NOTICE

Notice is hereby given that the Mayor and City Council will hold a Work Session on Wednesday, September 18, 2013 in the Council Chambers, 45 West 100 South, beginning at 6:00 pm.

DISCUSSION ITEMS

1. J-U-B Engineering
   a. Culinary Water CFP, IPP, & IFFA
2. Review of Agenda Items
3. General Discussion

If you are planning to attend this Public Meeting and, due to a disability, need assistance in understanding or participating in the meeting, please notify the City Office ten or more hours in advance and we will, within reason, provide what assistance may be required.

CERTIFICATE OF MAILING

The undersigned duly appointed City Recorder for the municipality of Santaquin City hereby certifies that a copy of the foregoing Notice and Agenda was e-mailed to the Payson Chronicle, Payson, UT, 84651.

S B Farnsworth

By: Susan B. Farnsworth, City Recorder

Posted:
City Offices
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MINUTES OF A COUNCIL WORK SESSION
HELD IN THE COUNCIL CHAMBERS
SEPTEMBER 18, 2013

The meeting was called to order by Mayor James E. DeGraffenried at 6:00 pm. Council Members Keith Broadhead, Matthew Carr, Kirk Hunsaker, James Linford, and Rick Steele.

Others attending: City Manager Ben Reeves, Director Dennis Marker, Director Kevin Schmidt, J-U-B Engineering Representatives Norman Bagley and Mark Christensen, and Zion Bank Representative Mat Mills.

DISCUSSION ITEMS

J-U-B Engineering

Culinary Water CFP, IPP, & IFFP

Mr. Bagley and Mr. Mills reviewed the proposed Culinary Water System CFP, IPP, & IFFP reports with the Mayor and Council Members (see attachment "A" for a copy of the plans).

Review of Agenda Items

Nothing

General Discussion

Nothing

At 6:55 pm the meeting adjourned.

Approved on October 2, 2013.

James E. DeGraffenried, Mayor

Susan B. Farnsworth, City Recorder

SANTAQUIN CITY

CULINARY WATER SYSTEM MASTER PLAN and CAPITAL FACILITIES PLAN

August 2013

Prepared by:

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J-U-B ENGINEERS, Inc.
ENGINEERS • SURVEYORS • PLANNERS

Santaquin

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Adopted by Santaquin City Council
on _____

J-U-B ENGINEERS, Inc.
ENGINEERS • SURVEYORS • PLANNERS

Santaquin

EXECUTIVE SUMMARY

The Santaquin City Culinary Water Master Plan and Capital Facilities Plan plans for future infrastructure improvements to the Santaquin culinary water system. It also provides the foundation for collection of culinary water impact fees. J-U-B Engineers created a computer model of the water system in order to identify what improvements would be needed when Santaquin is built out.

We established a level of service consistent with standards of the State of Utah. The existing culinary water system meets the level of service, with the exception of three areas of low pressure under fire flow conditions and one area under peak day demand conditions. When development occurs in these areas it will loop lines, increasing the pressure to meet the standard.

Santaquin City will need two additional wells, four additional water tanks, and many booster pumps and pressure reducing valves. Some of these facilities will likely be installed by land developers. Multiple water lines to be installed by land developers will need to be larger than the minimum 8" diameter line size. Santaquin City will need to fund the additional line size costs for upsizing. Improvements needed to satisfy the demands of future growth are eligible for payment with impact fees. However the timing of many of these improvements will be driven by specific developments, and the City will likely have to bond for some of them and then be reimbursed by future impact fee collections.

While growth will likely not trigger the construction of the most expensive infrastructure in the next decade, some of it will provide operational and cost saving benefits. If such infrastructure is constructed prior to being needed to support growth, impact fees can be collected after construction to reimburse the costs as development consumes the available reserve capacity.

We make the following recommendations:

1. Collect impact fees to fund infrastructure to support future growth.

2. Make improvements to the pressure irrigation system so that it is not consuming source and storage capacity in the culinary water system, particularly on the east side of the city.

3. Accelerate construction of the additional storage at the location of the Zone 10 Tank (W) and the associated booster facility, and provide a booster facility to pump water from Zone 10 to Zone 11E.

4. Make operational changes to the system, in conjunction with the aforementioned storage and booster facility, to reduce pumping costs and allow for more efficient operation of the system.

5. Update the Master Plan/Capital Facilities Plan at least every 5 years, or when significant changes to planned land use, development or water use occur.

CULINARY WATER MASTER PLAN AND CAPITAL FACILITIES PLAN

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I. INTRODUCTION

A. Purpose

This document is an integrated master plan and capital facilities plan for Santaquin City's culinary water system. It identifies the City's current culinary water system as well as current and future infrastructure needs and provides direction as growth occurs. The recommendations herein are based on conclusions reached using growth projections and computer modeling of the City's culinary water system.

B. Background

The Santaquin City culinary water system has evolved over many years. From "Santaquin, 'Through the Years' 1856 – 1956" (Lamb, Florence, et al. 2nd ed, 2001) we learn the following: "The first Santaquin water system was constructed between 1910 and 1911. The city bonded for the project and constructed a head house with water being distributed to the citizens through wooden pipe. Between 1930-1932 pipe was laid from the head house to the creek to increase the water in the system. The wooden pipe was changed into cast iron pipe. Six meters were installed in 1930. Between 1936-1937, 120 acres of land in the north of the canyon was purchased to dig tunnels for more water. The wooden flow line was replaced with an 8-inch line. This developed one second foot of new water. During the "Depression years" Santaquin utilized "Make Work Projects" to clean the springs, replace nearly 1 mile of worn out pipes and improved the head house to hold 240,000 gallons in an effort to store and conserve water. Santaquin's first culinary well was drilled in 1953. A 500,000 gallon tank replaced the first head house in 1956."

Over the subsequent years the system continued to develop and evolve in order to serve additional new users. In the early 1990's approximately $1.8 million worth of improvements were made to the system. In the mid-2000's the pressure irrigation system was constructed, reducing a portion of the demand on the culinary water system. The culinary water system still supplies some water to the pressure irrigation system. Santaquin City completed culinary water system master plans in 1991-1992 and again in 1995. An update that begun in the late 2000's was delayed in order to incorporate changing impact fee legislation in Utah.

C. Scope

This master plan includes a discussion of system modeling efforts and summary results and capital facilities planning for the City's culinary water system from 2013 to buildout. The plan also includes an implementation plan for recommended capital improvement projects.

This plan provides direction for future growth, and the integrated capital facilities plan provides a plan for construction of culinary water system improvements to serve the residents of Santaquin City. The capital improvement projects portion of the plan includes planning level cost estimates as well as an estimated schedule for construction of the recommended improvements

D. Objectives

The objectives of this Culinary Water Master Plan & Capital Facilities Plan are listed below:

1. Model the existing culinary water system
2. Establish levels of service
3. Identify improvements needed to meet existing system deficiencies
4. Model the future water system required to service projected build-out conditions based on the City's current General Plan
5. Identify improvements needed to meet future demands to build-out
6. Prioritize improvement projects
7. Estimate the cost of improvements
8. Identify potential sources of funding for needed improvements
9. Make recommendations for implementation of system improvements

II. APPROACH

A. Existing Conditions

1. Existing Water System

The current Santaquin City Culinary Water System has 3,123 ERU's (equivalent residential units). Figure A-1 "Existing System" in Appendix A shows the City's existing culinary water system. The system currently has several pressure zones, which are shown in Figure A-2 "Existing Pressure Zones" in Appendix A. It should be noted that although fully defined pressure zones are shown in Figure A-2, there is currently not infrastructure in place to reach all extents of the pressure zones shown. Figure A-1 shows the extents of the distribution system that currently exist.

The current Santaquin City culinary water distribution system also serves as a transmission system to provide some culinary water to the town of Genola. Genola Town holds a water right to 100 gpm from the City's springs in Santaquin Canyon. Santaquin City delivers this 100 gpm to Genola City through the City's system.

