Saratoga Springs Utah

# City of Saratoga Springs

# Sewer Capital Facilities Plan

## Project No. 305-17-02

Prepared by:

BOWEN COLLINS & ASSOCIATES
Celebrating 20 Years

June 2018

# SEWER CAPITAL FACILITIES PLAN

**June 2018**

LICENSED PROFESSIONAL ENGINEER
25 JUNE 18
343787
KEITH J.
LARSON
STATE OF UTAH

**Prepared for:**

SARATOGA SPRINGS

**Prepared by:**

BOWEN COLLINS & ASSOCIATES
Celebrating 20 Years

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**Figure Reference Note:** Some figure numbers are appended with an A, B, C etc. These denote varying map extents when the entire City cannot be shown on a single page. Text references generally only refer to the main figure number without the appended A, B, C, etc. For example, the in-text reference "See Figure 5-1" refers simultaneously to Figures 5-1A, 5-1B, and 5-1C.

# CHAPTER 1
# INTRODUCTION AND BACKGROUND

## INTRODUCTION

The City of Saratoga Springs has retained Bowen Collins & Associates (BC&A) to prepare a capital facilities plan for the City's wastewater collection system. The primary purpose of this Sewer Capital Facilities Plan is to provide recommended improvements to resolve existing and projected future deficiencies in the City of Saratoga Springs wastewater collection system based on the City's adopted General Plan. As part of this process, an Impact Fee Facilities Plan following the requirements of Section 11-36a of Utah code will be created, but it is included in a separate report.

## SCOPE OF SERVICES

The general scope of this project involved a thorough analysis of the City of Saratoga Spring's sewer system and its ability to meet the present and future wastewater needs of its residents. As part of this project, BC&A completed the following tasks:

**Task 1.1:** Collect and review existing information pertinent to the City's existing sewer system including revised annexation plans and hold a kickoff meeting for the planning project.

**Task 1.2:** Project future growth in the City and use gathered information to update the City's sewer system models. This includes an existing condition model and a buildout condition model, which will be used to identify existing deficiencies, predict future deficiencies, and evaluate possible improvement projects to remedy identified deficiencies.

**Task 1.3:** Perform system analysis described in 1.2 and develop conceptual cost estimates for the identified projects. Meet with City Staff to coordinate on the projects and add any maintenance related projects that should be identified.

**Task 1.4:** Use the City's existing sewer inventory to update the documented existing facilities in the Impact Fee Facilities Plan (separate report).

**Task 1.5:** Develop a Capital Facilities Plan (this report) that can be used by City personnel for budgeting and planning purposes. Meet with City personnel to develop project prioritization criteria for recommended improvements and to develop a recommended implementation schedule.

**Task 1.6:** Attend progress and coordination meetings for the project and attend a City Council meeting to answer questions regarding the plans before adoption of the Impact Fee Facilities Plan.

**Task 1.7:** Prepare a Capital Facilities Plan report (this report).

**Task 1.8:** Prepare for and attend a meeting for stakeholders at which comments from the stakeholders are obtained. Assist City staff in addressing stakeholder comments.

**Task 2:** Develop an Impact Fee Facilities Plan and document it in the Impact Fee Facilities Plan report. (See the separate Impact Fee Facilities Plan report for additional information.)

**Task 3:** Develop an Impact Fee Analysis and document it in the Impact Fee Analysis report. (See the separate Impact Fee Analysis report for additional information.)

This document is a working document. Some of the recommended improvements identified in this report are based on the assumption that development and/or potential annexation will occur in a certain manner. If future growth or development patterns change significantly from those assumed and documented in this report, the recommendations may need to be revised.

## AUTHORIZATION

Saratoga Springs contracted the services of BC&A to prepare this Sanitary Sewer System Capital Facilities Plan in June of 2017. The initial draft facility plan study and associated report were completed in November 2017. The final plan was completed in June 2018.

## PROJECT STAFF

The project work was performed by the BC&A team members listed below. Team member's roles on the project are also listed. The project was completed in BC&A's Draper, Utah office. Questions may be addressed to Keith Larson, Project Manager at (801) 495-2224.

| | |
|---|---|
| Keith Larson | Principal-In-Charge and Project Manager |
| Justin Dietrich | Staff Engineer |

# CHAPTER 2
# EXISTING SYSTEM DESCRIPTION

## SERVICE AREA

The City of Saratoga Springs, which first incorporated in 1997, is bounded to the west by the Lake Mountains and Eagle Mountain City and to the east and northeast by Utah Lake and Lehi City. Figure 2-1 shows the approximate planning extent of Saratoga Springs along with the City's major collection system components. The topography of the majority of the City slopes west to east toward either Utah Lake or the Jordan River. For the purposes of this report, it has been assumed that the future service area of the City's wastewater collection system will be limited to the annexation boundaries of the City as shown in Figure 2-1.

For convenience and to match the convention of the last CFP, the City's overall area has been divided into three general areas for the identification of projects. These are shown in Figure 2-1 and include the North Area, South Area, and the Future Treatment Area (aka "Teguayo Area"). Generally, properties currently flowing to the Posey Lift Station are included in the North Area and properties currently flowing to the Inlet Park Lift Station are included in the South Area. Areas to the far south that will require the construction of a new treatment plant are included in the Future Treatment Area.

## EXISTING FACILITIES

Saratoga Springs was incorporated in December of 1997. As a relatively new City, much of its existing infrastructure was built by developers as part of individual developments. This infrastructure was then turned over to the City as the developments were incorporated into the City. Because of how the system was constructed, much of the sewer collection infrastructure currently owned by the City still has obligations to be paid to the developer who built the infrastructure as new development connects to the facilities. These obligations, referred to as pioneering agreements, will need to be considered in detail as part of the impact fee analysis prepared for the sewer collection system.

## LIFT STATIONS

The City's entire sewer production is treated at the Timpanogos Wastewater Treatment Plant (WWTP), which is owned by the Timpanogos Special Services District (TSSD). This plant is located near the northeast corner of Utah Lake at a slightly higher elevation than the shoreline of the lake that runs the length of much of the City. As a result, much of the City's service area must be pumped to gravity pipelines that flow to the treatment plant.

The Posey Lift Station collects flow from the north end of the City while the Inlet Park Lift Station collects flow from the south end. Both of these lift stations pump through force mains to discharge into a TSSD 54-inch main at approximately 7350 North 9550 West (Lehi City address system). There are five other smaller lift stations that discharge into the City's Inlet Park sewer trunk main. This trunk begins at Harbor Park Way and Redwood Road and flows north to the

Inlet Park Lift Station. Table 2-1 summarizes some of the characteristics of each lift station. Lift station capacity is based on the reliable capacity of each station. Reliable capacity is defined as the capacity with one pump out of service (e.g. for a pump station with three pumps, reliable capacity is the capacity of two pumps running with one standby).

**Table 2-1**
**Existing Public Lift Stations**

| Lift Station | Address[a] | Impeller Size | Wet Well Volume[c] (gallons) | Pump Count & Motor Size (HP) | Design Flow (gpm) | Design Head (ft) |
|---|---|---|---|---|---|---|
| 1 – Inlet Park | 400 S. Saratoga Rd | 14” | 4,600 | 3 – 40 | 2,350[b] | 95 |
| 2 – Posey | Pioneer Crossing, Jordan River | 15” | 5,200 | 3[d] – 50 | 3,000[b] | 78 |
| 3 – Eagle Park | 1448 S. Cottonwood Lane | 4” | 2,500 | 2[d] – 7 ½ | 110 | N/A |
| 4 – North Twin | 1800 S. Centennial Blvd | 4” | 2,500 | 2 – 7 ½ | 110 | N/A |
| 5 – South Twin | 2170 S. Centennial Blvd | 4” | 2,500 | 2 – 7 ½ | 110 | N/A |
| 6 – Marina | 275 E. Cascade Court | 4” | 2,500 | 2[d] – 25 | 350 | 140 |
| 7 – El Nautica | 100 W. 3000 S. (Harbor Bay) | 6” | 3,500 | 3 – 20 | 550[b] | 140 |

[a] Addresses are approximate
[b] Estimated capacity with two pumps running and utilizing both force mains
[c] Values shown represent approx. effective wet well volume based on as-built drawings and wet well level settings
[d] Lift stations indicated include provisions to add an additional pump on the existing manifold

All of the City’s lift stations are connected to the City’s SCADA system. The SCADA system currently provides real time data collection at each station for items such as pump status and wet well level. The planned collection areas for each of the smaller lift stations (Lift Stations 3 through 7) have been delineated and are included in this report in the appendix.

## COLLECTION SYSTEM

Table 2-2 lists the recorded length of pipe in the City’s collection system as documented in the City’s geographic database as of October 2017.

**Table 2-2**
**Saratoga Springs Collection System Pipe Lengths**

| Diameter (in) | Length (ft) | Length (mi) |
|---|---|---|
| **Gravity Mains** | | |
| Unknown | 2,699 | 0.51 |
| 6 | 857 | 0.16 |
| 8 | 447,893 | 84.83 |
| 10 | 19,473 | 3.69 |
| 12 | 31,132 | 5.90 |
| 15 | 18,430 | 3.49 |

| Diameter (in) | Length (ft) | Length (mi) |
|---|---|---|
| 18 | 27,843 | 5.27 |
| 21 | 6,335 | 1.20 |
| 24 | 11,226 | 2.13 |
| 42 | 1,637 | 0.31 |
| **Total** | **567,525** | **107.49** |
| **Pressure Force Mains** | | |
| Unknown | 7,646 | 1.45 |
| 4 | 1,758 | 0.33 |
| 6 | 3,452 | 0.65 |
| 8 | 1,022 | 0.19 |
| 10 | 11,388 | 2.16 |
| 12 | 3,246 | 0.61 |
| 14 | 13,180 | 2.50 |
| **Total** | **41,692** | **7.90** |
| **Total All Pipes** | **609,217** | **115.38** |

It should be noted that because of the rapid growth in the City, there are some portions of the existing collection system that have not yet been inventoried as part of the City's geographic database. The City is currently in the process of collecting data to complete the inventory of its sewer manholes and sewer mains as part of its asset management program. As it moves forward, the City is also requiring developers to submit manhole and sewer main data in a compatible geographic database and format to aid in the collection of asset management data. It should be emphasized that those areas with missing manhole and pipeline data consist strictly of smaller diameter collection piping for individual project level improvements. As a result, none of the data remaining to be collected is necessary for the completion of this study. All the data required to evaluate larger diameter system level improvements is included in the City's geographic database.

## METERING STATIONS

At the downstream end of the collection system, the City's sewer flow is metered before being discharged into TSSD's 54-inch trunk line. Table 2-3 summarizes the characteristics of the three existing metering stations serving the City. All of these metering stations are owned and operated by TSSD.

**Table 2-3**
**TSSD Sewer Metering Stations for Saratoga Springs**

| Meter Station | Address | Size | Count | Type |
|---|---|---|---|---|
| Inlet Park | 145 North Saratoga Road | 10" | 2 | Electromagnetic |
| Posey | 145 North Saratoga Road | 14" | 2 | Electromagnetic |
| Loch Lomond | 575 W 145 North | 10" | 1 | Radar |

## TREATMENT

All of the City's wastewater is treated at the Timpanogos Wastewater Treatment Plant (WTP). TSSD is responsible for all capacity and treatment requirements from the discharge point of the Posey and Inlet Park lift stations and the TSSD's WTP. However, Saratoga Springs does operate and maintain Bioxide feed systems at the Posey and Marina lift stations.

### Bioxide Feed Systems

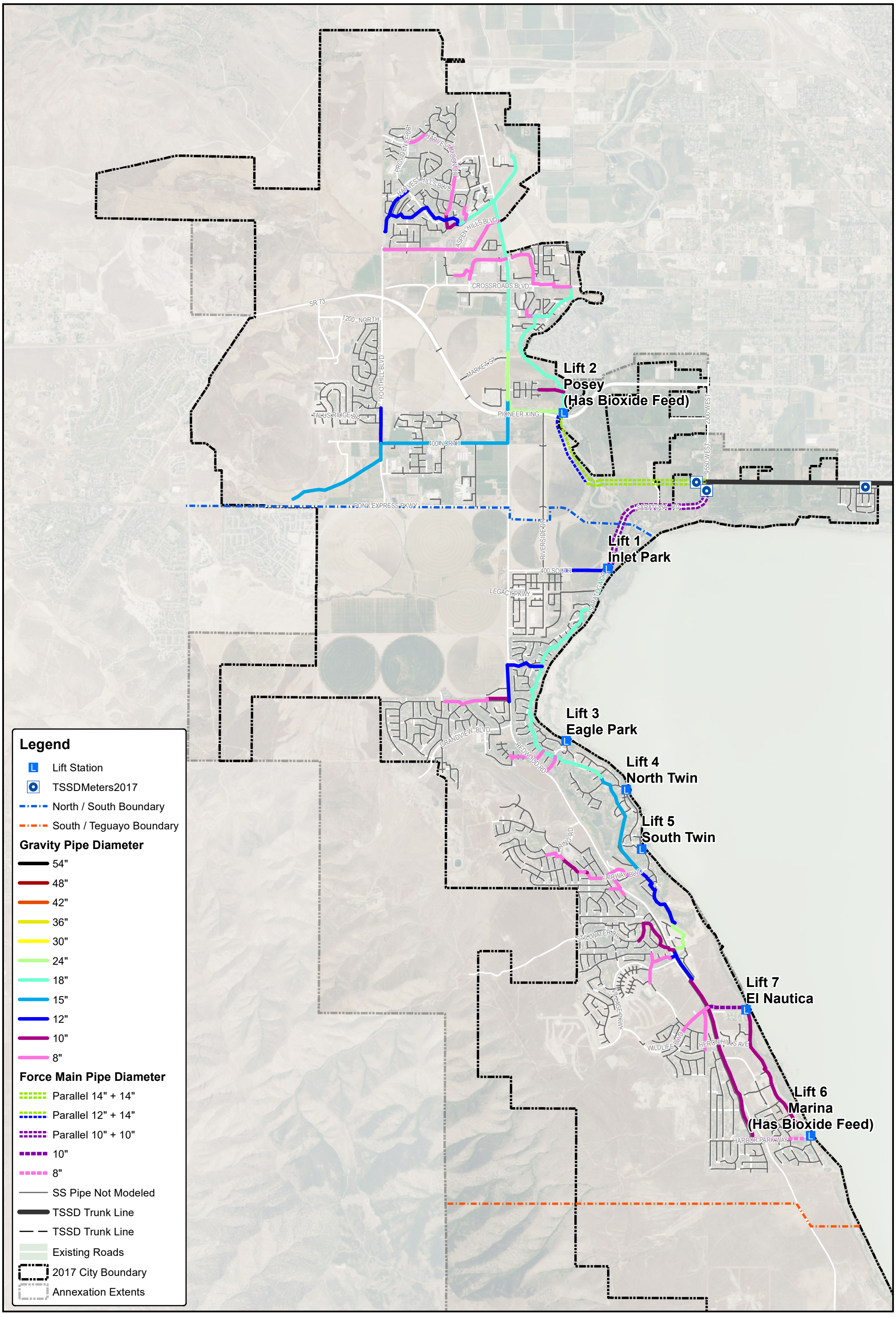
To mitigate the corrosion and odor concerns, the City implemented bioxide treatment in coordination with TSSD in 2008. This consisted of working with Siemens Water Technologies to design and implement a Bioxide storage and feed system to minimize the production of hydrogen sulfide in the wastewater at the Posey and Marina lift stations. Each Bioxide tank is equipped with two pumps, one that provides a continuous feed and another that is on a timer providing increased dosing during peak flows. Table 2-4 provides the current dosing rates and the data provided by TSSD on measured hydrogen sulfide levels.

**Table 2-4**
**Saratoga Springs Bioxide Feed Systems**

| | Bioxide Tank Volume | Siemens Recommended Bioxide Dosing | Measured Bioxide Dosing 6-5-2012 | Low TSSD measured $H_2S$ gas | High TSSD measured $H_2S$ gas | Target $H_2S$ levels |
|---|---|---|---|---|---|---|
| ***Posey Lift Station*** | 4,500 gal | 48 gal/day | 45 - 49 gal/day | 11 ppm | 76 ppm | 4 ppm |
| ***Marina Lift Station*** | 6,000 gal | 96 gal/day | 91 - 97 gal/day | 4 ppm | 20 ppm | 4 ppm |

Three additional strategies are being implemented to address TSSD's concerns and to provide better data to the City so that the hydrogen sulfide issue can be better managed in the future:

1. An odor logger was purchased so that hydrogen sulfide levels at various locations in the system can be monitored and Bioxide levels adjusted accordingly to maintain reduced levels of gas.
2. A fresh water source was added at Posey so that one of the force mains can be filled with water and shut down, eliminating the need to switch lines and preventing clogging in the inactive line.
3. The type of Bioxide has been switched from ammoniated Bioxide (Bioxide-AQ) to chlorinated Bioxide (Bioxide-71). Siemens has informed the City that the chlorinated Bioxide will not only help reduce grease build up in the system, but will also provide a more immediate reduction in sulfide gas and will be effective at lower dosing.

