0%	$108,000.00	$0.00	$108,000.00	$110,000.00	$0.00	$110,000.00
F-1	$1,748,932.37	$612,126.33	0%	100%	$0.00	$2,361,058.70	$2,361,058.70	$0.00	$2,365,000.00	$2,365,000.00
F-2	$145,664.53	$50,982.59	10%	90%	$19,664.71	$176,982.40	$196,647.11	$20,000.00	$180,000.00	$200,000.00
F-3	$137,847.14	$48,246.50	63%	37%	$117,238.99	$68,854.65	$186,093.64	$119,700.00	$70,300.00	$190,000.00
F-4	$1,541,134.19	$539,396.97	0%	100%	$0.00	$2,080,531.15	$2,080,531.15	$0.00	$2,085,000.00	$2,085,000.00
F-5	$890,120.51	$311,542.18	0%	100%	$0.00	$1,201,662.69	$1,201,662.69	$0.00	$1,205,000.00	$1,205,000.00
F-6	$785,000.00	$274,750.00	0%	100%	$0.00	$1,059,750.00	$1,059,750.00	$0.00	$1,060,000.00	$1,060,000.00
F-7	$650,000.00	$227,500.00	0%	100%	$0.00	$877,500.00	$877,500.00	$0.00	$880,000.00	$880,000.00