2. Existing Land Use and Culinary Water Connections

Santaquin City's water meters have been located by city staff using mapping grade GPS units. Rather than using existing land use, estimated densities and estimated water use rates to approximate current demand, we used actual water use data and locations. This method bypasses the existing land use component traditionally integral to modeling.

Figure A-3 "Existing Culinary Water Connections" in Appendix A shows the Santaquin City boundary, the study area boundary, and existing culinary water connection locations.

3. Existing Population

From 2000 to 2010 Santaquin City experienced tremendous growth. The City's population nearly doubled during that time, from 4,834 in 2000 to 9,128 in 2010, according to US Census data. This type of significant growth can strain the City's infrastructure like the water system. The 2013 estimated population is 10,999 residents. This was estimated using the 2010 census figure and estimated growth rates of 6.56% in 2010, and 8.28% in 2011 through 2013.

According to the 2010 US Census, the average household size in Santaquin was 3.93 persons per household. For evaluation purposes we rounded to 3.9 persons per household.

B. Future Conditions

This report identifies two different horizon years for planning purposes. A 10 year horizon was used to determine which capital projects will be needed within that time frame (for impact fee purposes). A buildout horizon was also used to determine capital projects needed between 10 years and buildout.

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

In order for the City to provide new users with the levels of service indicated herein, the culinary water system will need to be expanded and upgraded.

1. Future Land Use

The study area boundary does not coincide with the current Santaquin City boundary. Currently there are approximately 6,700 acres of land within the City limits. The study area boundary defined by Santaquin City includes the current and anticipated future culinary water service areas. The study area boundary includes 8,444 acres of land. Of these 8,444 acres, 1,200 acres is land that will not contribute to future water demand (street right of way, rail road, open space etc.).

Figure A-4 "Future Land Use" in Appendix A shows the current Santaquin City boundary, the study area boundary, and the anticipated future land uses provided by the Santaquin City Planning Department

2. Future Population

Santaquin City bases future growth projections on the 2010 US Census and annual growth rates projected by the State of Utah's Governor's Office of Planning and Budget, which are consistent with past actual growth rates in Santaquin City. Table 1 shows anticipated growth projections for the City from 2010 to 2060 (which is considered the buildout population year).

Table 1: Santaquin City Growth Projections

Year	Population	Estimated Annual Growth Rate	Year	Population	Estimated Annual Growth Rate
2010	9,128	6.56%			
2011	9,381	8.28%	2036	33,089	3.05%
2012	10,158	8.28%	2037	34,098	3.05%
2013	10,999	8.28%	2038	35,138	3.05%
2014	11,910	8.28%	2039	36,209	3.05%
2015	12,896	8.28%	2040	37,314	3.05%
2016	13,963	8.28%	2041	38,027	1.91%
2017	15,120	8.28%	2042	38,753	1.91%
2018	16,371	8.28%	2043	39,493	1.91%
2019	17,727	8.28%	2044	40,247	1.91%
2020	19,195	8.28%	2045	41,016	1.91%
2021	19,907	3.71%	2046	41,799	1.91%
2022	20,645	3.71%	2047	42,598	1.91%
2023	21,411	3.71%	2048	43,411	1.91%
2024	22,206	3.71%	2049	44,241	1.91%
2025	23,030	3.71%	2050	45,086	1.91%
2026	23,884	3.71%	2051	45,811	1.61%
2027	24,770	3.71%	2052	46,549	1.61%
2028	25,689	3.71%	2053	47,298	1.61%
2029	26,642	3.71%	2054	48,060	1.61%
2030	27,631	3.71%	2055	48,834	1.61%
2031	28,473	3.05%	2056	49,620	1.61%
2032	29,342	3.05%	2057	50,419	1.61%
2033	30,237	3.05%	2058	51,231	1.61%
2034	31,159	3.05%	2059	52,055	1.61%
2035	32,109	3.05%	2060	52,893	1.61%

The Santaquin City Planning Department estimated that the majority of the growth over the next 10 years would be primarily in the three areas listed below and that the growth would be distributed among the three areas as indicated:

a. North of 400 North (45%)
b. Summit Ridge (40%)
c. East Bench (15%)

C. Level of Service

Santaquin City established levels of service standards that reflect existing conditions, and that comply with Utah culinary water requirements. The level of service is in terms of source, treatment, storage, pressure and fire flow.

D. Model

J-U-B Engineers Inc. (J-U-B) developed a computer model for the system using InfoWater®, a graphically-based water modeling software that runs within ArcGIS®. The model uses essential hydraulic data input to simulate the effect that input data has on the system under a specified scenario (i.e. peak day, peak instantaneous, average day, etc.). The data used for the model include the graphical layout and connectivity of the system, pipe lengths, pipe diameter, pipe roughness (a Hazen-Williams roughness coefficient used for all pipes in the model is 140), demand at each node, and elevation of each node. Given the required data, the model determines the flow through each pipe and the pressure at each node that will result when the system meets a given demand at each node. The layout and connectivity of the system is shown in Figure A-1 in Appendix A. The model was not calibrated using fire flow tests. However, some operational data from the City was used to verify input used in the model.

Existing peak day demands were estimated by evaluating the culinary water meter records for 2012. The highest monthly flow for each individual connection was divided by the number of days in the month, and assumed to be used over a period of approximately 21 hours per day to determine the peak day flow rate. If the water meter records indicate a use less than the state required 800 gallons per day (gpd) per connection (State Code R309-510-7(2)), the connection was assumed to use the 800 gpd.

Future peak day demands were estimated by adding existing peak day demands to demands resulting from future growth. Demands from future growth were estimated to be 800 gallons per day per connection.

Peak day demand for non-residential connections was estimated by analyzing the existing meter readings located in non-residential land use zones. The existing meter records indicate the majority of the connections use slightly less than the 800 gpd per ERU assumed as a minimum for residential connections. Conservatively, these non-residential connections were assumed to use the full 800 gpd per connection in the model. The number of connections per acre of future development is the land use density estimated by the Santaquin City Planning Department.

Table 2 summarizes the land use, acreage, density and demand data used in the model.

Table 2. Area, Connections and Demand Data used in the Model

Land Use Zone	Total Area (Acres)	Existing ERUs	Number of ERUs per Acre of Development at Buildout	Number of ERUs at Buildout	Total Peak Day Demand at Buildout (Gal)
A1	1,227	198	0.5	613	490,400
A2	1,218	112	0.5	609	487,200
C	514	79	3	1541	1,232,800
CR	29	0	0	0	0
ID	673	0	2	1346	1,076,800
MU-C	96	84	4	384	307,200
MU-R	122	116	4	487	389,600
PO	158	32	2	316	252,800
R1	1,211	1,495	2.6	3151	2,520,800
R1A	936	2	2	1872	1,497,600
R2	865	955	3	2596	2,076,800
RM	196	51	4.7	920	736,000
Total:	**7,244**	**3,123**	**N/A**	**13,835**	**11,068,000**

Peak instantaneous demands for both existing and future conditions were calculated by applying a factor of 2 to the peak day demand.

We evaluated both existing conditions and future conditions using the model to identify instances in which the existing system falls short of the established level of service (existing deficiencies) and what improvements would be needed in order for the future system to provide the established level of service (future needs). These evaluations include various demand scenarios to account for all the conditions represented in the level of service criteria.

E. Capital Improvements

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

III. LEVEL OF SERVICE

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

A. System Improvements vs. Project Improvements

Culinary water improvements are categorized according to their function as either system improvements or project improvements.

Project improvements are facilities that are either:

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

System Improvements are those improvements in excess of the minimum improvements needed by the development which is a larger segment of the community than a single development. System improvements include the following:

1. Existing improvements that have no reserve capacity
2. Existing improvements that have reserve capacity to accommodate future growth
3. Future improvements needed to accommodate growth.

For the purposes of this document, the definition of system improvements will be limited to the 2nd and 3rd definitions above, since the definition is irrelevant for those improvements having no reserve capacity.