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SARATOGA SPRINGS
SEWER CAPITAL FACILITIES PLAN

EXISTING SEWER COLLECTION SYSTEM

NORTH:

SCALE: 0 1,750 3,500 Feet

FIGURE NO. 2-1

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 2-1_Existing SS System.mxd jdietrich 11/9/2017

# CHAPTER 3
# PROJECTED WASTEWATER SYSTEM GROWTH

In order to do any kind of future planning, it is necessary to project wastewater flows increases in the future. The purpose of this chapter is to project future wastewater flows associated with City growth.

## EQUIVALENT RESIDENTIAL CONNECTIONS

Existing development in Saratoga Springs was quantified using an Equivalent Residential Connection (ERC). ERC's are a way to provide a common unit of measurement with which to combine residential and non-residential development to provide a development total for the City.

Residential development is generally assigned a value of one ERC for every dwelling unit. For non-residential development, the City assigns an ERC value based on a fixture count that is performed at the issuance of the Building Permit. The fixture count is based on the International Plumbing Code (IPC). Each fixture type is assigned a load value in water supply fixture units (wsfu). For example, a kitchen sink has a load factor of 1.4 wsfu based on how much water is used at a kitchen sink. A typical residential toilet has a load factor of 2.2 wsfu because a toilet uses more water than a kitchen sink. Once all the fixtures are identified, all the fixture units are added together for a total fixture unit count. The City also uses the IPC as the plumbing standard used for plan reviews and building inspections. The IPC fixture count method is used to size the water meter and sewer lateral.

For the evaluation of future growth, it has been assumed that the City will continue to use the IPC fixture unit count method to calculate ERCs. Based on historic City practice, a ¾-inch water meter is the minimum size allowed for a residential connection and all connections are considered to be at least one ERC. The maximum fixture count allowed for a ¾-inch residential water meter is 40. For fixture counts greater than 40, a larger meter will be required and a larger value of ERCs will be calculated. For example, a building with a fixture unit count of 87 would have an impact fee unit of 2.2 ERCs (87/40 = 2.2).

## EXISTING DEVELOPMENT

At the beginning of 2017, the City had approximately 6,494 ERC's. For the same period, the US Census Bureau estimated the population of the City to be 26,887 for an average household size of 4.14 people.

## GROWTH PROJECTIONS

The City is also in the process of updating its Culinary Water Capital Facilities Plan, which included a detailed analysis of growth projections within the City. Because the City is entirely serviced by a secondary water system to handle outdoor water use, the impact of a given development on the sewer system directly corresponds to the impact on the sewer system. Therefore, the growth projections obtained as part of the Culinary Water Capital Facilities Plan

have governed short term growth projections within the City. Short term growth projections for the City are summarized in Table 3-1.

**Table 3-1**
**Growth Projections**

| Year | Total Projected ERCs | Annual Projected Growth Rate |
|---|---|---|
| 2016 | 6,494 | - |
| 2017 | 6,902 | 6.2% |
| 2018 | 7,743 | 12.2% |
| 2019 | 8,385 | 8.3% |
| 2020 | 9,106 | 8.6% |
| 2021 | 10,016 | 10.0% |
| 2022 | 10,717 | 7.0% |
| 2023 | 11,424 | 6.6% |
| 2024 | 12,200 | 6.8% |
| 2025 | 13,030 | 6.8% |
| 2026 | 13,902 | 6.7% |
| 2027 | 14,833 | 6.7% |

Using the City's General Plan and expected development densities as a guide, an estimate of buildout growth was also created. The projected buildout number of ERCs within the City's current planned annexation extent is 73,000 ERCs. The planned buildout density within the City is shown in Figure 6-1.

## ESTIMATING EXISTING SEWER FLOWS

Utah Administrative Code R317-3-2 indicates that, "New sewer systems shall be designed on the basis of an annual average daily rate of flow of 100 gallons per capita per day (0.38 cubic meter per capita per day) unless there are data to indicate otherwise." A review of available flow monitoring data for the system would indicate a lower design flow rate is merited.

Although the City is still relatively young, it has a record of discharge flow rates at its main sewer outfall that has been collected by Timpanogos Special Service District (TSSD) since the City's inception. During the first several years of the City's existence, metered flow results vary significantly from month to month and year to year. This is believed to be the result of meter inaccuracies at the connection points to TSSD. In 2008, however, new meters were installed and consistent results have been observed since that time. For the purposes of establishing historic sanitary sewer flow rates, BC&A examined available TSSD records of average monthly flow as part of the 2014 CFP. These records indicated a variation in year to year flows per ERC from 157.7 gpd/ERC in the winter to 255.4 gpd/ERC in the summer. This analysis established the City standard design equivalency of 255 gpd per ERC (peak month, average day) for planning

purposes. This standard has been used since that time and is used for all analysis related to this CFP.

Table 3-2 summarizes the projected wastewater flow in Saratoga Springs based on projected growth as identified above and historic flow rates. Included in the table are annual projections for the next 10 years.

**Table 3-2**
**ERC and Design Sewer Flow Projections**

| Year | ERCs | Design Total Sewer Flow (mgd) |
|---|---|---|
| 2016 | 6,494 | 1.66 |
| 2017 | 6,902 | 1.76 |
| 2018 | 7,743 | 1.97 |
| 2019 | 8,385 | 2.14 |
| 2020 | 9,106 | 2.32 |
| 2021 | 10,016 | 2.55 |
| 2022 | 10,717 | 2.73 |
| 2023 | 11,424 | 2.91 |
| 2024 | 12,200 | 3.11 |
| 2025 | 13,030 | 3.32 |
| 2026 | 13,902 | 3.55 |
| 2027 | 14,833 | 3.78 |

# CHAPTER 4
# HYDRAULIC MODELING

The Saratoga Springs sanitary sewer system was evaluated as part of this study using a hydraulic modeling computer program. A hydraulic computer model is a mathematical representation of the pipes, manholes, pumps, and wastewater flows found in the sewer collection system. Hydraulic computer models are useful because they allow the user to simulate operation of large, complex sewer systems and consider how future changes in flow will affect those systems.

## AUTODESK STORM AND SANITARY ANALYSIS

The computer modeling software used in this study was Autodesk's Storm and Sanitary Analysis (ASSA). ASSA was chosen as the computer modeling software because of ability to simulate the full profile of sewer flows under gravity, pressure, and surcharging conditions and its availability as an extension of Autodesk's Civil 3D (a software system commonly owned by many municipalities).

## GEOMETRIC MODEL DEVELOPMENT

There are two major types of data required to create a hydraulic model of a sewer system: geometric data and flow data. Geometric data consists of all information in the model needed to represent the physical characteristics of the system.

### Modeled Pipelines

For the purposes of this study, it was only necessary to include the City's primary conveyance trunk lines as part of the hydraulic model. These system level improvements include those pipelines that serve more than a single development project and are consequently eligible for inclusion in impact fee calculations. In the future, the City could consider adding smaller, project level collection mains to the hydraulic model for inventory purposes. However, the more refined the analysis becomes, the more time, effort, and expense are needed to assemble and calibrate the model. Hence, it is important to consider the required accuracy and available budget when selecting sewer lines to model.

The major sewer mains included in the hydraulic model were shown in Figure 2-1 (see Chapter 2). The final selection of sewer lines included in this model was reviewed and approved by Saratoga Springs personnel.

Information on the physical characteristics of the pipes included in the model were collected and assembled by Saratoga Springs personnel. A basic framework for the model was developed using Saratoga Springs geographic information system (GIS) records and the model created as part of the 2014 CFP. The City's GIS database includes information on the diameter, length, and location of each pipe to be included in the model. Some, but not all inverts are available in the City's GIS database. However, between the elevation data available in the GIS database along

with the survey data obtained as part of the 2014 CFP, sufficient data was available to model main City trunklines, which is the extent of the scope of this plan.

### Modeled Lift Stations

The four largest lift stations in the Saratoga Springs collection system were simulated as part of the hydraulic model. This includes the Posey, Inlet Park, El Nautica, and Marina lift stations. The three remaining existing lift stations serve relatively small service areas that are nearly built-out. Instead of modeling these three individual pump stations, their discharge flows were simply assigned as an inflow at their corresponding discharge manholes. Details for existing lift station characteristics were summarized in Chapter 2.

## FLOW MODEL DEVELOPMENT

The second type of data required by the hydraulic model is sewer flow into the pipes being modeled. Required information includes magnitude of flow, point of entry into the system, and a description of how flow varies with time (to establish peak demand and consider the effects of flow travel time in the system).

Sewer flows for existing and future conditions were calculated based on projections of ERCs as estimated in the City's general plan and land use projections. Existing flows were distributed to the nearest manholes in the hydraulic model. Future flows were distributed into the collection system based on the nearest available collection lines or future collection lines that will be installed. The location of future pipes are indicated as part of the system improvements discussed in Chapter 6.

A distribution of flow over time was accomplished using a composite diurnal curve as shown in Table 4-1. Table 4-1 summarizes the ratio of flow to average day flow over 24 hours. This curve is based on flow monitoring within Utah County municipalities similar to Saratoga Springs. The curve estimates the average effect of all development including residential, commercial, and industrial demands. The curve includes a maximum peaking factor of 2.5 to match the required peaking factor for interceptor and outfall sewers in State of Utah requirements.

**Table 4-1**
**Hydraulic Model Diurnal Pattern**

| Hour | Ratio of Average Day Flow |
|---|---|
| 0 | 0.80 |
| 1 | 0.60 |
| 2 | 0.40 |
| 3 | 0.30 |
| 4 | 0.20 |
| 5 | 0.25 |
| 6 | 0.30 |
| 7 | 0.45 |
| 8 | 0.64 |
| 9 | 1.10 |
| 10 | 1.70 |
| 11 | 2.50 |
| 12 | 2.00 |
| 13 | 1.60 |
| 14 | 1.40 |
| 15 | 1.25 |
| 16 | 1.10 |
| 17 | 1.05 |
| 18 | 1.15 |
| 19 | 1.33 |
| 20 | 1.09 |
| 21 | 0.97 |
| 22 | 0.90 |
| 23 | 0.92 |
| 24 | 0.80 |

# CHAPTER 5
# SYSTEM EVALUATION

With the development and calibration of a hydraulic sewer model, it is possible to simulate sewer system operating conditions for both present and future conditions. The purpose of this chapter is to evaluate hydraulic performance of the collection system and identify potential hydraulic deficiencies.

## EVALUATION CRITERIA AND LEVEL OF SERVICE

In evaluating the performance of the collection system, it is necessary to first define the required level of service for the various components of the system. This level of service is the same for both existing and future customers:

### Sewer Main Level of Service

Saratoga Springs Engineering Standards and Specifications (adopted August 30, 2017) require that all sewer mains be designed such that the peak daily flow depth in the pipe is less than or equal to 80 percent of the pipe's diameter. This design standard will be used as the level of service for system evaluation.

### Force Main Level of Service

Saratoga Springs Engineering Standards and Specifications require that lift station force mains should be designed such that peak velocity through the force main does not exceed 7 ft/sec. By eliminating excessive pipeline velocities, this standard optimizes pump efficiency, limits potential for hydraulic surge issues, and maximizes the life of the force main. It is also required that all force mains have a minimum diameter of 6 inches and that the maximum distance between clean outs along the pipeline be no greater than 1,200 feet. This is to facilitate cleaning of the force mains using the City's jet truck equipment (max reach of approximately 600 feet).

### Lift Station Level of Service

Based on industry standards and good design practice, it is recommended that peak daily flow to a lift station not exceed 85 percent of the lift station's hydraulic pumping capacity. Allowing for a modest amount of capacity above projected flows accounts for unknowns associated with flow projections and mechanical wear at each lift station. The minimum design level of service for lift stations has correspondingly been established at 15 percent higher than estimated peak flows at build-out.

The minimum wet well volume for lift stations should be large enough to prevent excessive cycling of lift station pumps. Based on manufacture recommendations for pump operation, the maximum number of cycles per hour should be six or less. Exceeding this value will significantly shorten the lifespan of the lift station pumps. The number of cycles that will occur at a lift station can be calculated using one of the following two equations:

Equation 1: $V_{min} \geq \frac{60 \times Q_D (Q_P - Q_D)}{N \times Q_P}$ When $Q_D < 0.5 * Q_p$

Equation 2: $V_{min} \geq \frac{15 \times Q_P}{N}$ When $Q_D \geq 0.5 * Q_p$

Where:

N – Maximum number of cycles per hour
$Q_D$ – Peak design flow into the wet well
$Q_P$ – Pump capacity out of wet well
$V_{min}$ – Minimum wet well volume

Table 5-1 lists a summary of the evaluation criteria used in this capital facilities plan.

**Table 5-1**
**Evaluation Criteria for System Level of Service**

| Criteria | Value |
|---|---|
| Design Sewer Flow Allowance per ERC including I&I (gpd) | 255 |
| Design Flow Peaking Factor | 2.5 |
| Maximum Allowable Depth to Diameter Ratio for Peak Flow conditions | 0.80 |
| Maximum Velocity in Force Mains (ft/sec) | 7.0 |
| Maximum Distance Between Force Main Cleanouts (ft) | 1,200 |
| Maximum Allowable Peak Flow to Pump Capacity Ratio at Lift Stations | 0.85 |
| Maximum Cycles Per Hour at Lift Station (as a result of wet well volume) | 6 |

## EXISTING COLLECTION SYSTEM ANALYSIS

Figure 5-1 shows the performance of the sewer system under existing flow conditions. Pipes in the figures are color coded to show the ratio of peak flow depth in the pipe to the pipe's diameter. As can be seen in the figure, the existing collection system performs well under current conditions. However, there are a few pipes that exceed the level of service adopted by the City.

All lift stations appear to have adequate capacity to convey peak flow under existing conditions. There are, however, some opportunities to optimize performance at a few of the lift stations through some projects as discussed in Chapter 6.

## FUTURE COLLECTION SYSTEM ANALYSIS

For allocating future resources in this analysis, Saratoga Springs identified the location and magnitude of likely growth in the City for each of the next 20 years and at full buildout. From these projections, BC&A developed short term (growth expected to occur in the next 1 to 10 years) and long-term (growth beyond the next 10 years) collection system models. These models

were used to calculate the effect of projected growth on the performance of the Saratoga Springs collection system.

**Short Term Development Analysis**

Figure 5-2 shows the performance of the existing sewer system with additional loading from expected short term growth. The resultant deficiencies identify the immediate needs of the system. As can be seen in the figures, most of the collection system in the City continues to perform well, even with the growth expected to occur in the short term. However, there are some pipes that do not meet the level of service standards if the expected short term growth was to occur. Improvement projects will be required to satisfy this growth.

Projects to bring these pipelines up to the required level of service have been identified and described in Chapter 6.

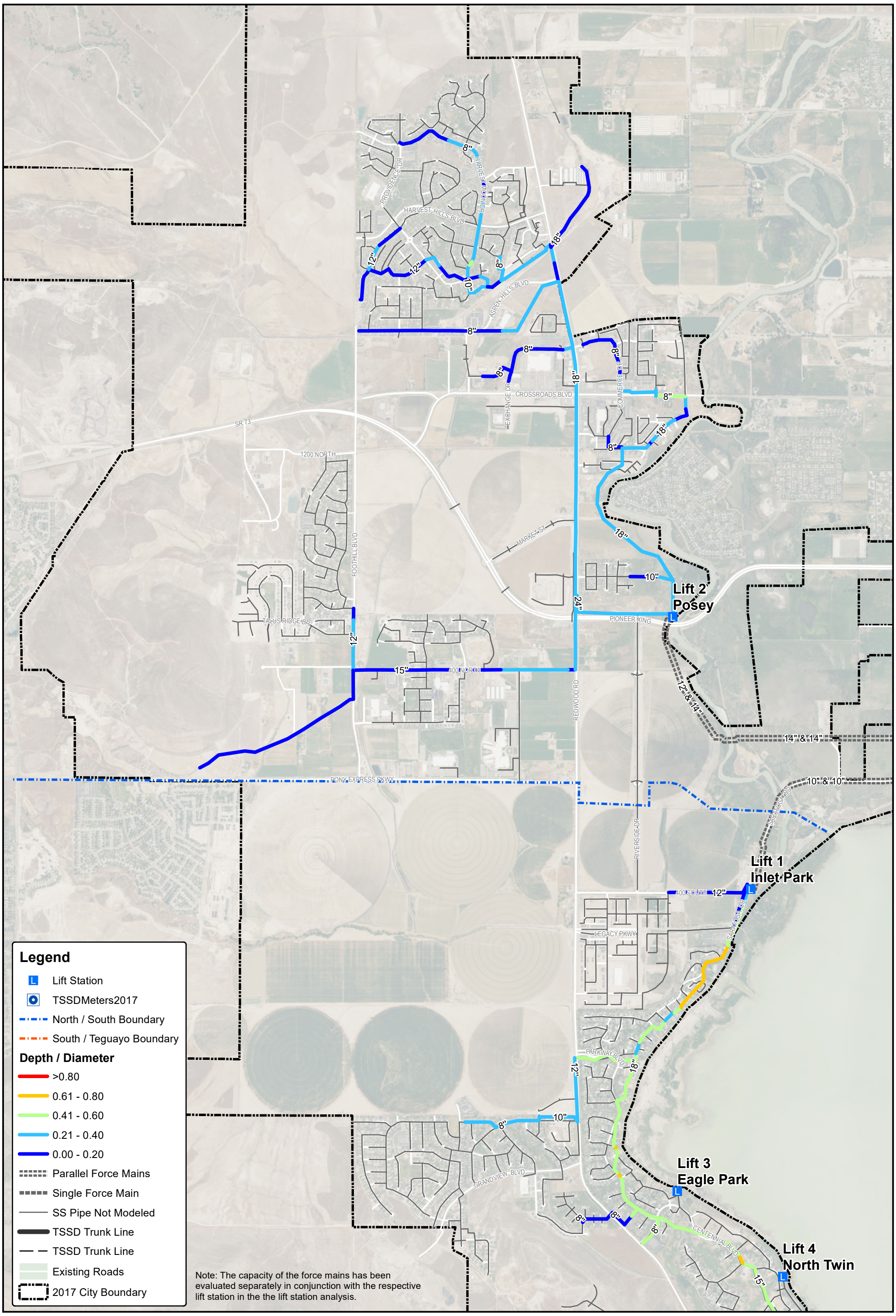
**Growth Beyond Short Term**

With the additional future growth projected in Saratoga Springs, it is expected that a number of improvements will be required to meet buildout conditions in the City. Additional trunks will need to be constructed to new areas and some existing trunks will need to be replaced with larger diameter pipes. Chapter 6 discusses conceptual improvements that will be needed to continue to serve growth in Saratoga Springs.

**Lift Station Analysis**

Table 6-3 in Chapter 6 shows the flows and capacities of the several lift stations at various stages of development. With respect to the Inlet Park and Posey Lift Stations, the anticipated gravity improvement projects will shorten the force mains of both lift stations. These improvements add sufficient capacity to the lift stations to meet the expected future loading. However, it is expected that within the 10-year window, growth will exceed the capacity of these lift stations (especially Inlet Park) if the accompanying gravity projects that are designed to remove loading from these two lift stations are not completed (See Projects S1, S4, and N1 in Chapter 6 for additional information.

All force mains have sufficient capacity for the expected maximum capacities of all lift stations.

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SEWER CAPITAL FACILITIES PLAN

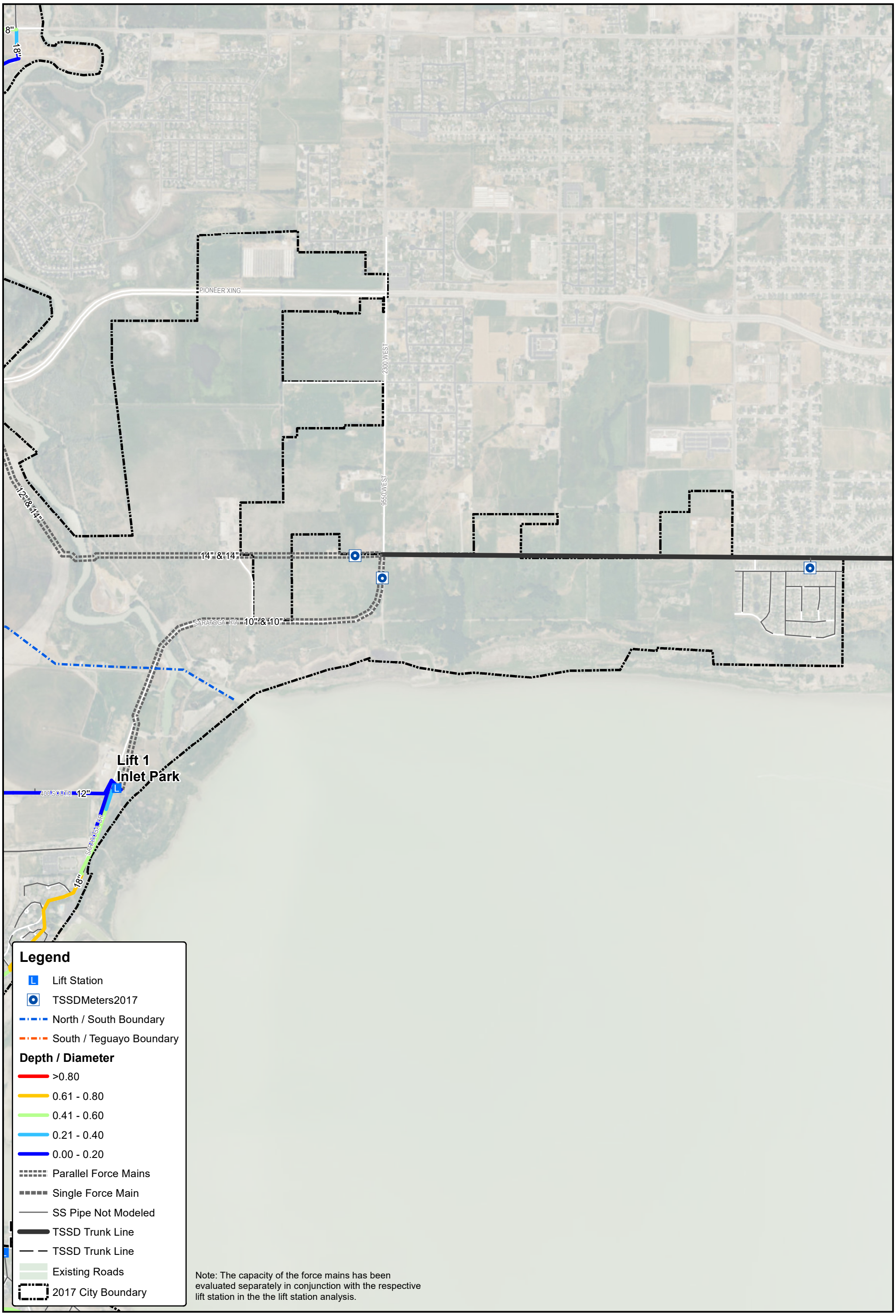
EXISTING COLLECTION SYSTEM CAPACITY

NORTH:

SCALE: 0 1,000 2,000 Feet

FIGURE NO. 5-1A

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-1_Existing System Capacity.mxd jdietrich 11/9/2017




Note: The capacity of the force mains has been evaluated separately in conjunction with the respective lift station in the the lift station analysis.

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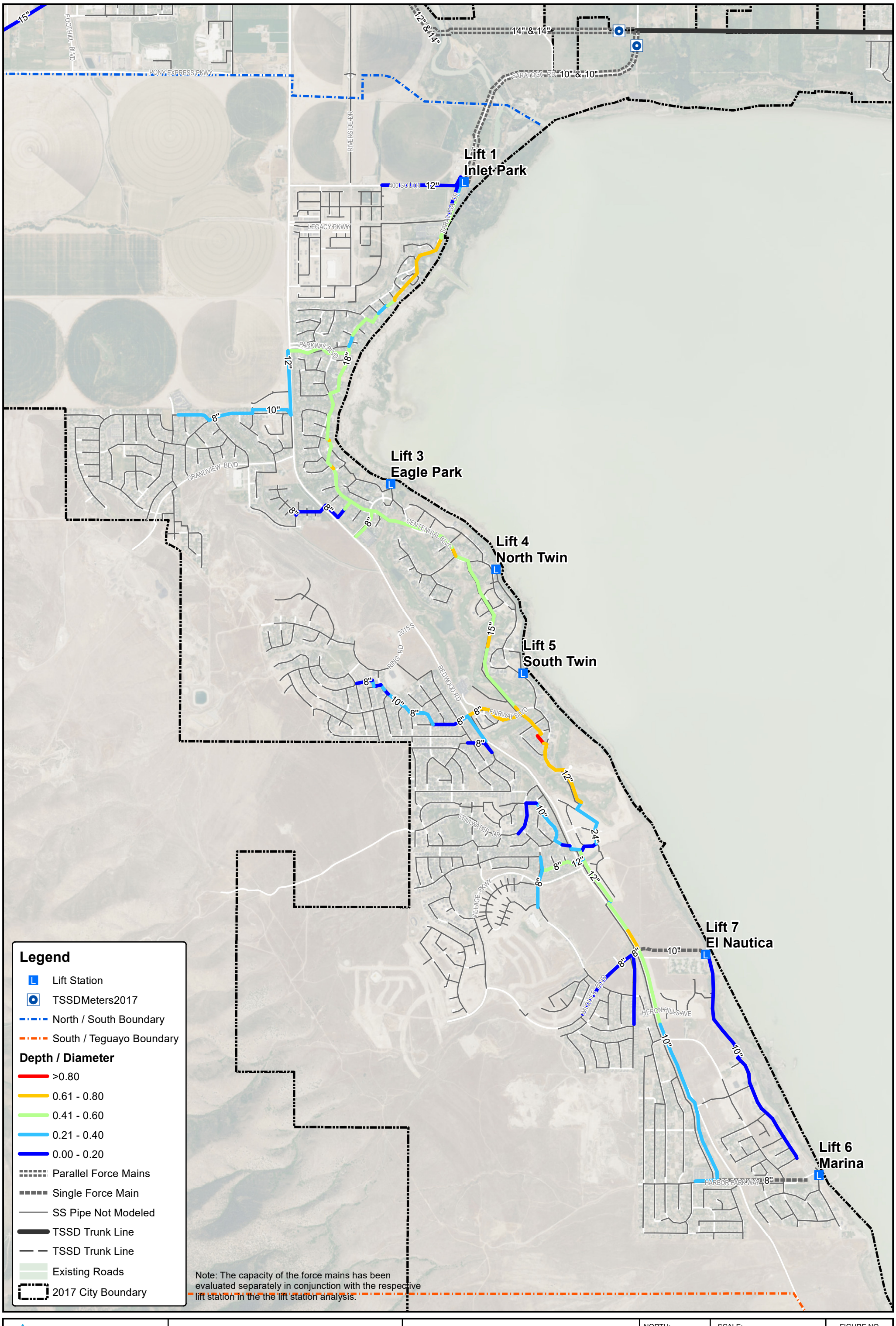
EXISTING COLLECTION SYSTEM CAPACITY

NORTH:

SCALE: 0 660 1,320 Feet

FIGURE NO. 5-1B

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-1_Existing System Capacity.mxd jdietrich 11/9/2017

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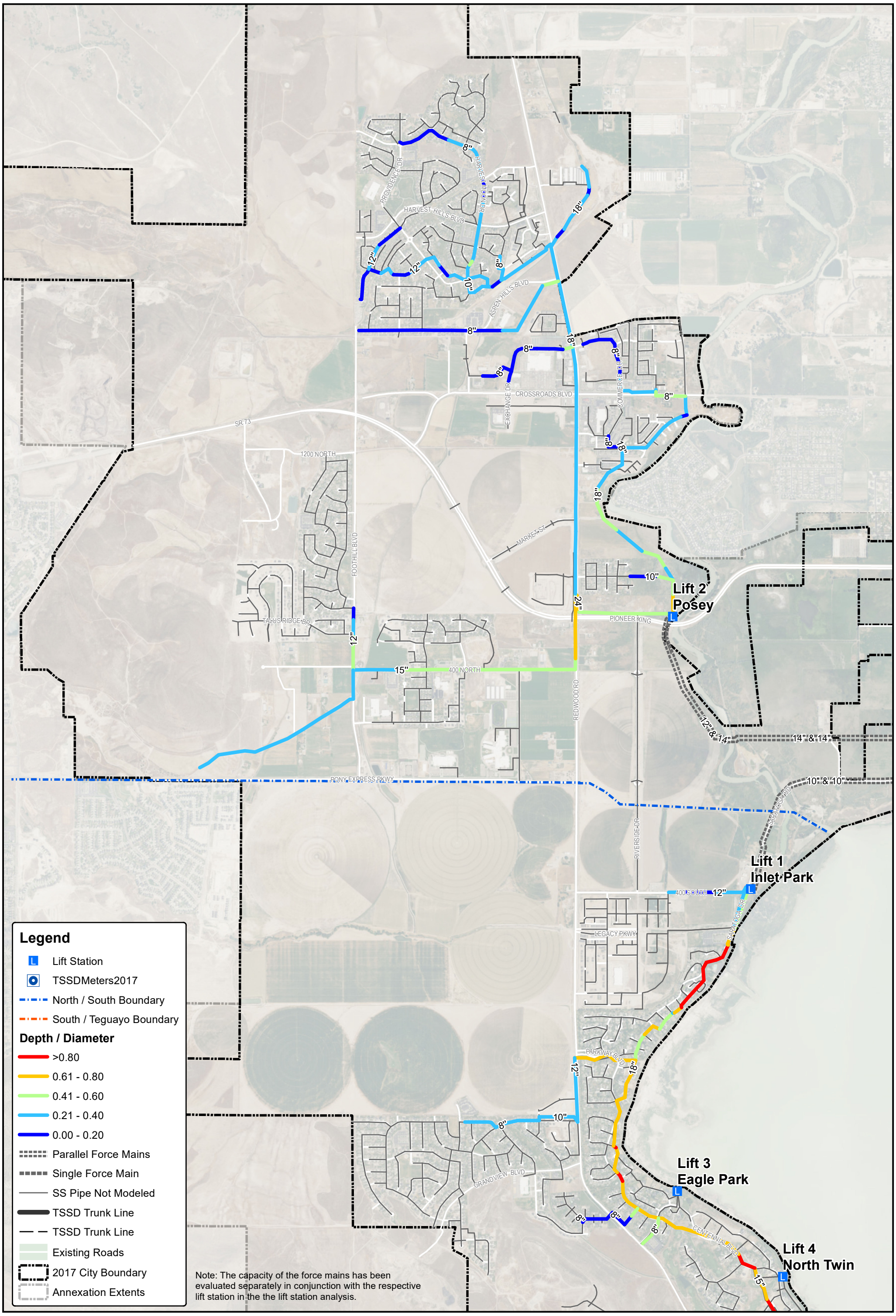
EXISTING COLLECTION SYSTEM CAPACITY

NORTH:

SCALE: 0 1,000 2,000 Feet

FIGURE NO. 5-1C

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-1_Existing System Capacity.mxd jdietrich 11/9/2017

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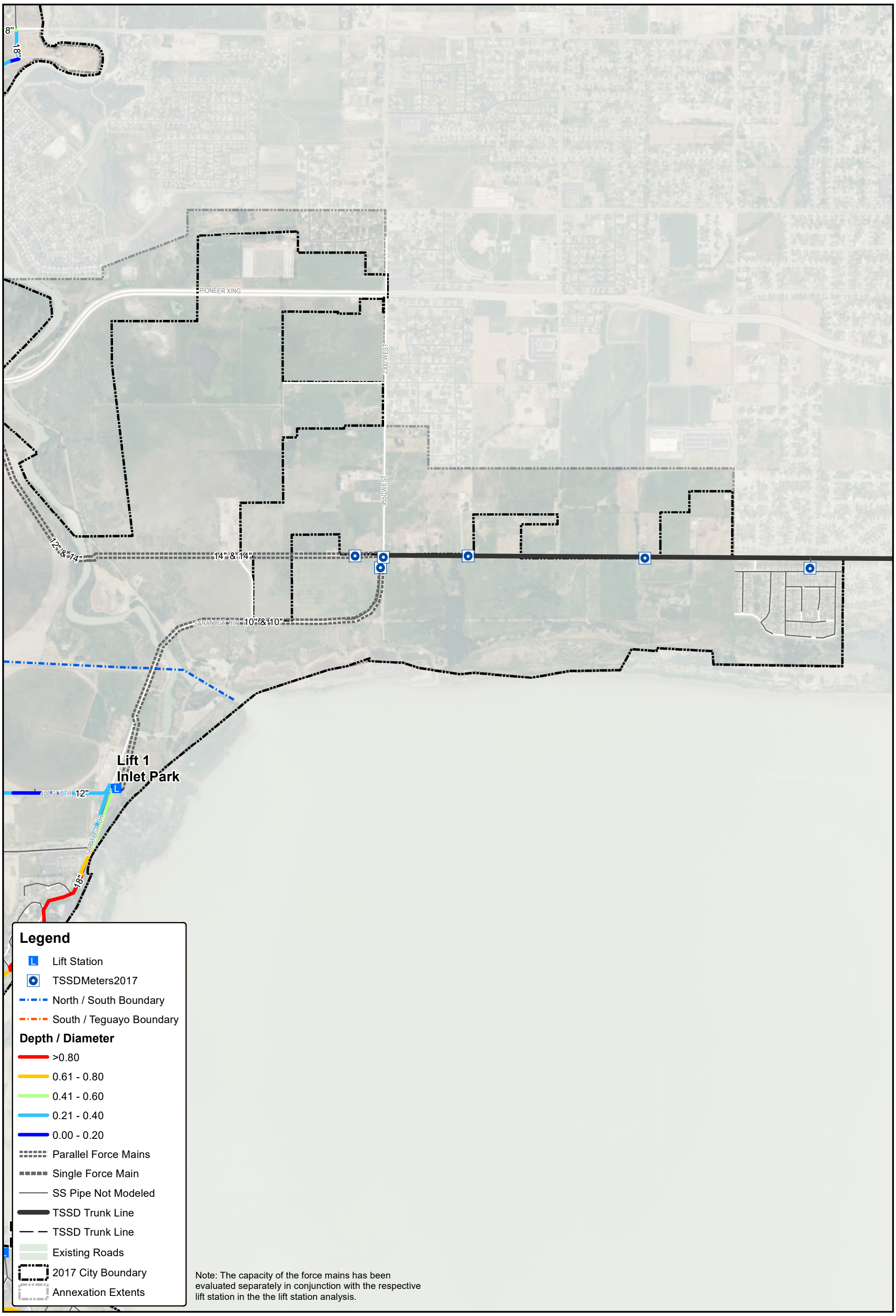
CAPACITY OF EXISTING SYSTEM WITH 10-YEAR GROWTH

NORTH:

SCALE: 0 1,000 2,000 Feet

FIGURE NO. 5-2A

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-2_Capacity of Ex Sys w 10 yr Growth.mxd jdietrich 2/19/2018




Note: The capacity of the force mains has been evaluated separately in conjunction with the respective lift station in the the lift station analysis.