B. Level of Service Categories and Magnitude

The level of service criterion for the culinary water system is defined as follows:

1. Source

The level of service related to source is both of the following:

a. Flow rate: provide a minimum of 800 gallons per minute per ERU on the peak day
b. Volume: provide a minimum of 146,000 gallons per ERU per year

For the purposes of evaluating the ability of source infrastructure to satisfy the level of service with regard to flow rate, we have established the following criteria:

a. For springs that provide generally constant flow (which is the case with Santaquin's springs): the average flow rate
b. For wells: pumping at full physical capacity for 21 out of 24 hours per day, or in other words at 87.5% maximum capacity.

These levels are consistent with the Utah Administrative Code Section 309-510-7, Source Sizing.

2. Treatment

The minimum level of service related to water quality and treatment is in compliance with the applicable "Primary" standards established by the Utah Administrative Code Section 309-200, Monitoring and Water Quality: Drinking Water Standards.

3. Storage

The minimum level of service for culinary water storage is the sum of the following three categories of storage:

a. Equalization Storage:

1) Indoor: 400 gallons/ERU
2) Outdoor: 2848 gallons/irrigated acre

This volume is consistent with Utah Administrative Code R309-510-8(2), Facility Design and Operation: Minimum Sizing Requirements, Storage Sizing, Equalization Storage. The volume for outdoor storage corresponds to the requirement in Map Zone 4 of the code, which includes the Santaquin area. Since portions of the culinary water system provide water for outdoor use, the outdoor use component is included in the level of service.

b. Fire Storage: 120,000 gallons

This volume is consistent with Utah Administrative Code R309-510-8(3), Facility Design and Operation: Minimum Sizing Requirements, Storage Sizing, Fire Suppression Storage. It indicates that the engineer shall consult with the local fire suppression authority regarding needed fire flow, and that if no such authority exists, needed fire suppression storage shall be assumed to be 120,000 gallons (1000 gpm for 2 hours). In December 2012 J-U-B and city Staff, including Santaquin Fire Chief Bott, determined that an appropriate amount of fire storage was 120,000 gallons.

c. Emergency Storage: 338,400 gallons

Utah Administrative Code R309-510-8(4), Facility Design and Operation: Minimum Sizing Requirements, Storage Sizing, Emergency Storage indicates that emergency storage shall be considered, and if deemed appropriate by the water supplier, provided to meet demands in the event of an unexpected emergency situation. No specific volume is indicated, but rather is left up the local jurisdiction.

J-U-B worked with Santaquin City staff to establish a level of emergency storage that fits within the risk tolerance of the community. The amount of emergency storage was determined to be 30% of the required equalization volume for indoor usage.

The 338,400 gallons of emergency storage corresponds to 120 gallons of emergency storage per ERU.

4. Pressure

The level of service related to pressure is each of the following:

a. Minimum of 20 psi with fire flow during peak day demand
b. Minimum of 30 psi during peak instantaneous demand
c. Minimum of 40 psi during peak day demand

These levels are consistent with the Utah Administrative Code Section 309-105-9, Minimum Water Pressure requirements.

5. Fire Flow

The minimum level of service related to fire flow is providing a minimum of the following:

a. 1000 gallons per minute for one- and two-family dwellings with an area of less than 3600 square feet
b. 1500 gallons per minute for all other buildings

These levels are consistent with the Utah Administrative Code Section 309-550(5), Water System Design, Fire Protection.

IV. EXISTING CULINARY WATER SYSTEM

A. Overview

The Santaquin City culinary water system consists of sources, treatment facilities, storage facilities and transmission/distribution lines. Existing supply, existing demand, existing deficiencies and reserve capacity of system improvements for each category of improvements is described later in this report.

1. General System Description

The culinary water system currently has multiple pressure zones. The existing pressure zones are:

a. Zone 9N (lowest pressure zone)
b. Zone 10 (2nd lowest pressure zone)
c. Zone 11E (2nd highest pressure zone on the east side of town)
d. Zone 12E (highest pressure zone on the east side of town)
e. Zone 11W (highest pressure zone in the Summit Ridge area)

Water flow from the City's springs, located up Santaquin Canyon, is piped and gravity flows to the Zone 11E tank. This water is conveyed from the springs (which have developed diversions) through a dedicated pipeline that runs first through a chlorinator facility (located at the mouth of Santaquin Canyon, just north of Canyon Road, near the Zone 10 tank (E)) then to the Zone 11E tank.

Water from Zone 11E is pumped (by pumps located in the Zone 12E Booster (N) pump station) from the distribution system, using a dedicated pipeline to the Zone 12E tank. This is currently the only source of water into Zone 12E.

Water is also allowed to flow from the Zone 11E tank, through a dedicated pipeline to the Zone 10 tank (E). This flow is controlled by an altitude valve within the dedicated pipeline between the two tanks. When the Zone 10 tank (E) water level falls below a set point, the altitude valve opens and allows water to enter the tank.

It should be noted that the existing pressure boundary between Zone 11E and 12E at buildout may possibly need to change from its current location. In order to meet the defined level of service in the area along 840 East between approximately 240 south and 450 South the pressure boundary may need to shift to the west (downhill). As additional growth occurs in the surrounding areas, pressures in these areas should be reevaluated and necessary adjustments made as needed.

2. Summit Ridge

Within the Summit Ridge well house there is a well and a booster pump. Both pumps have the ability to pump water to the Zone 11W tank. This is accomplished by opening or closing the appropriate valves inside the well house and within the fenced area outside of the well house.

During fall, winter & spring months (on average 6 months out of the year depending on the type of water year) the booster pump is used to pump spring water, fed through a 16" pipeline along 500 South, to the Zone 11W tank. This saves considerable

energy in the form of lower pumping costs. Using this booster pump allows that water only needs to be boosted approximately 200 feet in elevation rather than pumping 600 feet in elevation using the well. The Zone 11W tank is fed through a dedicated pipeline between the Summit Ridge well house and the Zone 11W tank.

During the summer months (and possibly at other times of large demands, as determined necessary by City staff) the Summit Ridge well pumps to the Zone 11W tank rather than using the booster pump. Again this is accomplished by opening & closing the appropriate valves within the well house and outside the well house. This well is utilized during the summer months because spring water from Santaquin Canyon is not sufficient to keep up with the high demands on the culinary system.

3. Operations

Figure A-2 in Appendix A shows the existing pressure zones. All of the existing higher pressure zones can provide water to the lower pressure zones through multiple pressure reducing valve stations (PRV's). However, in order to conserve energy, by not having to pump water higher than necessary, and to effectively maintain adequate storage within each pressure zone, these existing PRV's should be set to **only** open in the event of a large demand, such as a fire flow. All PRV's should normally operate in a closed position to maintain water within the higher pressure zones other than during these rare events.

When all tanks that can be fed by spring water are full or near full (i.e. not calling for water to be pumped or diverted to them), the spring water overflows into a ditch that directs water to Summit Creek Irrigation network of ditches and pipelines and eventually flows to the Summit Creek Irrigation reservoir # 2 located near the Summit Ridge area of town. This spring overflow water is then no longer available for use in the culinary system.

During the irrigation season, the City plans to capture as much of this overflow water as possible and divert it into the pressure irrigation system. This is discussed further in the City's Pressure Irrigation Master Plan & Capital Facilities Plan being developed concurrent with this plan.

The Summit Ridge well has the ability to pump into Zone 10. Currently this configuration is not used because Zone 10 only has a 500,000 storage tank which is the smallest tank in the entire system. Consequently this smallest tank happens to serve the largest number of users in the City. Operationally, due to these dynamics, this configuration is less desirable to City staff and therefore is not used. Once an additional larger tank is built for Zone 10 (identified later in this plan) this configuration will be more desirable from an operational standpoint.

In 2008 a 16" pipeline was installed from approximately 600 West on 500 South to the Summit Ridge well house. Use of this pipeline allows the City to transmit spring water from the east side of the city (through the Zone 10 distribution system) to the Summit Ridge area (southwest area of the city).

With the exceptions of the Zone 9N and that part of Zone 10 located in the Summit Ridge Development, each pressure zone has its own storage facility. As discussed previously, it is important that each higher pressure zone's storage water be

maintained within its own zone rather than allowing it to flow through PRV's other than for large demand events (again, other than Zone 9N).