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SEWER CAPITAL FACILITIES PLAN

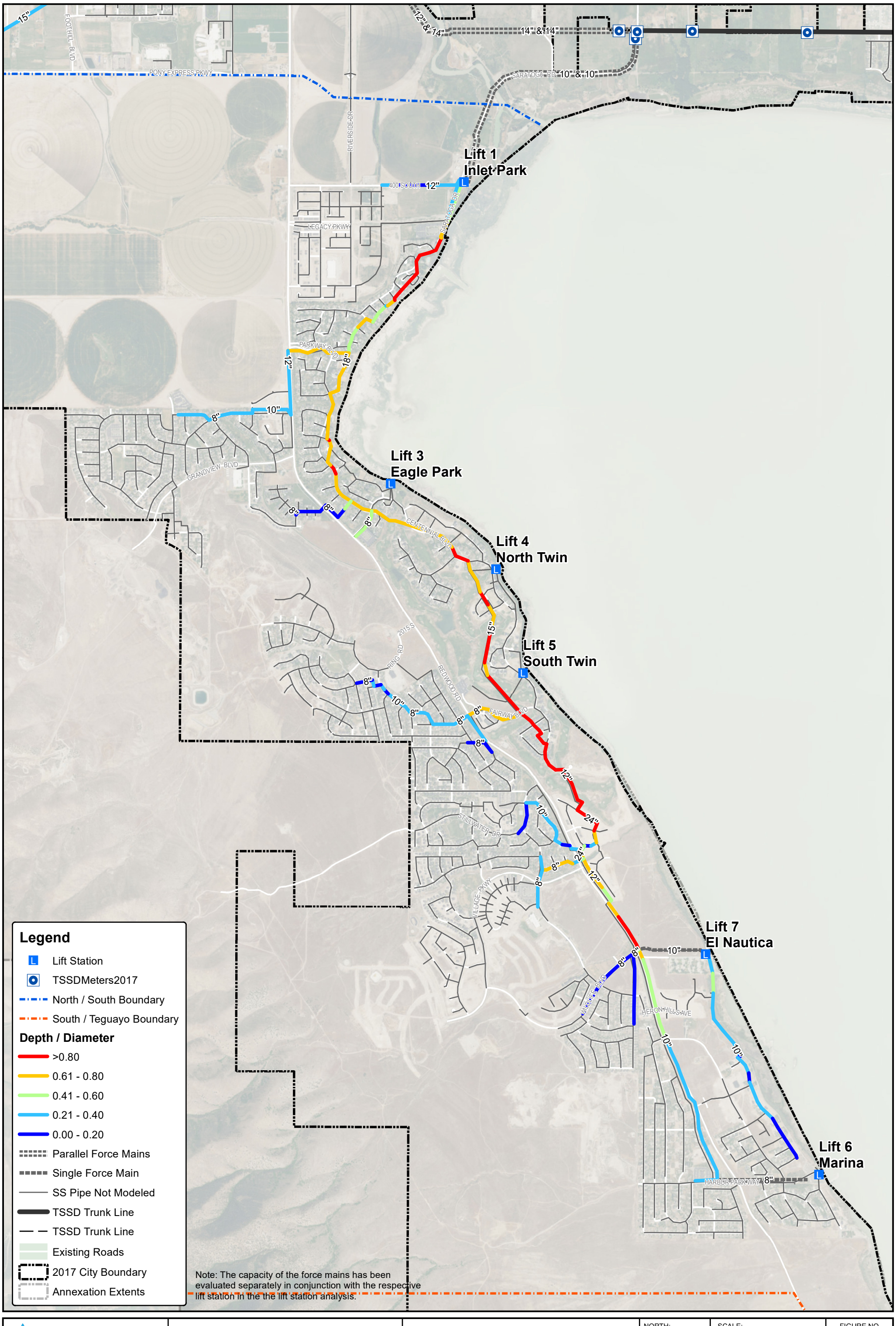
CAPACITY OF EXISTING SYSTEM WITH 10-YEAR GROWTH

NORTH:

SCALE: 0 660 1,320 Feet

FIGURE NO. 5-2B

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-2_Capacity of Ex Sys w 10 yr Growth.mxd jdietrich 2/19/2018

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CAPACITY OF EXISTING SYSTEM WITH 10-YEAR GROWTH

NORTH:

SCALE: 0 1,000 2,000 Feet

FIGURE NO. 5-2C

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 5-2_Capacity of Ex Sys w 10 yr Growth.mxd jdietrich 2/19/2018

# CHAPTER 6
# SYSTEM IMPROVEMENTS

The hydraulic model was used to evaluate various alternatives for servicing growth under projected short term and buildout conditions. For the purposes of this report, buildout is defined as full development of all property in the service area at current planning densities as defined in the City's land use element of the General Plan. The buildout densities used are shown in Figure 6-1. The following chapter describes the preferred conveyance option for accommodating flows from future growth.

## SYSTEM IMPROVEMENT APPROACH

There are a number of different approaches that could be used to service future growth in Saratoga Springs. Prior to developing a recommended approach, BC&A and Saratoga Springs personnel examined previous master plan alternatives and several new alternatives identified during the course of this facilities plan. In developing a preferred conveyance alternative, several issues were considered:

- **Cost –** A primary goal in developing a preferred conveyance alternative was to minimize overall cost. The sizing and alignment of future pipelines were optimized to convey projected flows in the most efficient manner possible. Projects have also been phased to defer projects that are more expensive where possible to try to achieve the lowest present worth cost of improvements.
- **Maintenance and Reliability –** Facilitating maintenance and providing maximum reliability was another important goal in developing a preferred alternative. Based on experience, one of the best ways to accomplish this goal is to minimize reliance on future lift stations. Both lift stations and force mains are the source of frequent maintenance. Lift stations are also vulnerable to power interruption and mechanical failure. They also require ongoing electrical pumping costs that add to the overall cost of operating the system. The improvements recommended here include the construction of several new gravity mains that will allow as much of the City to be conveyed to TSSD by gravity as possible. This will significantly reduce the size of the collection areas currently served by the Inlet Park and Posey Lift Stations.
- **Disruption to Existing Residents –** Where possible, construction of new sewer mains through existing neighborhoods and paved roadways was avoided. By minimizing work in developed rights-of-way, disruption to traffic and residents can be minimized.

After considering these various issues, a preferred alternative for meeting future growth was identified as recommended below.

## RECOMMENDED CONVEYANCE IMPROVEMENTS

Figure 6-2 shows the approximate location of improvements recommended to meet future growth in Saratoga Springs through buildout. It should be noted that proposed sizes for pipes

have been estimated based on projected flow, estimated pipe slopes developed using digital elevation data, and the State of Utah's minimum slope criteria for sanitary sewer mains. Once detailed design of sewer mains commences, the pipeline sizes should be reviewed with design pipe capacity based on the projected buildout flows in upstream sub-basins. Also shown in Figure 6-2 is the approximate collection area associated with each major trunk line improvement. It should also be noted that collection basins and pipeline alignments shown are approximate based on current understanding of projected development patterns and future road alignments. As the time for completion of each project approaches, the City should review each collection area and pipeline alignment in detail to optimize the location and functionality of each improvement.

As discussed in Chapter 2, the City can be separated into three areas, a south area (currently served by the Inlet Park Lift Station), a north area (currently served by the Posey Lift Station), and an area to be served by future treatment facilities at the far south end of the City. Because the area at the far south end of the city will be its own system, no projects are identified for the future treatment area. Projects for each of the other two service areas are described below.

**South Area**

S1. River Crossing Trunk – A key component to the proposed improvement approach is the construction of a new gravity outfall across the Jordan River. This will allow flow to be conveyed across the Jordan River by gravity to the Timpanogos Special Service District connection. Once this line is completed, it will facilitate two major categories of improvements. First, it will allow new gravity lines to be constructed to service new development on higher elevation properties in the City (see Projects S4 and N1). Second, it will allow the length of the Inlet Park and Posey force mains to be significantly reduced and the existing force main siphons under the river to be eliminated.

S2. Inlet Park Sewer Trunk Upgrade – There are portions of the existing Inlet Park Sewer Trunk that starts along Redwood Road at the south end of the City and continues north following the shoreline of Utah Lake will need to be upgraded to accommodate build-out wastewater flows. There are no existing deficiencies along the sewer trunk, but most of the line is at nearing or at capacity in the existing condition. The entire line will become deficient with expected short term (10-year) growth and would need to be replaced (except the two small segments that have already been completed) if not for the planned Project L5 (described below). With timely completion of L5, the S2 trunk upsize projects are limited to the not yet completed reaches south of the new lift station and a small section near Cove Road.

S3. New Gravity Outfall from 900 South – A new trunk is recommended to be constructed from west to east at approximately 900 South (tying in at School House Road). The purpose of this project is to convey the flows down from future development on the Lake Mountain's benches.

S4. New Gravity Outfall from Ring Road – A new gravity trunk is recommended from Ring Road. The purpose of this trunk line will be to connect all practical upstream gravity pipelines to the River Crossing Trunk (Project S1) via Project N1d. Once this pipeline and the River Crossing Trunk are completed, a large portion of the south service area will be able to bypass the Inlet Park Lift Station. Currently 100 percent of the south service area flows through the lift station. Once the recommended improvements are completed, the collection area for the Inlet Park Lift Station will be reduced to the area shown in Figure 6-2.

It should be noted that even though major segments are considered high priority depending on available funding, development near this project may require the completion of this project prior to the completion of the River Crossing Trunk. If this is the case, this pipeline can temporarily be connected to the Inlet Park Lift Station until the River Crossing Trunk is completed. During the final design of this pipeline, great care should be taken to make sure the invert elevations of this pipeline are consistent with its ultimate goal of connecting to the River Crossing Trunk (Project S1).

S5. Foothill Trunk – A new trunk is recommended along the future Foothill Blvd to collect areas along the western edge of the City. Construction of this pipeline will allow all upstream areas to be conveyed by gravity to the River Crossing Trunk (Project S1) via Project S3 and Project S4. As noted above, this will allow all the area served by this pipeline to bypass the Inlet Park Lift Station and flow by gravity to TSSD.

S6. West 300 South Trunk – A new trunk is recommended along the future 400 South roadway (approximate). Construction of this pipeline will allow all upstream areas to be conveyed by gravity to the New Gravity Outfall from 900 South trunk (Project S4).

L10. New Fairway Blvd Lift Station – A new lift station will be constructed to lift flows from the south end of the city into the new gravity outfalls.

**North Service Area**

N1. North Trunk – Similar to the south service area, one primary goal of the recommended improvements is to connect as much of the service area as possible to pipelines that can drain by gravity. The key project to accomplish this in the north service area is N1. This improvement would include a new gravity trunk line from the intersection of Redwood Road and Pioneer Crossing to the River Crossing Trunk. Once these pipelines and the River Crossing Trunk are completed, a large portion of the north service area will be able to bypass the Posey Lift Station. Currently 100 percent of the north service area flows through the lift station. Once the recommended improvements are completed, the collection area for the Posey Lift Station will be reduced to the area shown in Figure 6-2.

It should be noted that capturing the existing flow at the intersection of Redwood Road and Pioneer Crossing will require a relatively deep pipeline.

One additional note is that the completion of the gravity lines described above will provide opportunity for the Posey Lift Station force main to be significantly reduced in length by connecting it to the new gravity trunk lines. This will increase the capacity and efficiency of the Posey Lift Station. The work necessary to accomplish this is part of Project N4.

N2. 200 West Trunk – A new trunk line will need to be constructed along Redwood Road and 200 West to Crossroads Blvd to collect wastewater from future development. Creating capacity in a new trunk line along this corridor is more cost effective than upsizing the existing pipeline in Redwood Road.

N3. 1400 North Extension – A new trunk line will need to be constructed along and parallel to 1400 North (SR73) and into the northwest corner of the City to collect wastewater from future development in those areas.

N5. North Line Extension and Redwood Road Crossing – A sewer trunk line should be extended along the canal near the storage units east of Redwood road at Cambria Way across Redwood Road and stubbed near the Saratoga Water tank to collect wastewater flow from areas at the north end of the City.

Table 6-1 and 6-2 summarize the cost of the proposed improvements in 2017 dollars. The estimated year of construction is also shown in the table. Note that development will be the primary motivation for most of the projects, and the timing of projects (especially beyond the short-term planning window) may be expedited or deferred depending on the rate of development.

It should be noted that costs contained in this chapter are total project costs and do not include any division between existing and future users. As described above, some of the recommended improvements identified in this plan will benefit existing users. A division of project costs between existing and future users based on proportionate share of capacity is contained in the Impact Fee Facilities Plan (separate report).

It should also be remembered that the collection system improvements identified in these two figures do not include any improvements for potential development at the south end of the City. The topography of Saratoga Springs is different from most other cities because of its location relative to Utah Lake. Conveying flow from the south end of the City to the outfall at the north end of Utah Lake is difficult because there is very little elevation difference between these locations. To cost effectively serve its residents and avoid an excessive number of lift stations, the City has established a policy to extend service on its existing system no further than the southern boundary of the Marina Lift Station. This boundary is shown in Figure 6-2. All properties south of this boundary should be served by a new wastewater treatment plant. As a result, any development that occurs in this area will not be subject to the sewer collection impact

fees of the City but will be responsible for development of the new plant and corresponding collection system. An illustrative location for a future wastewater treatment plant is shown at the south end of the City in Figure 6-2. The final location of this plant along with layout of the corresponding collection system pipelines will need to be determined once development plans in this area become more established.

**Table 6-1**
**Short Term Collection System Improvements (2018-2027)**

| Project ID | Estimated Construction Year | Project Name | Estimated Cost (2017 dollars) |
|---|---|---|---|
| N1b | 2019 | North Trunk - Redwood Rd and Pioneer Xing to Riverside Dr | $1,685,002 |
| N1c | 2019 | North Trunk - Riverside Drive | $1,787,126 |
| N1d | 2018 | North Trunk from Riverside Drive to River Crossing | $2,549,738 |
| N1e | 2019 | Posey Force Main Modification | $646,635 |
| N2 | 2026 | Exchange Drive to Project N1 (no Redwood Rd. trunkline replacement; new line to parallel existing line) | $1,894,863 |
| N3b | 2027 | 1400 North Extension | $2,375,378 |
| N5 | 2027 | North Line Extension and Redwood Road Crossing | $1,153,507 |
| N7 | 2027 | Saratoga Road East Collector and Outfall 1 | $1,117,410 |
| N8 | 2027 | Saratoga Road East Collector and Outfall 2 | $919,123 |
| S1.2 | 2018 | River Crossing Trunk (Suspended) | $1,221,990 |
| S1.3 | 2018 | River Crossing Trunk - Outfall | $2,799,743 |
| S2.1b | 2018 | Remaining Portion of Inlet Park Trunk Phase 1 | $762,637 |
| S2.2b | 2019 | Inlet Park Trunk - Phase 2, Golf Course Main | $1,581,751 |
| S2.6 | 2026 | Inlet Park Trunk - Phase 6 | $1,762,354 |
| S2.8 | 2025 | Force Main From Lift 10 | $1,701,407 |
| S4.1a | 2018 | Parkway Blvd Crossing At Redwood Road | $155,666 |
| S4.1b | 2025 | Redwood Road to Gravity Outfall | $4,885,610 |
| S4.2a | 2025 | Redwood Road Gravity Extension - Parkway Blvd to Grandview Blvd (Replace Existing) | $1,178,520 |
| S4.2b | 2025 | Redwood Road Gravity Extension - Grandview Blvd to 2015 S (New Pipe) | $2,261,553 |
| **Total** | | | **$32,440,013** |

**Note 1:** See Appendix B for the breakdown of cost estimates.
**Note 2:** See Figure A1 in Appendix A for design flows.