The City has two additional wells that can be utilized to pump water into the culinary system. The first is the Cemetery well. This well pumps water through a dedicate pipeline to the Zone 11E tank and is only used when spring water is not sufficient to meet demands. Typically the Cemetery well is used during the summer months to supplement the spring flow when demands are highest.

The second well that can be used to supply culinary water into the system is the Center Street well. However, this well has not been used for culinary supply since approximately 2003 or 2004. Currently the Center Street well pumps water into the City's pressure irrigation system. Should the need arise, the current piping configuration west of the pump house can be disconnected from the pressure irrigation system and connected into the culinary system. If this source is needed for culinary purposes, the Drinking Water Source Protection Plan (DWSP) filed with the State of Utah, Division of Drinking Water (DDW) would need to be updated prior to use for the culinary system. The Center Street Well is not considered a source for the culinary water system for the purposes of this plan.

Within the Summit Ridge well house there is a chlorinator facility. This chlorinator facility treats only water pumped from the Summit Ridge well (not water pumped by the booster pump). This is done so that as water from the Zone 11W tank (pumped from the Summit Ridge well) mixes with spring water and then flows into the overall culinary system it is able to maintain a chlorine residual as required by State drinking water standards.

4. Supply to the Pressure Irrigation System

There is a major concern with the culinary water system. The concern is that currently there are 4 pressure zones within the city where the pressure irrigation system is fed by the culinary water system. This is facilitated using backflow preventers. The four pressure zones are: Zone 11E, Zone 12E, the Zone 11W and that portion of Zone 10 that is within the Summit Ridge Development.

Specifically on the east side of the city (Zones 11E & 12E) this configuration causes significant stress on the culinary system during the hot dry summer months when outside watering demands are high. At present, during summer months, the system is just barely able to provide an adequate amount of water to Zones 11E & 12E to keep up with high summer demands. As more development occurs and connections are added within these two zones, the system will be **unable** to keep up with increasing demands that are placed on the culinary system.

It is imperative that the City move as quickly as possible to build the necessary infrastructure to enable removing the pressure irrigation system demands from the culinary system. The necessary infrastructure to accomplish this is discussed in detail in the City's Pressure Irrigation Master Plan & Capital Facilities Plan being developed concurrent with this plan.

Due to a small number of existing service connections in the Summit Ridge area the culinary system (in that area) is not currently stressed as heavily by the pressure

irrigation demands. However, as additional connections are made in that area, the system may also get to the point where it is unable to provide sufficient water for both pressure irrigation demands and culinary demands with the culinary system, and the pressure irrigation system will need to supply its own needs in the Summit Ridge Development.

5. Historic Projects

Santaquin City has plans for some historic projects constructed as part of the culinary water system. See Appendix D "Historic Projects" for a list of projects that the City currently has plans for.

B. Rights

1. Existing Water Rights

Appendix G contains a summary of Santaquin City's existing culinary water rights as provided by Santaquin City and verified by Sunrise Engineering.

A full evaluation and assessment of Santaquin City's water rights is beyond the scope of this plan. This plan only addresses infrastructure needed for sources to provide water into the system.

2. Process of Acquiring Water Rights

According to city ordinances, anything annexed prior to November 1994 was required to dedicate water prior to annexation. Between that time and March 2004, water was required at annexation unless a property owner was non-consenting to the annexation or did not intend to develop. After 2004, water was required after annexation and prior to preliminary plats.

The current Santaquin City Code requires that property annexed into the City must be accompanied by sufficient valid water rights to provide water for existing and future needs of the land being annexed (See Santaquin City Code 8-1-10 "Annexation"). The amount of water right required is 3 acre-feet of diversion rights per acre of land annexed. At the City's discretion, as an alternative to providing valid water rights at annexation, City code allows the City to accept "Cash Equivalent of Water Rights". This is sometimes referred to as "Cash in Lieu of Water Rights".

Additionally the City also actively pursues for purchase other water rights that become available. The City purchases both Summit Creek Irrigation Company shares as well as water rights held in area wells when they become available.

3. Water Rights Already Committed but not yet Delivered to Santaquin

There are a number of properties that have committed dedication of water rights to Santaquin City as a condition of annexation. These properties have already been annexed into the City, however the City has not yet received these water rights. Fulfillment of these commitments should be made prior to development of the land. Figure B-1 "Annexed Land without Committed Water Rights" in Appendix B shows land that has been annexed into the City but no water rights have been surrendered as

yet. Figure B-1 also shows land that does not require dedication of water rights at the time of development. In order for the City's annexation policy to be met, the City will need to obtain an appropriate amount of water rights at the time of development of these properties.

C. Sources

1. Existing Sources

Santaquin City currently obtains culinary water from the City's springs and wells. The City's springs are located in Santaquin Canyon to the south of the City. Two wells located within the City currently supply culinary water into the system. They are the Summit Ridge Well and the Cemetery Well.

The flow rate of surface water sources (such as springs) is inherently variable since they can depend greatly on weather conditions. Underground sources (such as wells) have a more stable and reliable flow rate. Since the City's surface sources are less expensive to use, because they don't require pumping, they are used to their full capacity as much as possible, with water from wells supplementing the flow as necessary.

Table 3 below shows the capacities of the City's existing culinary water sources. The capacities listed are the average flow rate of the City springs and the well pumps pumping 21 hours per day at their design capacities.

With the exception of transmitting water from the Summit Ridge well to Zones 11E & 12E, water from all other sources can be combined to meet demands throughout the system. The City's springs and the Cemetery Well are the only sources of water for Zones 11E & 12E.

Table 3. Existing Culinary Water Source Capacities

Source	Maximum Flowrate (MGD)
Springs	1.30
Cemetery Well	0.95
Summit Ridge Well	3.78
Total Culinary Water Sources:	**6.03**

2. Demand on Existing Sources

Current demands on the culinary system are varied throughout different areas of the city. In several areas of the city the system is nearing its capacity to supply sufficient source water to meet demands. This is especially true during the hot, dry summer months. As discussed previously, taking the pressure irrigation system off of the culinary system needs to be accomplished in order to preserve culinary water source resources for indoor use. The existing total culinary water source demand is 2.50 mgd for indoor use, plus the same sources provide 1.27 mgd through the culinary system for the areas using culinary water for outdoor use (in Zones 11E, 12E & 11W). The total source available to meet peak day demand is 6.03 mgd.

Currently the Summit Ridge Well water cannot be delivered to Zones 11E & 12E. The culinary water demand for the Zones 11E & 12E (which can only receive water from the Springs and Cemetery Well) is 0.68 mgd. The Springs and Cemetery well also currently provide water to the pressure irrigation system in those zones to meet an outdoor watering demand of 1.57 mgd. The total of these two demands is 2.25 mgd. The total source available (Springs and Cemetery Well) to the Zones 11E & 12E is 2.25 mgd. This shows that the current demand is equal to current source capacity. Therefore the only excess source would be to have the Cemetery well pump more than 21 hours per day. This also means that if the Cemetery well becomes inoperable there would not be enough source to meet demand in Zones 11E & 12E.

The Cemetery Well and the springs are currently the only sources that can supply Zones 11E & 12E. Therefore these two sources of water must be preserved for those two zones before being used in lower zones.

3. Existing Source Deficiencies

The pressure irrigation demand on the existing culinary system for Zones 11E & 12E is 1.57 mgd. When this demand is taken off the culinary system the peak day demand in these zones will be 0.68 mgd. We consider this a pressure irrigation system issue, meaning that at the point in time when the pressure irrigation system has the ability to provide its own source of water other than the culinary water system, the water previously "loaned" to the pressure irrigation system will serve the culinary water system to meet culinary water needs. Provided this occurs before the culinary water system needs that capacity to meet its own needs, there are not and will not be any deficiencies in the culinary water system as a result of this issue.

There are no existing source deficiencies.

D. Treatment Facilities

1. Existing Treatment Facilities

Currently two sources of water for the culinary water system are treated. The City has two facilities where water is treated: 1) a chlorination building where the spring water is treated prior to entering the Zone 11E tank and 2) the Summit Ridge well house. Spring water is treated year round in order to meet State drinking water requirements. Water from the Summit Ridge well that is pumped to the Zone 11W tank is only treated when the well is being used (not when the booster pump is being used). This is because the spring source water, when pumped by the booster pump, is already treated before it reaches the Summit Ridge well house. As water is pumped from the Cemetery well it mixes with spring water and also gets treated in order to maintain chlorine residual required by the State of Utah.

2. Demand on Existing Treatment Facilities

The current system has the capability to provide sufficient chlorine as needed. As such, the existing treatment facilities have the ability to treat the full amount of water provided by the Springs and the Summit Ridge well. The existing system treatment capacity meets current demands.

3. Existing Treatment Facility Deficiencies

There are no existing treatment facilities deficiencies.

E. Storage

1. Existing Storage

Santaquin City has 4 tanks for culinary water storage. A listing of the current culinary water storage tanks with capacity of each is shown in Table 4.

Table 4. Existing Culinary Water Storage

Existing Storage Tanks	Capacity (MG)
Zone 12E	1.04
Zone 10 (E)	0.49
Zone 11W	1.14
Zone 11E	1.09
Total Storage Capacity:	**3.76**

The zones that each tank can serve are as follows (the primary zone is listed 1st with lower zones being served through PRV's in the distribution system).

a. Zone 10 Tank –Zones 10 & 9N
b. Zone 11E Tank –Zones 11E, 10 & 9N
c. Zone 12E Tank –Zones 12E, 11E, 10 & 9N
d. Zone 11W Tank – Zones 11W, 10 & 9N

Because all zones can be served from multiple storage tanks, this report analyzes storage on a city-wide basis.

2. Demand on Existing Storage

The current culinary storage demand was determined using the existing number of ERU's, and the established level of service. The current irrigation storage requirements from the culinary water tanks were determined using the existing demand from the pressure irrigation model for each area that is currently served by the culinary system.

Table 5 shows the existing culinary water storage demand, by purpose for the storage.

Table 5. Existing Culinary Water Storage Demand

Category of Storage	Culinary Water	Pressure Irrigation
Equalization Storage Demand (MG)	1.25	0.63
Fire Flow Storage Demand (MG)	0.24	
Emergency Storage Demand (MG)	0.37	
Total Storage Demand (MG):	**1.86**	**0.63**

Note that the fire flow storage demand is twice the required amount of 120,000 gallons (1000 gallons/minute for 2 hours). Because Santaquin is configured with high areas on the east side, lower areas in the middle, and higher areas on the west

side, no single tank can provide gravity fire storage for all locations. For this reason fire storage demand is included twice – once for the east side and once for the west side of the city.

3. Existing Storage Deficiencies

There are no existing storage deficiencies in the culinary water system.

Although there are currently no storage deficiencies in the culinary system, in order to solve current operational issues, for redundancy and to save energy in the form of pumping costs, a new storage tank will be constructed in the Summit Ridge area, at the same elevation as the Zone 10 tank (E). This new tank (Zone 10 Tank (W)) will allow for more storage in Zone 10 which has the largest number of users. Once constructed this new tank will also provide reserve capacity for future growth.

This new tank will allow for additional storage of spring water that does not need to be pumped. This will be done by capturing the spring water that is currently diverted into Summit Creek Irrigation facilities and then becomes unavailable for use in the culinary system.

Along with this new storage tank a new booster pump facility will be constructed that will boost water from this new tank (Zone 10 Tank (W)) to the Zone 11W Tank. This new booster pump facility is anticipated to be located adjacent to and must be constructed concurrent with the new tank (Zone 10 Tank (W)).

F. Transmission/Distribution System

1. Existing Transmission/Distribution System

Santaquin City has a well-developed existing culinary water distribution system. There are approximately 69 miles of pipelines with associated valves, fittings and other related infrastructure.

Figure A-1 in Appendix A shows the extents of the existing transmission/distribution system.

2. Demand on Existing Transmission/Distribution System

The existing transmission/distribution system serves 3,123 ERU's.

Figures C-1, C-2, and C-3 in Appendix C show the existing system pressures under the following three conditions:

a. Fire flow during peak day demand (minimum LOS is 20 psi residual)
b. Peak instantaneous demand (minimum LOS is 30 psi residual)
c. Peak day demand (minimum LOS is 40 psi residual)

3. Existing Transmission/Distribution System Deficiencies

For the most part the transmission/distribution system is able to meet current demands while maintaining the levels of service identified in this plan.

a. Existing Transmission/Distribution deficiencies

1) There is an area on 400 North between approximately 500 east and 600 east that cannot currently meet the pressure requirements for fire flow during peak day demand due to the 4" water line currently installed.
2) Another area of deficiency is located at the west end of 30 south (14000 south in Utah County) between approximately 800 and 1100 west. The existing 6" line cannot meet pressure requirements for fire flow during peak day demand.
3) Another area of deficiency is located along 100 West (Pole Canyon Road) south of 900 South. The existing culinary water lines in both 900 South and 100 West are only 6" lines. This small line size combined with significant elevation change (southbound on 100 West) make it so that the system cannot currently meet the pressure requirements for fire flow during peak day demand for the last two fire hydrants located south along 100 West.
4) The home located at 665 South 600 East is currently deficient with regard to meeting the minimum level of service for Peak Day Demand (see Figure C-2 "Existing Pressures at Peak Day Demand"). As additional development occurs in the area this home will need to be removed from the Zone 11E pressure zone and connected to Zone 12E pressure zone.

Although not a transmission system deficiency a booster pump facility will be constructed in order to solve current operational issues, for redundancy and to save energy in the form of pumping costs. This new booster pump facility will pump water from Zone 10 to Zone 11E. This project will make it possible for water to be supplied to any of the zones, from any of the sources. It is planned that this new booster pump facility will be constructed near the Zone 10 Tank (E). This new booster pump facility will be constructed after both the new Zone 10 Tank (W) and Zone 11W Booster facilities are constructed and are in operation.

b. Solutions to existing Transmission/Distribution deficiencies

1) We expect there to be development in the areas where there are fire flow deficiencies on 400 North and on 30 South (see 3.a.1 & 3.a.2 above). Development in these areas will allow for looping in the CW system. When this looping is complete, the pressure deficiencies will be resolved. Since we anticipate this occurring by development, there is no plan for projects to address these deficiencies.
2) The fire flow deficiency at the south end of 100 West (south of 900 South) will be remedied by constructing an additional 8" CW line from Center Street, along 900 south and south approximately 500 feet on 100 West. Once constructed, this new 8" line, combined with the existing 6" line, will have excess capacity. We consider this new 8" line combined with the existing 6" line as the equivalent of a 10" line. Therefore, a portion of the costs for constructing this new 8" line can be repaid to the City using impact fees.
3) As additional development occurs near and around the home locate at 665 south 600 East this home will need to be removed from the current pressure zone (Zone 11E) and connected to the higher pressure zone (Zone 12E) once piping in that higher pressure zone will allow. This will solve the deficiency for this home.

V. FUTURE CULINARY WATER SYSTEM AT BUILDOUT

A. Overview

Figure E-1 "Buildout System" in Appendix E shows the anticipated culinary water system at buildout.

The culinary system at buildout will be comprised of the entire existing system infrastructure along with the new improvements identified within this plan. Most, if not all, of the inefficiencies, peculiarities and operational difficulties in the existing system will be overcome and or solved as the improvements identified herein are constructed. These include: reduced pumping costs, the ability to convey water from each major pressure zone to another (I.e. pumping from lower zones to higher zones), removing the pressure irrigation demand from the culinary system and the ability to capture and make use of spring water that is currently lost for use in the culinary system.