**Table 6-2**
**Long Term Pipe Projects Cost Estimates**

| Project ID | Project Name | Pipe Length (ft) | Diameter (in) | Installation Type | Asphalt Restoration Share (%) | Pipe Installation Unit Cost ($/LF) | Asphalt Restoration Unit Cost ($/LF) | Estimated Construction Year | Estimated Cost (2017 Dollars) |
|---|---|---|---|---|---|---|---|---|---|
| N10 | Upsize Future Evans Lane from 8" to 12" | 2,543 | 12 | Upsize Only | 0 | $7 | $77 | 2028+ | $17,803 |
| N3c | Northwest Extension | 6,395 | 12 | New Pipe | 0 | $208 | $77 | 2028+ | $1,330,095 |
| N9.1 | New LS Force Main East of Jordan | 1,243 | 10 | New Pipe | 0 | $210 | $73 | 2028+ | $260,992 |
| N9.2 | East LS Collector 1 | 4,884 | 15 | New Pipe | 0 | $220 | $80 | 2028+ | $1,074,538 |
| N9.3 | East LS Collector 3 | 2,801 | 15 | New Pipe | 0 | $220 | $80 | 2028+ | $616,327 |
| S2.7 | Inlet Park Trunk Phase 7 | 5,852 | 15 | Replace Pipe | 75 | $257 | $80 | 2028+ | $1,855,094 |
| S3 | West of School House Road Trunk | 5,481 | 21 | New Pipe | 0 | $268 | $88 | 2028+ | $1,468,896 |
| S4.3 | Ring Road Gravity Connection | 1,083 | 8 | New Pipe | 100 | $201 | $73 | 2028+ | $296,773 |
| S5 | Foothill Blvd Trunk | 21,784 | 21 | New Pipe | 0 | $268 | $88 | 2028+ | $5,838,221 |
| S6 | West of 400 South Trunk | 8,554 | 15 | New Pipe | 0 | $220 | $80 | 2028+ | $1,881,956 |
| **Totals** | | **60,621** | | | | | | | **$14,640,695** |

## LIFT STATION IMPROVEMENTS

Table 6-3 lists the future recommended wet well volume and hydraulic capacity of lift stations in Saratoga Springs at buildout.

**Table 6-3**
**Required Capacity at Lift Stations**

| Lift Station | Address[1] | Existing Wet Well Volume (gallons) | Future Required Wet Well Volume (gallons) | Existing Hydraulic Capacity (gpm) | Future Required Hydraulic Capacity (gpm) |
|---|---|---|---|---|---|
| 1 – Inlet Park | 400 S. Saratoga Rd | 4,600 | 4,000 | 2,350 | 1,600[3] |
| 2 – Posey | Pioneer Crossing, Jordan River | 5,200 | 4,630 | 3,000[2] | 1,850 |
| 3 – Eagle Park | 1448 S. Cottonwood Lane | 2,500 | 190 | 110[2] | 75 |
| 4 – North Twin | 1800 S. Centennial Blvd | 2,500 | 250 | 110 | 100 |
| 5 – South Twin | 2170 S. Centennial Blvd | 2,500 | 250 | 110 | 100 |
| 6 – Marina | 275 E. Cascade Court | 2,500 | 930 | 350[2] | 370 |
| 7 – El Nautica | 100 W. 3000 S. (Harbor Bay) | 3,500 | 1,100 | 550 | 440 |
| 8 – Mallard Bay (Future) | Bliss Drive | -- | 190 | -- | 75 |
| 9 – Future | Appx. 900 E. 200 N. | -- | 2,880 | -- | 1150 |
| 10 – Future | Fairway Blvd (east of Redwood) | -- | 11,000 | -- | 4,370 |

[1] Addresses are approximate
[2] Lift stations indicated include provisions to add an additional pump on the existing manifold
[3] When the force main is shortened (needs Projects S1.2 and S1.3), the lift station capacity will grow to 3,250 gpm. This is not sufficient to serve buildout flows, but is estimated to be able to serve growth through the next 10 years.

Table 6-4 lists the costs associated with lift station improvements recommended to meet future collection system needs at buildout.

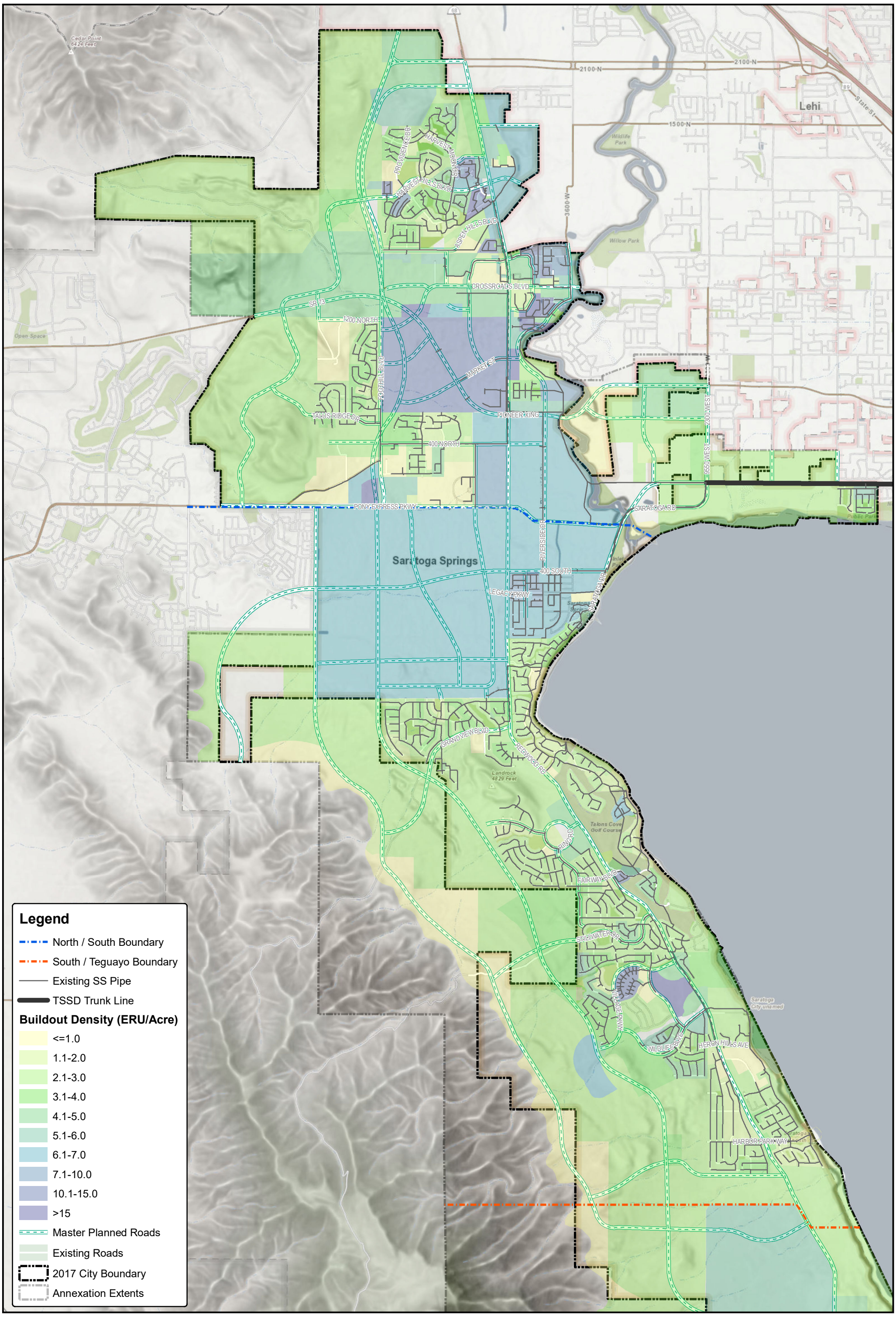
**Table 6-4**
**Lift Station Project Costs**

| Project ID | Project Name | Estimated Construction Year | Estimated Cost (2017 dollars) |
|---|---|---|---|
| L10 | New Lift Station 10 Design/Construction | 2025 | $1,997,050 |
| L9 | New Lift Station 9 Design/Construction | 2028+ | $804,750 |
| L6 | Lift Station 6 Pump Upgrade (Marina) | 2028+ | $175,000 |
| **Total** | | | **$2,976,800** |

Saratoga Springs personnel also provided a list of lift station and collection system upgrades that are recommended to improve system operation. Table 6-5 lists the costs associated with these maintenance related projects.

**Table 6-5**
**Maintenance Project Costs**

| Project ID | Project Name | Estimated Completion Year | Estimated Cost (2017 dollars) |
|---|---|---|---|
| M1 | Lift Station 1 Upgrades (Replace Pump Motors and Rotating Assemblies, Add New Grinder and Vault, Upgrade Existing Grinder) | 2018 | $180,000 |
| M2 | Lift Station 2 Upgrades (Replace Generator, Upgrade Existing Grinder) | 2018 | $170,000 |
| M5 | New TV Truck | 2027 | $203,000 |
| M6.2 | Lift Station 2 Force Main Cleanouts | 2028 | $46,000 |
| **Total** | | | **$599,000** |

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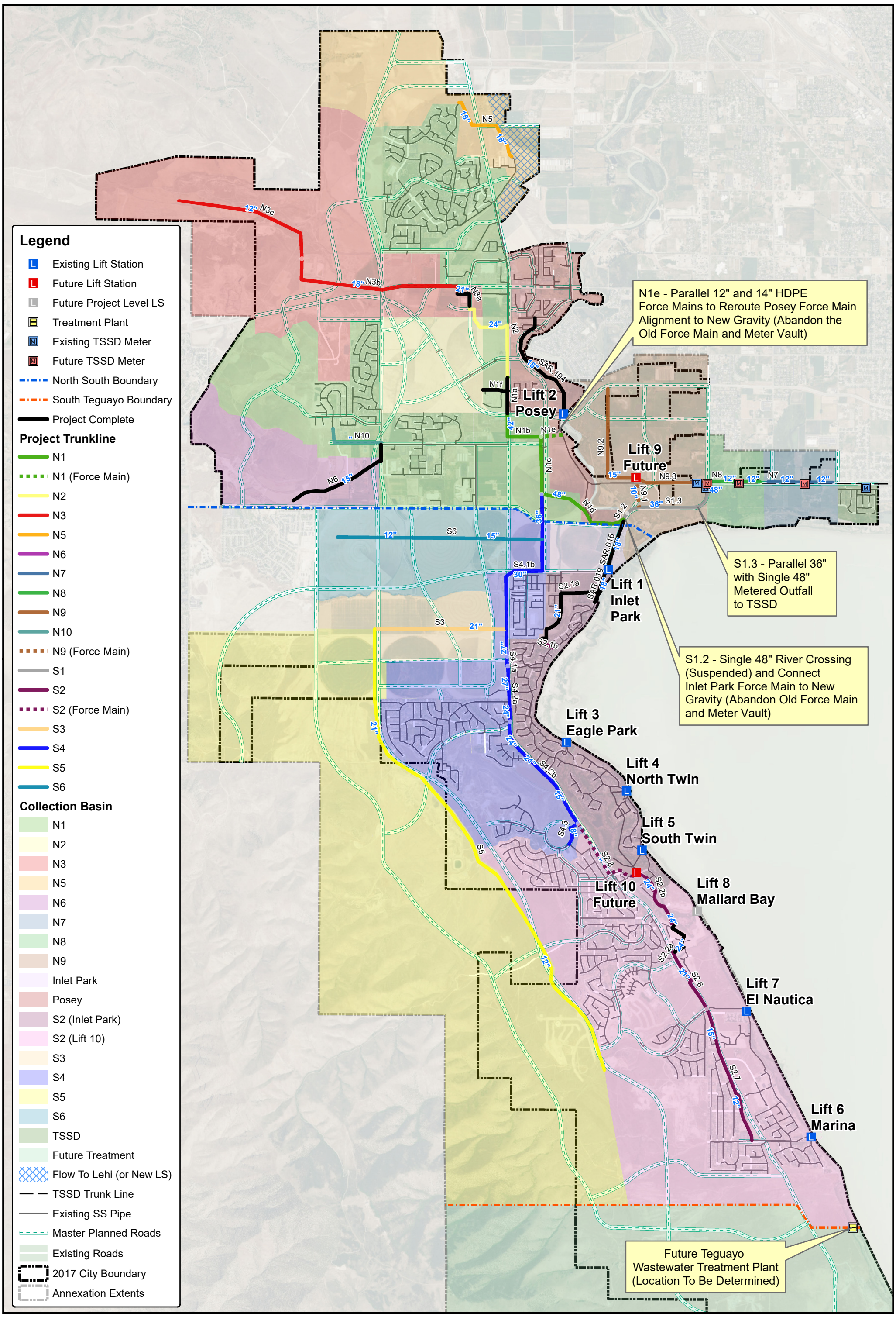
PLANNED BUILDOUT DENSITIES

NORTH:

SCALE: 0 1,750 3,500 Feet

FIGURE NO. 6-1

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 6-1_Buildout Density.mxd bashcroft 3/12/2018

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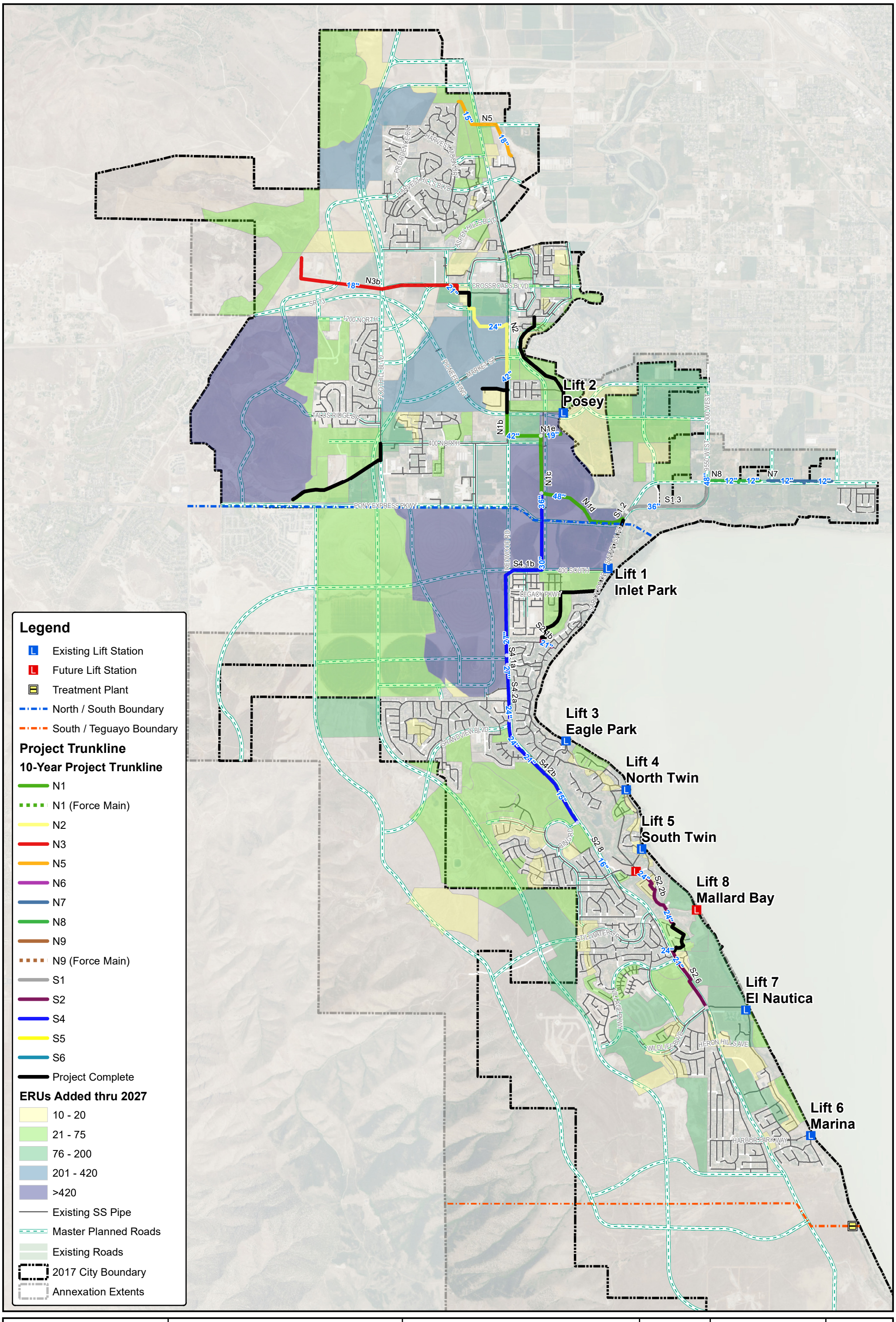
BUILDOUT SYSTEM IMPROVEMENTS

NORTH:

SCALE: 0 1,750 3,500 Feet

FIGURE NO. 6-2

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 6-2_Buildout Improvements.mxd jdietrich 6/25/2018

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SARATOGA SPRINGS
SEWER CAPITAL FACILITIES PLAN

SHORT TERM GROWTH AND PROJECTS (2018-2027)

NORTH:

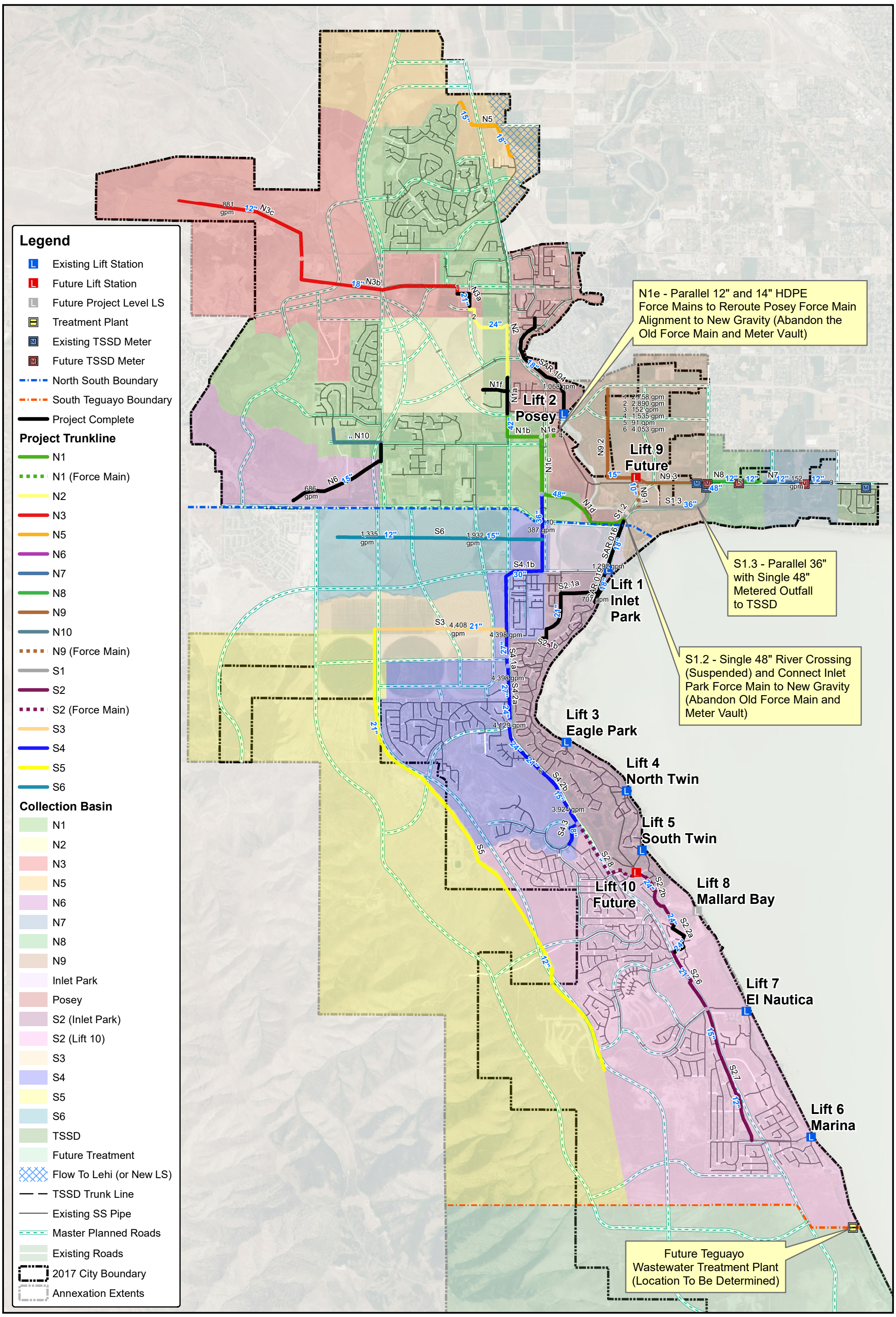
SCALE: 0 1,750 3,500 Feet

FIGURE NO. 6-3

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Figure 6-3_Short Term Growth and Projects.mxd jdietrich 5/18/2018

# APPENDIX A:

# SUPPLEMENTAL FIGURES




BOWEN COLLINS & ASSOCIATES
Celebrating 20 Years

SARATOGA SPRINGS
SEWER CAPITAL FACILITIES PLAN

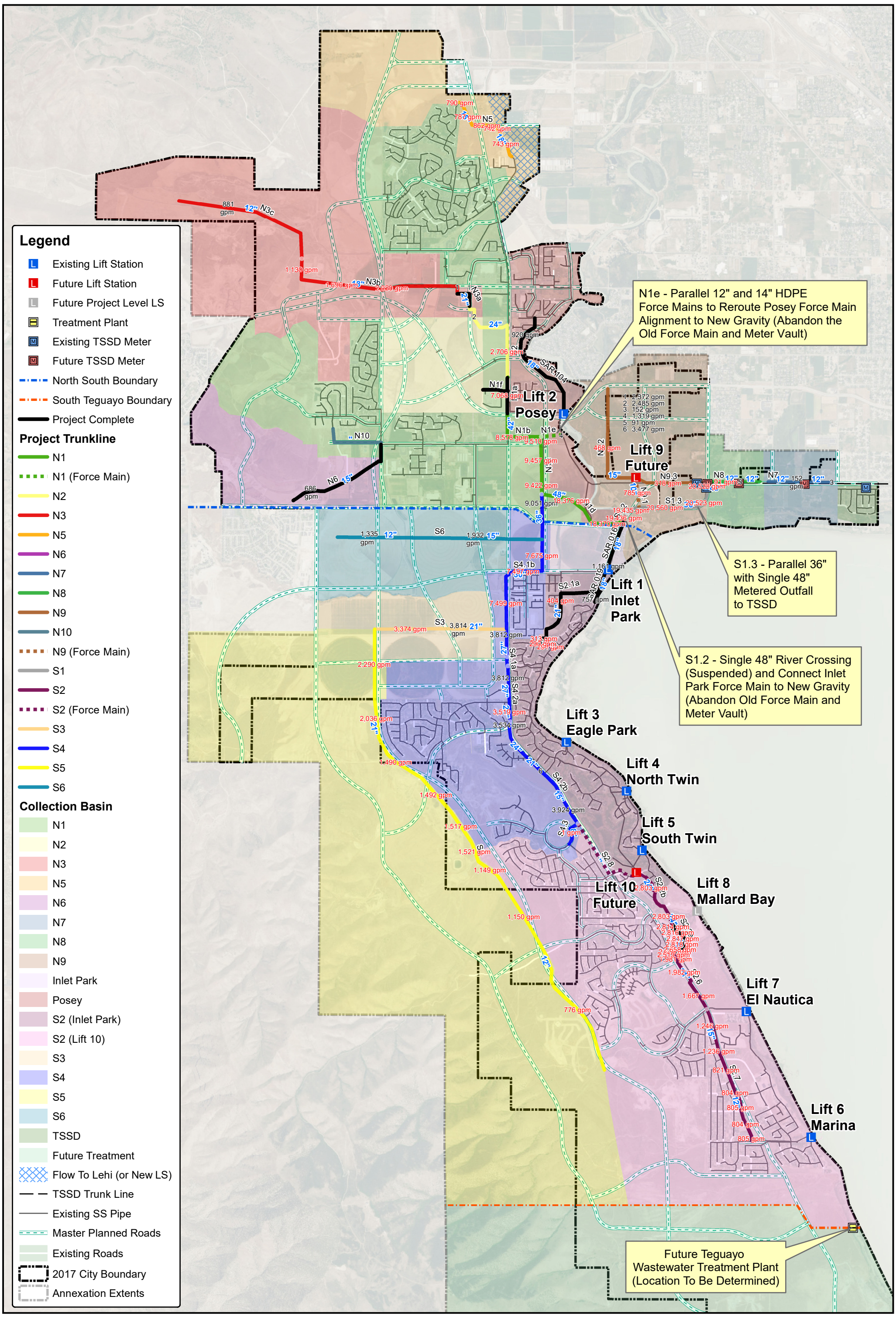
BUILDOUT SYSTEM IMPROVEMENTS WITH DESIGN FLOWS

NORTH:

SCALE: 0 1,750 3,500 Feet

FIGURE NO. A-1

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Scratch Figure A-1_Buildout Improvements with Flows.mxd jdietrich 6/25/2018

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SARATOGA SPRINGS
SEWER CAPITAL FACILITIES PLAN

BUILDOUT SYSTEM IMPROVEMENTS WITH DESIGN FLOWS

NORTH:

SCALE: 0 1,750 3,500 Feet

FIGURE NO. A-2

P:\Saratoga Springs\305-17-02 2017 Sewer Capital Facilities Plan, IFFP & IFA Update\4.0 GIS\Scratch Figure A-1_Buildout Improvements with Flows_10-15-18.mxd jdietrich 10/15/2018

# APPENDIX B:

# COST ESTIMATES

# TECHNICAL MEMORANDUM

| | |
|---|---|
| **TO:** | City of Saratoga Springs |
| **COPIES:** | File |
| **FROM:** | Keith Larson and Justin Dietrich<br>Bowen, Collins & Associates<br>154 East 14075 South<br>Draper, UT 84020 |
| **DATE:** | November 8, 2017 |
| **SUBJECT:** | 2017 Sewer Capital Facilities Plan Cost Estimates |

## 2017 CFP COST ESTIMATES

Two levels of cost estimates have been prepared for this capital facilities plan. For short term projects (within 10 years), detailed cost estimates are attached to this memorandum. These estimates have been based on BC&A's database of recent bids for pipe projects along the Wasatch Front and the detailed analysis completed at the time of the last CFP. The database includes extensive data on unit costs for smaller pipes and appurtenances along with some data for larger pipelines. A national cost estimating database for sewer pipes was also consulted to provide data for larger diameter pipes, and to confirm pipe costs for smaller pipes. The unit costs are based on 2017 dollars.

For cost estimates of projects outside the IFFP planning window, project details are less certain. As a result, BC&A has grouped pipeline and appurtenances together for estimating purposes. This simplifies the valuation procedure for long-term projects without significantly compromising accuracy. Instead of uncertain estimates of the number of individual manholes along an existing pipeline or their approximate location on a future pipeline, using a combined valuation wraps the cost of manholes and other appurtenances at average spacing into the total pipe cost. Based on this research, the proposed valuation for long-term cost estimates is as summarized in Table 1.

**Table 1**
**Long Term Pipe Projects Unit Costs**

| Pipe Diameter (in) | New Pipe ($/LF) | Replace Pipe ($/LF) | CIPP ($/LF) | Pavement Restoration ($/LF) |
|---|---|---|---|---|
| 8 | $201 | $233 | $57 | $73 |
| 10 | $210 | $240 | n/a | $73 |
| 12 | $208 | $242 | $64 | $77 |
| 15 | $220 | $257 | $71 | $80 |
| 18 | $250 | $291 | $88 | $86 |
| 21 | $268 | $310 | $102 | $88 |

| Pipe Diameter (in) | New Pipe ($/LF) | Replace Pipe ($/LF) | CIPP ($/LF) | Pavement Restoration ($/LF) |
|---|---|---|---|---|
| 24 | $285 | $328 | $115 | $89 |
| 27 | $357 | $405 | $172 | $99 |
| 30 | $400 | $449 | $214 | $104 |
| 36 | $457 | $509 | $257 | $108 |
| 42 | $628 | $685 | $357 | $117 |
| 48 | $696 | $754 | $400 | $121 |
| 54 | $800 | $861 | $457 | $126 |
| 60 | $846 | $909 | $500 | $130 |
| 66 | $927 | $993 | $558 | $136 |
| 72 | $1,028 | $1,100 | $657 | $145 |
| 78 | $1,107 | $1,185 | $757 | $154 |

Note: The 10-inch ID pipe cost shown is for a 10-inch (nominal) HDPE force main. The other values shown are for gravity sewer.

The table includes values for pipes under various conditions:

- **New Pipe –** This column represents the cost of installing a sewer pipe, complete in a new area. It includes excavation, pipe, stub outs for laterals, manholes, backfill, and traffic control. Because it is new pipe, there does not need to be bypass pumping, or reconnections to existing sewer lines.

- **Replace Pipe –** This column entails replacing an existing sewer pipe as part of a planned construction package. It includes everything in the new pipe column, but also includes bypass pumping and reconnections to existing sewer lines.

- **Cast in Place Pipe (CIPP)** – The City's most common form of pipeline rehabilitation is CIPP. Thus, it was deemed useful to include costs for this type of work. The costs for this category are based on estimates provided by two major companies that perform CIPP, along with bid results from various recently completed projects.

- **Pavement Restoration –** To be able to distinguish between pipes under pavement versus those outside pavement, asphalt restoration has not been included as part of the cost categories above. A separate number for pavement restoration is included in the table based on recent construction bids along the Wasatch Front.

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N1d North Trunk from Riverside Drive to River Crossing* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Lump | $100,000.00 | $100,000 |
| 2 | Misc. Unlisted Items | 5% | Lump | $100,810.00 | $100,810 |
| 3 | 48-inch Pipeline - Installed | 3,930 | LF | $486 | $1,910,079 |
| 4 | Bypass Pumping | 1 | LS | $35,000 | $35,000 |
| 5 | Manholes | 11 | EA | $6,459 | $71,049 |
| | Subtotal | | | | **$2,216,938** |
| | Engineering - Design | 6% | | | $133,100 |
| | Engineering - Construction Management | 6% | | | $133,100 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $66,600 |
| | **TOTAL CONCEPTUAL COST** | | | | **$2,549,738** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S1.2 River Crossing Trunk (Suspended)* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $92,390 | $92,390 |
| 2 | Misc. Unlisted Items | 5% | Lump | $46,200 | $46,200 |
| 3 | Parallel 36-inch or Single 48-inch River Crossing (suspended) | 1 | LS | $600,000 | $600,000 |
| 4 | End Structures | 2 | EA | $55,000 | $110,000 |
| 5 | Bypass Pumping | 1 | LS | $40,000 | $40,000 |
| 6 | Misc. Surface Restoration (Channel Restoration, etc.) | 1 | LS | $173,900 | $173,900 |
| | Subtotal | | | | **$1,062,490** |
| | Engineering - Design | 6% | | | $63,800 |
| | Engineering - Construction Management | 6% | | | $63,800 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $31,900 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,221,990** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S1.3 River Crossing Trunk - Outfall* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $211,690 | $211,690 |
| 2 | Misc. Unlisted Items | 5% | Lump | $105,850 | $105,850 |
| 3 | Parallel 36" Pipe - Installed | 4,200 | LF | $340 | $1,428,000 |
| 4 | Single 48" Pipe - Installed | 200 | LF | $389 | $77,760 |
| 5 | Parallel to Single Pipe Transition Structure | 1 | EA | $52,835 | $52,835 |
| 6 | Manholes | 12 | EA | $6,459 | $77,508 |
| 7 | Bypass Pumping | 1 | LS | $100,000 | $100,000 |
| 8 | Asphalt and Base | 2,600 | LF | $108 | $280,800 |
| 9 | Metering Flume and TSSD Connection | 1 | EA | $100,000 | $100,000 |
| | Subtotal | | | | **$2,434,443** |
| | Engineering - Design | 6% | | | $146,100 |
| | Engineering - Construction Management | 6% | | | $146,100 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $73,100 |
| | **TOTAL CONCEPTUAL COST** | | | | **$2,799,743** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S2.1b Remaining Portion of Inlet Park Trunk Phase 1* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $57,660.00 | $57,660 |
| 2 | Misc. Unlisted Items | 5% | Lump | $28,830.00 | $28,830 |
| 3 | Utility Relocation/Reconstruction | 1 | Lump | $80,000 | $80,000 |
| 4 | 21-inch Pipeline - Installed | 708 | LS | $194 | $137,359 |
| 5 | Additional Costs Associated with Depth | 1 | EA | $152,200 | $152,200 |
| 6 | Deep Manholes | 4 | EA | $9,068 | $36,272 |
| 7 | Lateral Reconnections | 8 | LS | $1,477 | $11,816 |
| 8 | Bypass Pumping | 1 | LS | $25,000 | $25,000 |
| 9 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | Lump | $90,000 | $90,000 |
| 10 | Asphalt and Base | 500 | LF | $88 | $44,000 |

| | | |
|---|---|---|
| Subtotal | | **$663,137** |
| Engineering - Design | 6% | $39,800 |
| Engineering - Construction Management | 6% | $39,800 |
| Legal and Admin. (ROW, Financing, etc.) | 3% | $19,900 |
| **TOTAL CONCEPTUAL COST** | | **$762,637** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S4.1a Parkway Blvd Crossing At Redwood Road* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $11,750.00 | $11,750 |
| 2 | Misc. Unlisted Items | 5% | Lump | $5,880.00 | $5,880 |
| 3 | 27-inch Pipe Installed | 341 | LF | $240 | $81,764 |
| 4 | Manholes | 4 | EA | $3,943 | $15,772 |
| 5 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $20,000 | $20,000 |
| | Subtotal | | | | **$135,166** |
| | Engineering - Design | 6% | | | $8,200 |
| | Engineering - Construction Management | 6% | | | $8,200 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $4,100 |
| | **TOTAL CONCEPTUAL COST** | | | | **$155,666** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N1b North Trunk - Redwood Rd and Pioneer Xing to Riverside Dr* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Lump | $100,000.00 | $100,000 |
| 2 | Misc. Unlisted Items | 5% | Lump | $65,000.00 | $65,000 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $50,000 | $50,000 |
| 4 | 42-inch Pipeline - Installed | 2,441 | LF | $387 | $944,730 |
| 5 | Additional Costs Associated with Depth | 1 | LS | $125,000 | $125,000 |
| 6 | Manholes | 8 | EA | $6,459 | $51,672 |
| 7 | Bypass Pumping | 1 | LS | $35,000 | $35,000 |
| 8 | Asphalt and Base | 800 | LF | $117 | $93,600 |
| | Subtotal | | | | **$1,465,002** |
| | Engineering - Design | 6% | | | $88,000 |
| | Engineering - Construction Management | 6% | | | $88,000 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $44,000 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,685,002** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N1c North Trunk - Riverside Drive* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Lump | $100,000.00 | $100,000 |
| 2 | Misc. Unlisted Items | 5% | Lump | $69,230.00 | $69,230 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $20,000 | $20,000 |
| 4 | 48-inch Pipeline - Installed | 2,385 | LF | $486 | $1,159,283 |
| 5 | Additional Costs Associated with Depth | 1 | LS | $125,000 | $125,000 |
| 6 | Manholes | 7 | EA | $6,459 | $45,213 |
| 7 | Asphalt and Base | 300 | LF | $117 | $35,100 |
| | Subtotal | | | | **$1,553,826** |
| | Engineering - Design | 6% | | | $93,300 |
| | Engineering - Construction Management | 6% | | | $93,300 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $46,700 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,787,126** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N1e Posey Force Main Modification* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $48,880.00 | $48,880 |
| 2 | Misc. Unlisted Items | 5% | Lump | $24,440.00 | $24,440 |
| 3 | Force Main Modification (12" & 14" - Installed) | 890 | LF | $320 | $284,715 |
| 4 | Bypass Pumping | 1 | LS | $52,000 | $52,000 |
| 5 | Asphalt and Base | 1,300 | LF | $117 | $152,100 |
| | Subtotal | | | | **$562,135** |
| | Engineering - Design | 6% | | | $33,800 |
| | Engineering - Construction Management | 6% | | | $33,800 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $16,900 |
| | **TOTAL CONCEPTUAL COST** | | | | **$646,635** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S2.2b Inlet Park Trunk - Phase 2, Golf Course Main* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $119,590.00 | $119,590 |
| 2 | Misc. Unlisted Items | 5% | Lump | $59,790.00 | $59,790 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $46,400 | $46,400 |
| 4 | 21-inch Pipeline - Installed | 3,325 | LF | $206 | $684,950 |
| 5 | Manholes | 18 | EA | $3,943 | $70,974 |
| 6 | Lateral Reconnections | 11 | EA | $1,477 | $16,247 |
| 7 | Bypass Pumping | 1 | LS | $143,700 | $143,700 |
| 8 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $136,800 | $136,800 |
| 9 | Asphalt and Base | 1,100 | LF | $88 | $96,800 |
| | Subtotal | | | | **$1,375,251** |
| | Engineering - Design | 6% | | | $82,600 |
| | Engineering - Construction Management | 6% | | | $82,600 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $41,300 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,581,751** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: L10 New Lift Station 10 Design/Construction* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Lump | $150,000.00 | $150,000 |
| 2 | Misc. Unlisted Items | 5% | Lump | $75,550.00 | $75,550 |
| 3 | Building | 1 | Lump | $450,000 | $450,000 |
| 4 | Pumps Installed with Controls | 1 | Lump | $280,000 | $280,000 |
| 5 | Other Mechanical (heat, metering, piping, etc.) | 1 | Lump | $220,000 | $220,000 |
| 6 | Backup Generator | 1 | Lump | $90,000 | $90,000 |
| 7 | Bypass Pumping | 1 | Lump | $26,000 | $26,000 |
| 8 | Bypass Vault | 1 | Lump | $45,000 | $45,000 |
| 9 | Inlet Vault with Grinder (including controls) | 1 | Lump | $80,000 | $80,000 |
| 10 | Other Electrical (power feed, building wiring, etc.) | 1 | Lump | $80,000 | $80,000 |
| 11 | Site Work | 1 | Lump | $210,000 | $210,000 |
| 12 | Landscaping | 1 | Lump | $30,000 | $30,000 |

| | | |
|---|---|---|
| Subtotal | | **$1,736,550** |
| Engineering - Design | 6% | $104,200 |
| Engineering - Construction Management | 6% | $104,200 |
| Legal and Admin. (ROW, Financing, etc.) | 3% | $52,100 |
| **TOTAL CONCEPTUAL COST** | | **$1,997,050** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S2.8 Force Main From Lift 10* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $128,640.00 | $128,640 |
| 2 | Misc. Unlisted Items | 5% | Lump | $64,320.00 | $64,320 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $25,000 | $25,000 |
| 4 | 16-inch HDPE Force Main Installed | 3,851 | LF | $260 | $1,001,247 |
| 5 | Polymer Discharge Manhole | 1 | EA | $15,800 | $15,800 |
| 6 | Bypass Pumping | 1 | LS | $30,000 | $30,000 |
| 7 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $100,000 | $100,000 |
| 8 | Asphalt and Base | 1,300 | LF | $88 | $114,400 |
| | Subtotal | | | | **$1,479,407** |
| | Engineering - Design | 6% | | | $88,800 |
| | Engineering - Construction Management | 6% | | | $88,800 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $44,400 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,701,407** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S4.1b Redwood Road to Gravity Outfall* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $369,420.00 | $369,420 |
| 2 | Misc. Unlisted Items | 5% | Lump | $184,710.00 | $184,710 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $160,000 | $160,000 |
| 4 | 36-inch Pipe Installed | 1,888 | LF | $305 | $575,934 |
| 5 | 30-inch Pipe Installed | 5,098 | LF | $260 | $1,325,518 |
| 6 | 27-inch Pipe Installed | 1,249 | LF | $240 | $299,773 |
| 7 | Manholes | 27 | EA | $3,943 | $106,461 |
| 8 | Bypass Pumping | 1 | LS | $220,000 | $220,000 |
| 9 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $150,000 | $150,000 |
| 10 | Asphalt and Base | 8,236 | LF | $104 | $856,493 |
| | Subtotal | | | | **$4,248,310** |
| | Engineering - Design | 6% | | | $254,900 |
| | Engineering - Construction Management | 6% | | | $254,900 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $127,500 |
| | **TOTAL CONCEPTUAL COST** | | | | **$4,885,610** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S4.2a Redwood Road Gravity Extension - Parkway Blvd to Grandview Blvd (Replace Existing)* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $89,110.00 | $89,110 |
| 2 | Misc. Unlisted Items | 5% | Lump | $44,550.00 | $44,550 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $25,000 | $25,000 |
| 4 | 24-inch Pipe Installed | 816 | LF | $206 | $168,130 |
| 5 | 27-inch Pipe Installed | 1,499 | LF | $240 | $359,763 |
| 6 | Manholes | 10 | EA | $3,943 | $39,430 |
| 7 | Bypass Pumping | 1 | LS | $65,000 | $65,000 |
| 8 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $30,000 | $30,000 |
| 9 | Asphalt and Base (assumed installation is parallel to, and not within, Redwood Road) | 2,315 | LF | $88 | $203,736 |
| | Subtotal | | | | **$1,024,720** |
| | Engineering - Design | 6% | | | $61,500 |
| | Engineering - Construction Management | 6% | | | $61,500 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $30,800 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,178,520** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S4.2b Redwood Road Gravity Extension - Grandview Blvd to 2015 S (New Pipe)* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 1 | Lump | $150,000.00 | $150,000 |
| 2 | Misc. Unlisted Items | 5% | Lump | $86,500.00 | $86,500 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $25,000 | $25,000 |
| 4 | 15-inch Pipe Installed | 2,536 | LF | $156 | $395,565 |
| 5 | 21-inch Pipe Installed | 1,053 | LF | $194 | $204,257 |
| 6 | 24-inch Pipe Installed | 1,689 | LF | $206 | $347,863 |
| 7 | Manholes | 18 | EA | $3,943 | $70,974 |
| 8 | Bypass Pumping | 1 | LS | $52,000 | $52,000 |
| 9 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $170,000 | $170,000 |
| 10 | Asphalt and Base (assumed installation is parallel to, and not within, Redwood Road) | 5,277 | LF | $88 | $464,394 |
| | Subtotal | | | | **$1,966,553** |
| | Engineering - Design | 6% | | | $118,000 |
| | Engineering - Construction Management | 6% | | | $118,000 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $59,000 |
| | **TOTAL CONCEPTUAL COST** | | | | **$2,261,553** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N2 Exchange Drive to Project N1 (no Redwood Rd. trunkline replacement; new line to parallel existing line)* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $143,270.00 | $143,270 |
| 2 | Misc. Unlisted Items | 5% | Lump | $71,630.00 | $71,630 |
| 3 | 24-inch Pipeline - Installed | 4,504 | LF | $220 | $990,836 |
| 4 | Manholes | 16 | EA | $3,943 | $63,088 |
| 5 | Lateral Reconnections | 7 | EA | $1,477 | $10,339 |
| 6 | Bypass Pumping | 1 | LS | $52,000 | $52,000 |
| 7 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $120,600 | $120,600 |
| 8 | Asphalt and Base | 2,200 | LF | $89 | $195,800 |
| | Subtotal | | | | **$1,647,563** |
| | Engineering - Design | 6% | | | $98,900 |
| | Engineering - Construction Management | 6% | | | $98,900 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $49,500 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,894,863** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: S2.6 Inlet Park Trunk - Phase 6* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $133,250.00 | $133,250 |
| 2 | Misc. Unlisted Items | 5% | Lump | $66,620.00 | $66,620 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $150,000 | $150,000 |
| 4 | 21-inch Pipeline - Installed | 2,865 | LF | $194 | $555,746 |
| 5 | 24-inch Pipeline - Installed | 86 | LF | $206 | $17,790 |
| 6 | Manholes | 12 | EA | $3,943 | $47,316 |
| 7 | Lateral Reconnections | 20 | EA | $1,477 | $29,540 |
| 8 | Bypass Pumping | 1 | LS | $180,000 | $180,000 |
| 9 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $100,000 | $100,000 |
| 10 | Asphalt and Base | 2,865 | LF | $88 | $252,091 |
| | Subtotal | | | | **$1,532,354** |
| | Engineering - Design | 6% | | | $92,000 |
| | Engineering - Construction Management | 6% | | | $92,000 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $46,000 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,762,354** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N3b 1400 North Extension* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $179,600.00 | $179,600 |
| 2 | Misc. Unlisted Items | 5% | Lump | $89,800.00 | $89,800 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $50,000 | $50,000 |
| 4 | 18-inch Pipe Installed | 6,931 | LF | $180 | $1,247,556 |
| 5 | 21-inch Pipe Installed | 792 | LF | $194 | $153,699 |
| 6 | Manholes | 21 | EA | $3,943 | $82,803 |
| 7 | Additional Costs Associated with MVC Crossing | 1 | Lump | $200,000 | $200,000 |
| 8 | Asphalt and Base | 720 | LF | $86 | $61,920 |
| | Subtotal | | | | **$2,065,378** |
| | Engineering - Design | 6% | | | $124,000 |
| | Engineering - Construction Management | 6% | | | $124,000 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $62,000 |
| | **TOTAL CONCEPTUAL COST** | | | | **$2,375,378** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N5 North Line Extension and Redwood Road Crossing* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $87,220.00 | $87,220 |
| 2 | Misc. Unlisted Items | 5% | Lump | $43,610.00 | $43,610 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $50,000 | $50,000 |
| 4 | 18-inch Pipe Installed | 1,462 | LF | $180 | $263,075 |
| 5 | 15-inch Pipe Installed | 2,173 | LF | $156 | $339,043 |
| 6 | Manholes | 13 | EA | $3,943 | $51,259 |
| 7 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $100,000 | $100,000 |
| 8 | Asphalt and Base | 800 | LF | $86 | $68,800 |
| | Subtotal | | | | **$1,003,007** |
| | Engineering - Design | 6% | | | $60,200 |
| | Engineering - Construction Management | 6% | | | $60,200 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $30,100 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,153,507** |

# *Preliminary Cost Estimate*

| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N7 Saratoga Road East Collector and Outfall 1* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $84,490.00 | $84,490 |
| 2 | Misc. Unlisted Items | 5% | Lump | $42,240.00 | $42,240 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $30,000 | $30,000 |
| 4 | 12-inch Pipe Installed | 2,770 | LF | $149 | $412,685 |
| 5 | Manholes | 8 | EA | $3,943 | $31,544 |
| 6 | Lateral Reconnections | 5 | EA | $1,477 | $7,385 |
| 7 | Metering Flume and TSSD Connection | 1 | Lump | $50,000 | $50,000 |
| 8 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $100,000 | $100,000 |
| 9 | Asphalt and Base | 2,770 | LF | $77 | $213,267 |
| | Subtotal | | | | **$971,610** |
| | Engineering - Design | 6% | | | $58,300 |
| | Engineering - Construction Management | 6% | | | $58,300 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $29,200 |
| | **TOTAL CONCEPTUAL COST** | | | | **$1,117,410** |

# *Preliminary Cost Estimate*

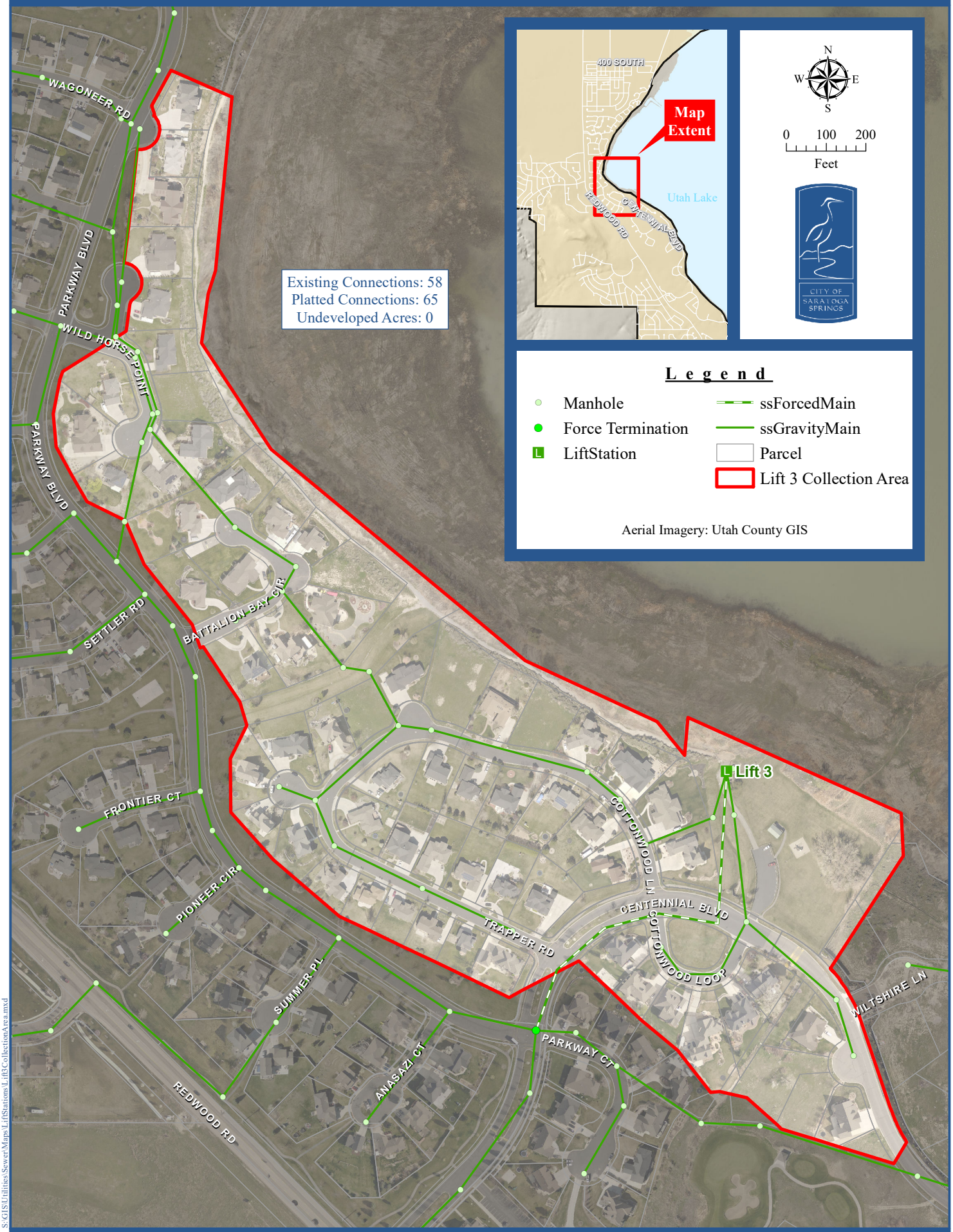
| | |
|---|---|
| *Capital Facilities Plan* | *Date: 02-08-18* |
| *Project: N8 Saratoga Road East Collector and Outfall 2* | *Prepared by: JD* |
| *Owner: City of Saratoga Springs* | |

| No. | Item | Quantity | Units | Unit Cost | Cost |
|---|---|---|---|---|---|
| 1 | Mobilization/Demobilization | 10% | Lump | $69,490.00 | $69,490 |
| 2 | Misc. Unlisted Items | 5% | Lump | $34,740.00 | $34,740 |
| 3 | Utility Relocation/Reconstruction | 1 | LS | $30,000 | $30,000 |
| 4 | 12-inch Pipe Installed | 2,104 | LF | $149 | $313,478 |
| 5 | Manholes | 7 | EA | $3,943 | $27,601 |
| 6 | Lateral Reconnections | 8 | EA | $1,477 | $11,816 |
| 7 | Metering Flume and TSSD Connection | 1 | Lump | $50,000 | $50,000 |
| 8 | Misc. Surface Restoration (Concrete, landscaping, etc.) | 1 | LS | $100,000 | $100,000 |
| 9 | Asphalt and Base | 2,104 | LF | $77 | $161,998 |
| | Subtotal | | | | **$799,123** |
| | Engineering - Design | 6% | | | $48,000 |
| | Engineering - Construction Management | 6% | | | $48,000 |
| | Legal and Admin. (ROW, Financing, etc.) | 3% | | | $24,000 |
| | **TOTAL CONCEPTUAL COST** | | | | **$919,123** |