Figure E-2 "Future Pressure Zones" in Appendix E shows the pressure zones for the culinary water system at buildout. The following 9 pressure zones or pressure zones with currently isolated areas from existing infrastructure do not currently exist and will become future zones/areas:

1. Zone 7N
2. Zone 8N
3. Zone 9W
4. Zone 10W
5. Zone 12W
6. Zone 11NE
7. Zone 13E
8. Zone 14E
9. Zone 15E

B. Rights

Santaquin City will need additional water rights to meet system demands at buildout. It is anticipated that continuation of the practice of requiring commitment of water shares at the time of annexation, in addition to fulfillment of the commitments already made when land was annexed, will not provide adequate rights to meet buildout demands. We recommend that Santaquin City address long-term water right needs. Santaquin City will need to address the question of adequacy of water rights in the near future.

Santaquin does not require dedication of water rights as a condition of land development, and therefore does not intend to collect impact fees for acquisition of water rights.

C. Sources

1. Future Demand on Sources

Table 6 summarizes the future demand on culinary water sources. This is based on the existing peak day demands plus future modeled peak day demands, which are a function of the future growth rate, development densities, and demand rates. Note that in 2023 the culinary water system should be providing no water to the pressure

irrigation system for outdoor watering. However, at buildout the culinary water system will be providing water for outdoor watering in several small areas that are higher than planned pressure irrigation service areas. We anticipate that this will occur through the culinary water pipe network, without a separate system of pressure irrigation pipes (but with separate meters) for those areas.

2. Future Source Needs

   Table 6 summarizes the future needs for culinary water sources. Future source needs are the difference between existing source capacity and future source demand. Table 6 shows future source needs at a point 10 years in the future and at buildout.

3. Solutions to Future Source Needs

   As shown in Table 6 there will be a need for two additional wells to satisfy the future demand on sources.

Table 6: Summary of Future Water Source Data

Table Row No.		Culinary Water Source (MGD)	Pressure Irrigation Source (MGD)	Total Source (MGD)
Existing Source				
1	Total Existing Source Peak Day Demand	2.50	1.27 [1]	3.76
2	Total Existing Source Capacity	4.76	1.27	6.03
Future Source Demands				
3	Estimated Source Peak Day Demand in 2023	4.63	0.00	4.63
4	Estimated Source Peak Day Demand at Buildout	11.09	1.10 [2]	12.19
Future Storage Needs				
5 (=3-2)[4]	Additional Source Need in 2023			-1.39 [3]
6 (=4-2)[4]	Additional Source Need at Buildout			6.17
Solutions to Future Source Needs				
7	West Side Well 1; Capacity Added			3.08
8	West Side Well 2; Capacity Added			3.08
9 (=2+7+8)[4]	**Total Future Source Capacity**			**12.19**

Notes

[1]This is existing PI source provided to Zones 11E, 12E, 11W and that part of Zone 10 that is within the Summit Ridge development

[2]This is estimated PI source provided to Zones 12W, 11NE, 13E, 14E & 15E

[3]This represents excess source capacity

[4]Row numbers provided in parenthesis indicate how totals are arrived at (i.e. in Row 5 the additional source needed is the difference between Row 3 and Row 2)

D. Treatment Facilities

We anticipate that in the future water from the springs will mix with water from future wells, and that the chlorinated spring water will be sufficiently diluted that further chlorination will be needed at future wells to provide required chlorine residual throughout the system. We therefore expect that chlorination systems will be a part of the design of future wells; these treatment systems are included in the future cost estimates for the wells as they will be constructed as part of those projects.

E. Storage

1. Future Demand on Storage

Currently, existing storage tanks are providing the pressure irrigation system with some storage capacity. As time passes the pressure irrigation system demands will change and that system will provide its own storage. However, at buildout there will still be a need for the culinary water system to permanently provide some storage for the pressure irrigation system. The storage provided to the pressure irrigation system in the various pressure zones at various times are shown in Table 7. Note that culinary water and pressure irrigation pressure zones have the same names and are coincident.

Table 7: Culinary Water System Storage Capacity Provided to Pressure Irrigation System

	Peak Day Storage Capacity Provided to PI System (MG)		
Pressure Zone	Existing	2023	Buildout
Zone 12E	0.10		
Zone 11E	0.38		
Zone 11W	0.16 [1]		
Zone 13E			0.19
Zone 14E			0.09
Zone 15E			0.01
Zone 12W			0.24
Total:	**0.63**	**0.00**	**0.54**

[1] A portion of Zone 10, within the Summit Ridge Development, is included

Table 8 summarizes the existing and future demand on culinary water storage. Note that only culinary water system storage permanently used by the pressure irrigation system is included in the required storage amount.

Table 8: Culinary Water Storage Demand Tabulation

Year	Population	ERUs	Culinary Water System Storage Required (MG)			Storage Permanently Provided to PI System (MG)	Total Required Storage (MG)
			Equalization (400 gal/ERU)	Fire Flow (0.12 MG at all areas)	Emergency (30% of Equalization)		
Existing	10,999	3,123	1.25	0.24	0.37		1.86
2023	21,411	5,793	2.32	0.24	0.70		3.25
Buildout	52,893	13,865	5.55	0.48	1.66	0.54	8.23

2. Future Storage Needs

Table 9 summarizes the future culinary water storage needs. Future storage needs are the difference between existing storage capacity and future storage demand. Table 9 shows future storage needs at a point 10 years in the future and at buildout.

3. Solutions to Future Storage Needs

As shown in Table 9 there will be a need for additional storage tanks to satisfy future demand on storage.

The two uppermost tanks (Zone 12W Tank and Zone 15E Tank) are expected to be the last tanks built and will be at the highest elevation (Zone 12W on the west side of the city and Zone 15E on the east side of the city). Until they are built, other tanks will have to provide fire storage for the two sides of the city. Once these final two tanks are built, they will also have to provide fire storage for the zones they serve, which will be above the service area of the next highest tanks. Because of this there will be duplication of fire storage in the system at buildout.

Table 9: Future Culinary Water System Storage Capacity

Table Row No.		Culinary Water Storage (MG)	Pressure Irrigation Storage (MG)	Total Storage (MG)
	Existing Storage			
1	Total Existing Storage Demand	1.86	0.63 [1]	2.50
2	Total Existing Storage Capacity	3.76		3.76
	Future Storage Demands			
3	Estimated Storage Demand in 2023	3.25	0.00	3.25
4	Estimated Storage Demand at Buildout	7.69	0.54 [2]	8.23
	Future Storage Needs			
5 (=3-2)[5]	Additional Storage Need in 2023			-0.51 [6]
6 (=4-2)[5]	Additional Storage Need at Buildout			4.47
	Solutions to Future Storage Needs			
7	Zone 10 Tank (W) & Zone 11W Booster Pump to Zone 11W			2.19
8	Zone 12W Tank and Booster Pump[3]			0.58
9	Zone 15E Tank; Booster Pump; Increase Capacity of East Side Booster Pumps[3]			0.66
10	Main Zone East Side 2 Tank			1.10
11 (=2+7+8+9 +10)[5]	**Total Future Storage Capacity**[4]			**8.29**

Notes

[1]This is existing PI storage provided to the Summit Ridge, East and Upper PI Zones

[2]This is estimated PI storage provided to the Upper Summit Ridge and Upper East Side PI

[3]These tanks will be needed not just for system-wide capacity, but also to provide storage for their respective Zones

[4]The total future storage capacity is slightly larger than the estimated storage at buildout because round water tanks are planned to be constructed at fixed increment radii in order to use standard concrete forms.

[5]Row numbers provided in parenthesis indicate how totals are arrived at (i.e. in Row 5 the additional storage needed is the difference between Row 3 and Row 2)

[6]This represents excess storage capacity

F. Transmission/Distribution System

1. Future Demand on Transmission/Distribution System

At buildout the transmission/distribution system is estimated to serve 13,865 ERUs.

2. Future Transmission/Distribution System Needs and Modeling

A modeling engineer uses a computer model to design a water system plan that will serve the needs of the community. The process is not one that lends itself to direct calculations, as is the case with water source and storage planning. Due to the finite nature of pipe sizing and the effect that changes in one pipe size have on a pressure pipe network, the process of resolving future network problems and inadequate pressures requires engineering judgment and skill.

We anticipate that the future pipes in the transmission/distribution system will be built by land developers to serve future development as it occurs. The minimum pipe size is 8" in diameter. We plan pipes to transmit and distribute water to areas of future development, knowing that some of these lines will need to be larger than 8" in diameter.

In the process of developing the buildout model it becomes necessary to adjust lines sizes to find combinations of pipe sizes that meet future needs while maintaining residual pressures under different demand scenarios. Through this process the modeling engineer eliminates errors generated by the model (when there are negative pressures), and establishes a network that satisfies residual pressure requirements under the level of service criteria.

The modeling engineer also exercises judgment to plan the system in a way that employs best practices, such as avoiding high velocities and unnecessary pumping, and providing looping and redundancy in the system. There will be some internal looping created by development projects that will reduce pressure losses at buildout. The uncertainty of when and where the project-level looping will occur makes depending upon them unreliable, so we neglect their effect when planning future transmission/distribution lines. Including looping and redundancy as is practical reduces the extent of system disruptions when there are operational situations (such as breaks in a pipe) that require flow to a general area to be provided from more than one direction.

3. Solutions to Future Transmission/Distribution System Needs

Figure E-1 in Appendix E shows the buildout system pipes that satisfy the established level of service for the future conditions.

Figures E-3 E-4 and E-5 in Appendix E show the buildout system pressures that result from pipe sizes shown in Figure E-1 under the following three conditions:

a. Fire flow during peak day demand (minimum LOS is 20 psi residual)
b. Peak instantaneous demand (minimum LOS is 30 psi residual)
c. Peak day demand (minimum LOS is 40 psi residual)

As is evident in the figures, these pipe sizes address the level of service needs with regard to pressure in the buildout condition.

Since we expect that the future pipes will be built by land developers, Santaquin City will need to require that the developers install the size of lines shown in Figure E-1. The developer would be responsible for installing an 8" line, and Santaquin City will be responsible for paying for the incremental cost difference between the required size and an 8" line. As such, these costs are not identified as discrete projects, but as a series of pipe segments for which the city will incur financial obligation when a developer installs them. Tables H-2, H-3 and H-4 in Appendix H contain tabulations of estimated typical pipe installation and upsizing costs.

In order to estimate the upsizing costs that Santaquin City might incur in the next 10 years, we have evaluated the flow in each of these future pipe segments in the year 2023, as well as at buildout. A tabulation of these demands is shown in Table E-1 "Future Transmission/Distribution Pipe Flows Tabulation" in Appendix E. We have calculated the total length and weighted average flow for each pipe size at both the year 2023 and at buildout, tabulations are shown in Table 10. Table 10 also shows the percentage of buildout pipe capacity that will be needed in the next 10 years. This is shown for impact fee analysis development purposes.

Table 10: Future Transmission/Distribution Pipe Flows Summary

	Pipe Size			
	10"	12"	14"	16"
Total Length at Buildout (ft)	25,026	6,676	1,362	3,082
Buildout Weighted Average Flow (GPM)	932	498	1,538	642
2023 Weighted Average Flow (GPM)	47	0	0	97
Percent of Buildout Pipe Capacity Needed in Next 10 Years:	5%	0%	0%	15%

For the purposes of estimating when pipes will be installed, we expect the construction timing to parallel the growth projections, since they will be constructed by future development.

VI. CAPITAL IMPROVEMENTS

A. List of Projects and Priorities

Table 11 shows capital improvement projects necessary to provide for future growth. It also indicates an approximate time frame when those projects will be needed. For source and storage projects the point at which projects are needed is shown in terms of ERUs and years. We determined the ERU numbers from the model, then applied anticipated growth rates to identify the estimated year when each project will likely be needed. Those projects that are likely very far in the future are shown at the buildout date. Payment to land developers for upsizing from 8" pipes to larger pipes needed as system improvements will gradually occur as land develops from now until buildout.

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

Table 11: Culinary Water Improvements

Project Number	Project Name	Estimated Cost	Point at Which Project is Needed (ERUs)	Point at Which Project is Needed (Year)	Funding Source	Comments
Projects to Satisfy Needs of Future Growth						
Source Projects						
1	Construct New West Side Well #1 (3.08 MGD)	$1,876,522	6,654	2027	Impact Fees	
2	Construct New West Side Well #2 (3.08 MGD)	$2,317,327	10,623	2044	Impact Fees	
Storage Projects						
3	Construct Zone 10 Tank (W) (2.19 MG) & Booster Pumps from Zone 10 Tank (W) to Zone 11W Tank	$3,846,335	6,654	2027	Impact Fees	
4	Construct Zone 12W Tank (0.58 MG) & Booster Pumps From Zone 11W to Zone 12W Tank	$2,195,302	10,820	2045	Impact Fees	This will occur when the area develops
5	Construct Zone 15E Tank (0.66 MG); Construct Booster Pumps from Zone 12E to Zone 15E Tank; increase capacity of Zone 12E Booster Pumps	$3,639,444	10,820	2045	Impact Fees	This will occur when the area develops
6	Construct Zone 10 Tank (E-2) (1.1 MG)	$1,758,229	10,429	2043	Impact Fees	
Transmission/Distribution System Projects						
7	3 Additional PRVs between Zones 9N & 8N	$225,000	4,501	2018	Impact Fees	The construction of 18 PRV's is spread over about 35 years, or at a rate of about 1 every 2 years
8	3 Additional PRVs between Zones 10W & 9W	$225,000	5,597	2022	Impact Fees	
9	2 Additional PRVs between Zones 13E & 14E	$150,000	6,890	2028	Impact Fees	
10	4 Additional PRVs between Zones 8N & 7N	$300,000	7,826	2032	Impact Fees	
11	1 Additional PRV between Zones 11W & 10W	$75,000	8,292	2034	Impact Fees	
12	2 Additional PRVs between Zones 14E & 15E	$150,000	9,870	2040	Impact Fees	
13	3 Additional PRVs between Zones 10 & 9N	$225,000	11,434	2048	Impact Fees	
14	Construct Booster Pumps from Zone 10 Tank (E) to Zone 11E Tank	$754,750	6,654	2027	Bonds & Impact Fees	See Note Below
15	Equip Cemetery Well to Pump into Zone 10	$331,375	6,654	2027	Bonds &	See Note Below
16	Construct VFD Booster Pumps from Zone 10 to Zone 11NE (Transmission Line as a Possible Alternate)	$765,688	9,870	2040	Development	This will occur when the area develops
17	Construct VFD Booster Pumps from Zone 11E to Zone 12E near Ahlin Pond (Transmission Line as a Possible Alternate)	$757,063	6,208	2025	Development	This will occur when the area develops
18	Construct 900 South & Pole Canyon Road Parallel 8" Water Line	$195,480	3,123	2013	Water Fund & Impact Fees	See Note Below
19	Incremental Cost of Upsizing Beyond 8" Pipes	$628,745	These costs are spread over the next 35 years as land develops		Impact Fees	The estimated annual cost is $628,745/35, or $17,964
	Incremental Cost from 8" to 10" Pipes	$225,238				
	Incremental Cost from 8" to 12" Pipes	$153,537				
	Incremental Cost from 8" to 14" Pipes	$55,830				
	Incremental Cost from 8" to 16" Pipes	$194,141				
Total:		$20,416,258				

Notes:

Project Numbers 14 and 15: The booster pump from the Zone 10 Tank (E) to the Zone 11E Tank will be required to meet future demands. However it will also provide immediate benefits as described in this document. Equipping the Cemetery Well to pump to the Zone 10 Tank (E) will provide the immediate operation benefit of reduced pumping costs and will allow for more efficient management of water levels in the tank. For operational reasons both projects should be completed as soon as is practical. After construction of these facilities the impact fees should be recalculated so the costs can be repaid through impact fees.

Project Number 18: The 8" line in 900 South and Pole Canyon Road will be placed in parallel with and will supplement an existing 6" line. This will resolve an existing deficiency, and the combined 6" and 8" lines will provide the capacity of a 10" line, and will consitute a system improvement that will meet the needs of future growth.

Figure F-1 "Culinary Water Improvements" in Appendix F shows the projects that need to be constructed to meet future needs.