# APPENDIX C:

# SEWER LIFT STATION SERVICE AREA MAPS

# Sewer Lift 3 Collection Area

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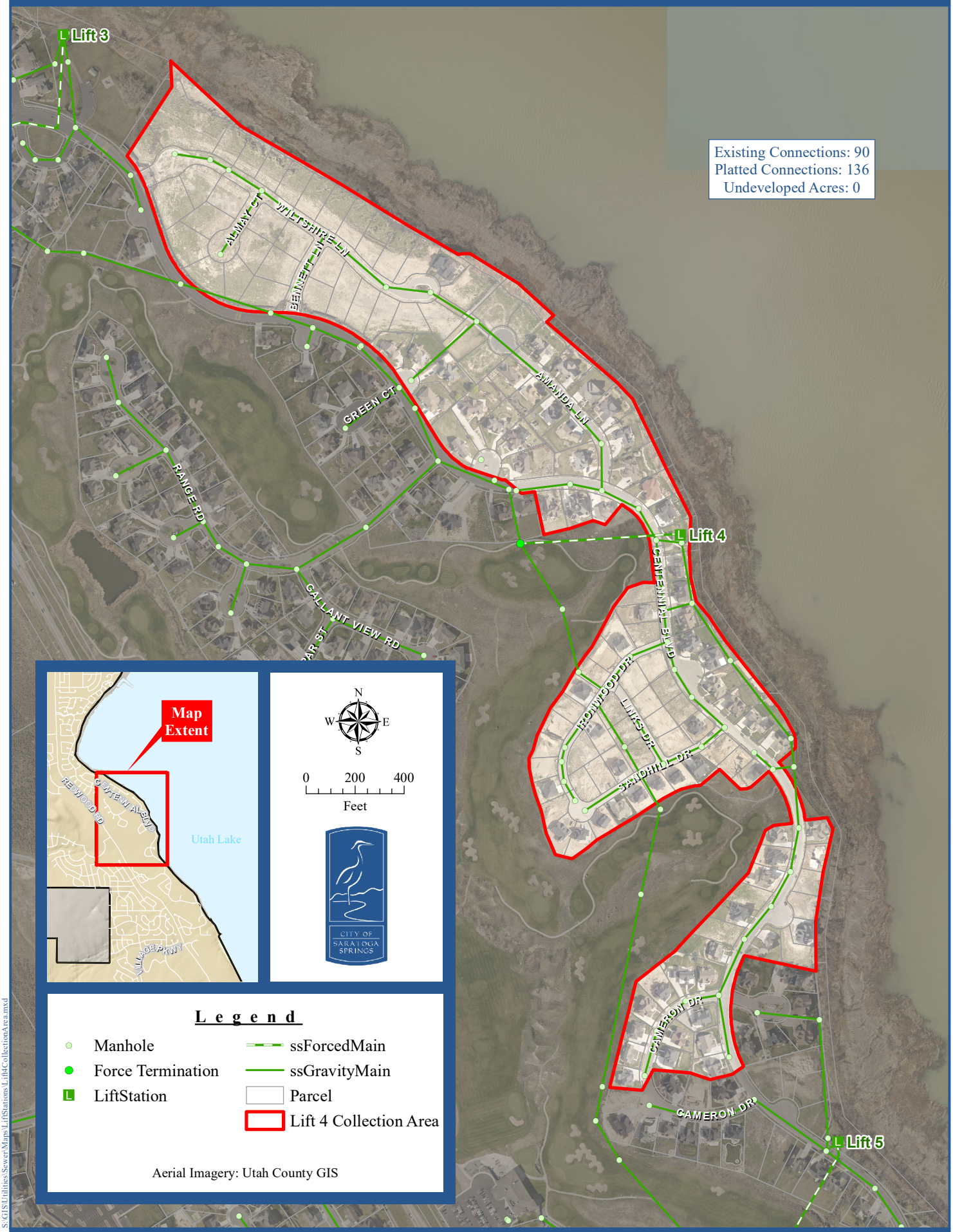
22 May 2018

# Sewer Lift 4 Collection Area

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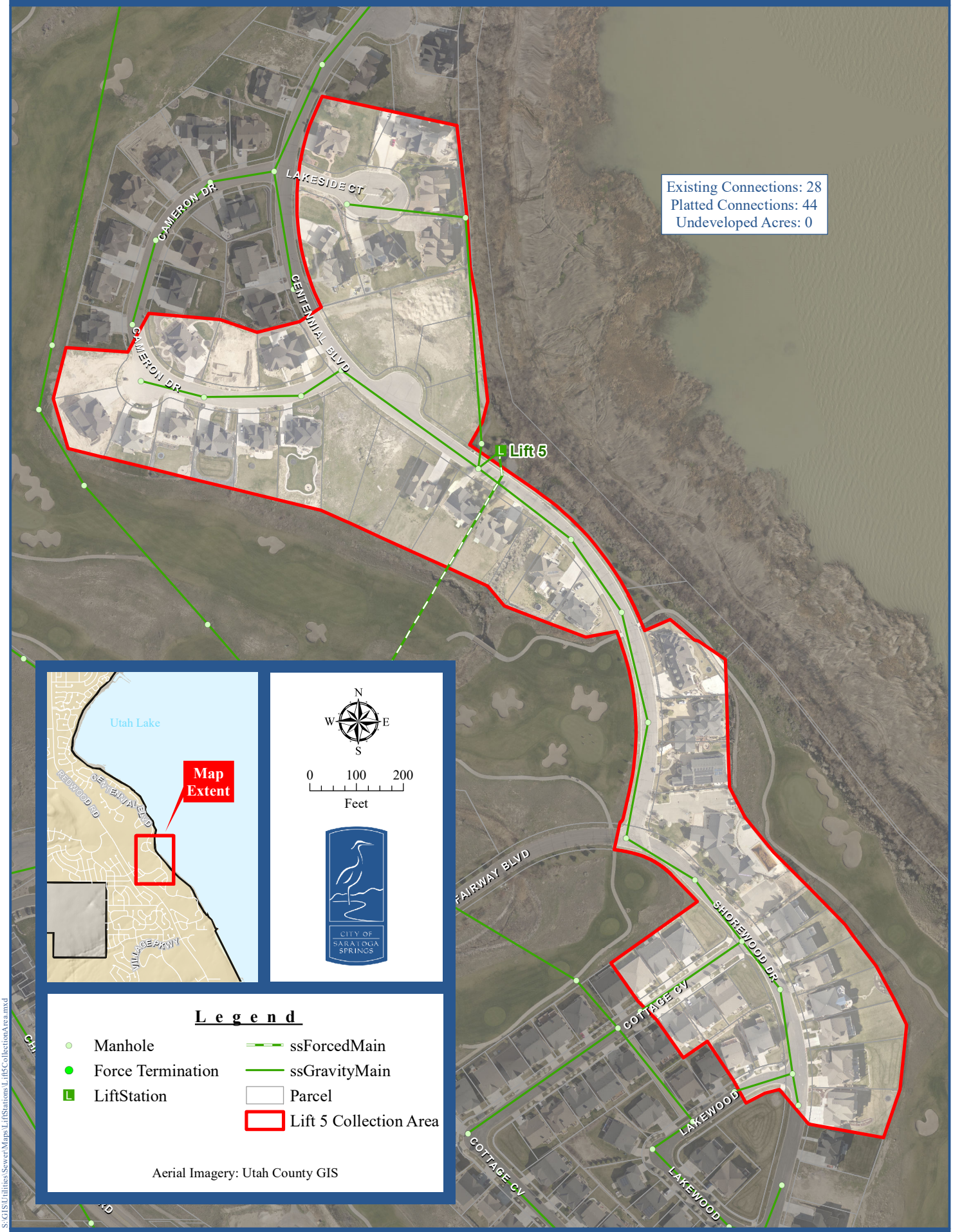
22 May 2018

# Sewer Lift 5 Collection Area

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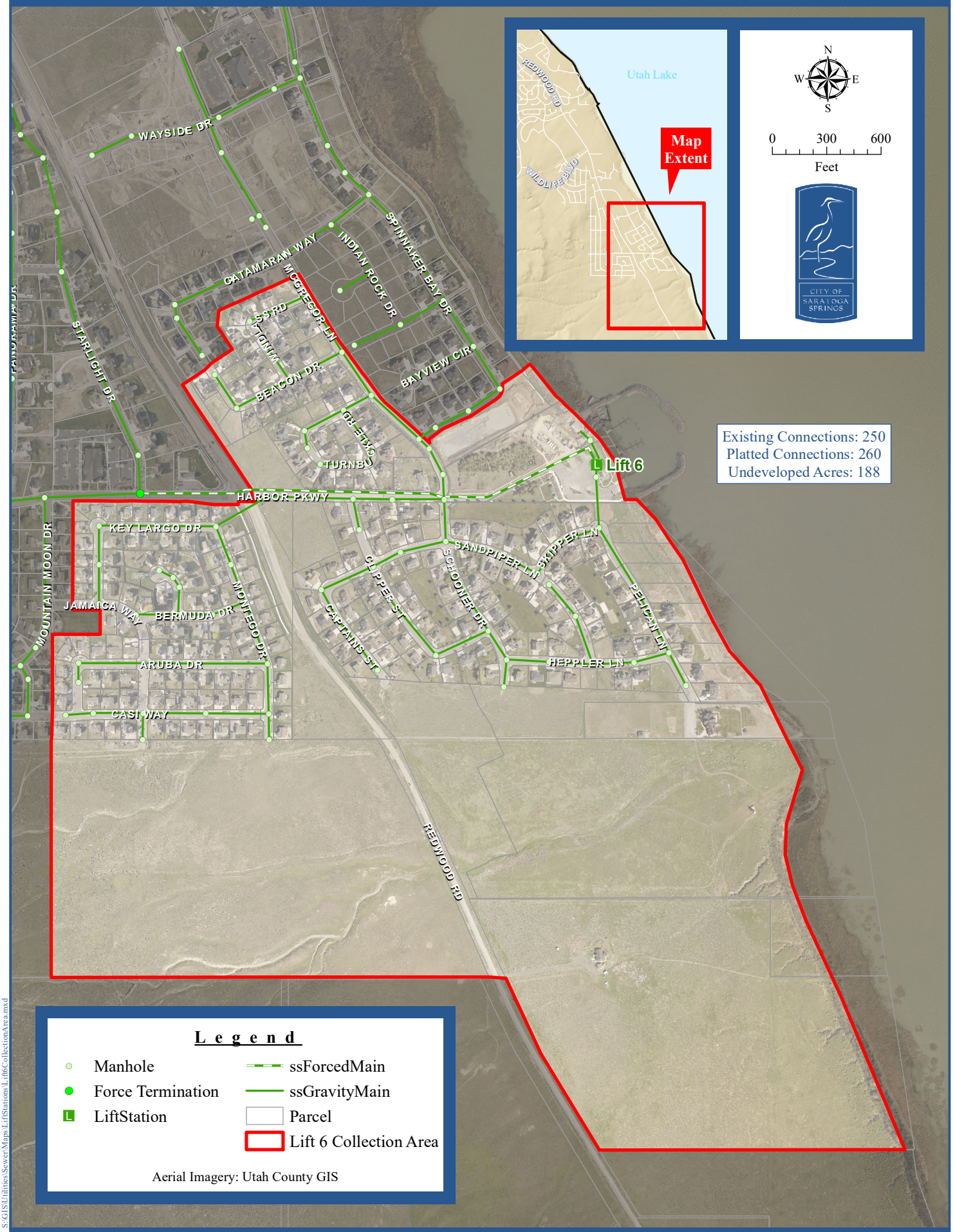
22 May 2018

# Sewer Lift 6 Collection Area

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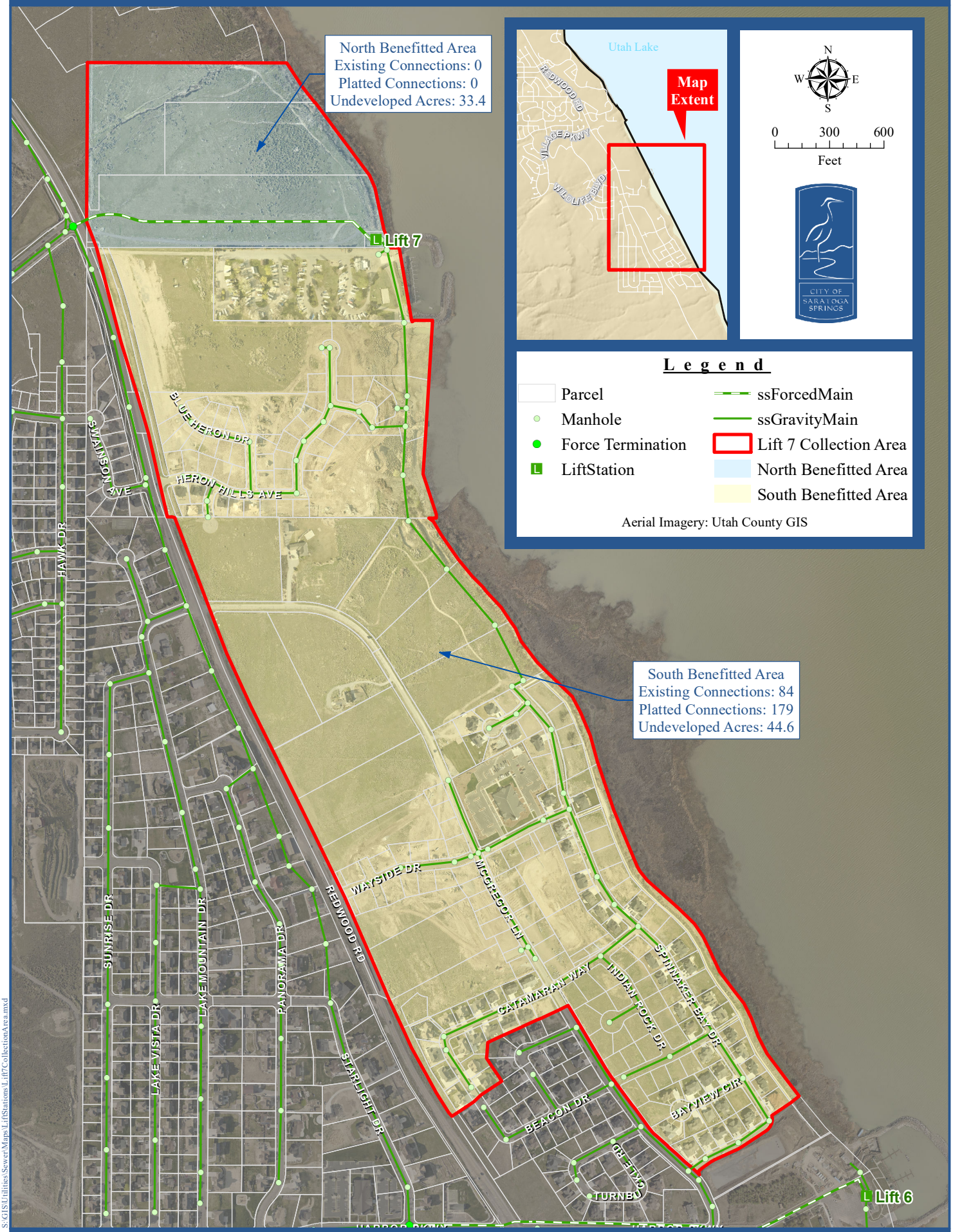
22 May 2018

# Sewer Lift 7 Collection Area

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22 May 2018

# Sewer Lift 8 Collection Area

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23 May 2018

**Salt Lake Area Office:**
154 East 14075 South
Draper, Utah 84020
Phone: (801) 495-2224
Fax: (801) 495-2225

**Boise Area Office:**
776 East Riverside Drive
Suite 250
Eagle, Idaho 83616
Phone: (208) 939-9561
Fax: (208) 939-9571

**Southern Utah Area Office:**
20 North Main
Suite107
St. George, Utah 84770
Phone: (435) 656-3299
Fax: (435) 656-2190

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