B. Funding Sources

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

There are a number of revenue sources available for managing Santaquin's culinary water system. They are listed below.

1. User Charges

   The City collects user fees for water services. User fees pay for water that the City purchases from various sources, as well as the value of water created by the City's own water sources. User fees are the primary source of funding for the maintenance and operation expenses of the City's water system.

2. Grants, Low Interest Loans and donations

   Santaquin City has had grants and low interest loans for water-related projects in the past. It is possible that it may get additional grants for future projects. Additionally some infrastructure is donated, though this typically is at the project improvement level rather than at the system improvement level.

3. Special Assessment Areas

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

4. General Obligation Bonds and Sales Tax Revenue Bonds

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

5. Impact Fees

   This source is a common and equitable method of funding new system improvements because it imposes the cost of new growth upon that new growth. The detailed analysis required to impose impact fees accurately allocates the true impact of a system or facility to those creating the impact. Those creating the most impact,

therefore, pay more. The speculative nature of these revenues, and their elasticity, however, make cash flows from impact fees unpredictable.

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

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

   This is a source that the City has recently used to help fund infrastructure needs within specific development areas of the city. This type of arrangement is typically accomplished with a development agreement between the City and the developer.

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

VII. CONCLUSION & RECOMMENDATIONS

A. Conclusion

This master plan effort was undertaken to evaluate Santaquin City's existing culinary water system, to identify existing deficiencies, to identify reserve capacities and to identify future system needs related to demands due to growth. Recommendations follow.

B. Recommendations

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

   This report, in conjunction with the IFFP and IFA will provide the basis for collection of impact fees necessary to construct the improvements required to support future growth.

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

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

2. Pressure Irrigation System to Provide its own Sources and Storage

   As discussed throughout this plan, it is imperative that the City work diligently to build new project improvements for the pressure irrigation system that will allow for removing pressure irrigation demands on the culinary system. This is an urgent need; we recommend that Santaquin City pursue it with diligence.

3. Constructing projects to provide Source, additional Storage and Redundancy

   There are two projects that, although they are not necessary to accommodate growth within the next ten years, we recommend the City bond for and construct. The first project is the new storage tank for Zone 10 (Zone 10 Tank (W)) and booster pumps from Zone 10 to Zone 11W. The second is the Zone 10 to Zone11E Booster facility.

   Both of these projects will provide for more efficient and flexible operation of the culinary water system, provide additional storage and provide redundancy. By constructing these new facilities the City will be able to save on pumping costs as well as have more operational flexibility for providing water from any source to any zone within the system. Once these facilities are constructed the IFFP should be updated. After constructed, these projects will transfer from future projects to system facilities with reserve capacity to serve future growth. Therefore impact fees can be collected to help pay for the bonds.

4. Address Adequacy of Water Rights

   We recommend that the City assess and evaluate the adequacy of existing water rights. We also recommend the City assess and evaluate the adequacy of their current water right acquisition policy to determine if this policy will provide sufficient water rights to buildout.

5. Replacement of Aging or Inadequate Infrastructure

   We recommend that the City plan for replacement of aging or inadequate infrastructure. For instance there are lead joint pipes along 400 South and 100 South in the core part of the City. The City should adopt a policy for replacement of these pipes as well as aging pipes.

6. Operational Recommendations

   As soon as new project improvements are constructed and in operation, several system operational parameters should be addressed. Changing these parameters will allow for better overall water management, reduced pumping costs and more efficient and flexible operation of the culinary system.

   Once the new 2.19 mg tank (Zone 10 Tank (W)) and Zone 11W Booster pump station are constructed the Summit Ridge well will be operated only when needed (i.e. when spring water from the canyon is not sufficient to keep up with citywide demands) to pump water to the Zone 10 tanks. This will save money in the form of pumping costs as water from the well will only be pumped as high as is needed.

   There is a small area near the Ahlin pressure irrigation pond (and eastward) where a local culinary water booster pump facility will need to be constructed. This area could contain dozens of homes but is too high in elevation to be served by the Zone 11E system in that area, without boosting. As this area develops, this booster pump facility will need to be constructed prior to development.

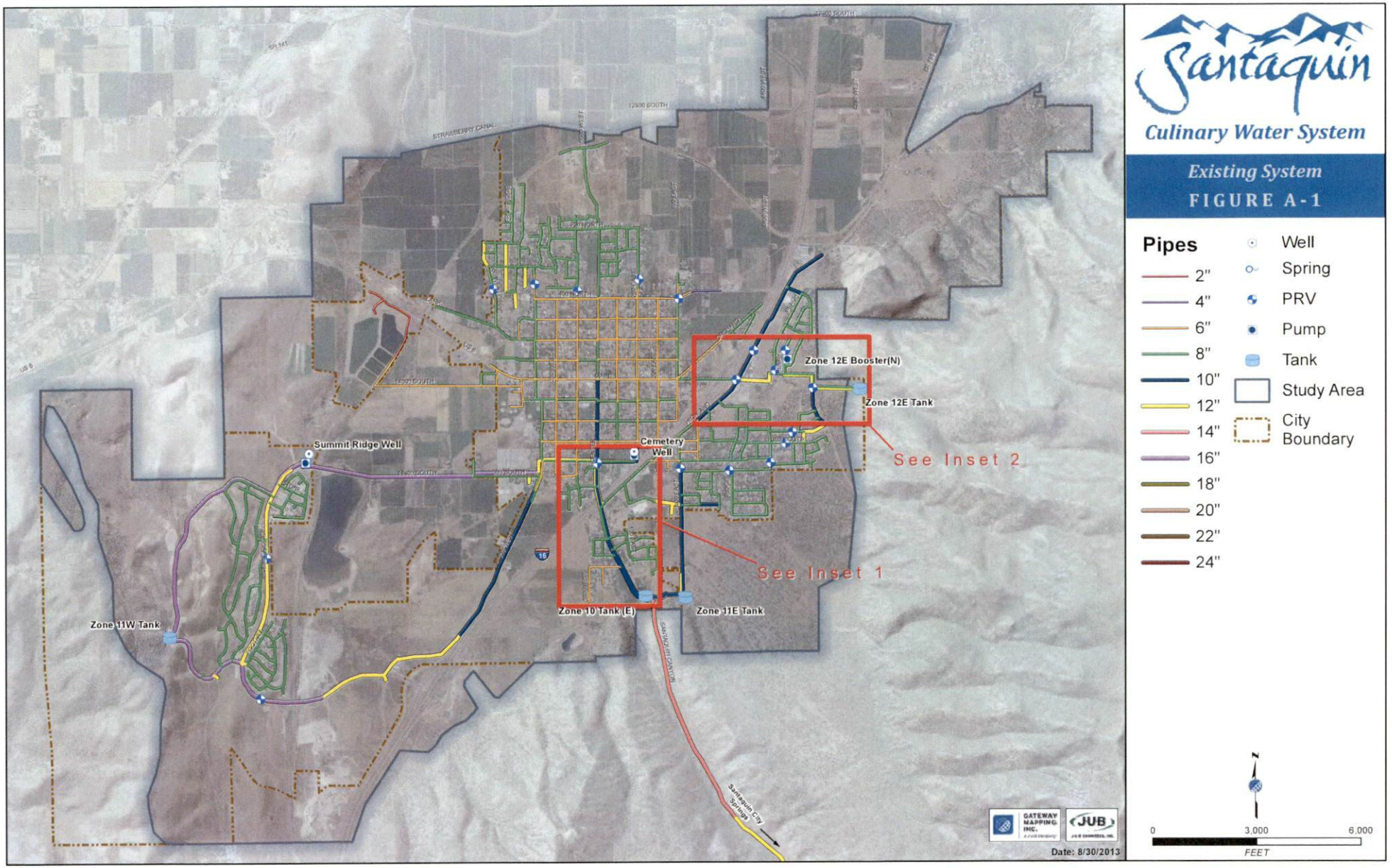
   For the future Zones 13E, 14E & 15E there will only be one storage tank constructed. This will be the Zone 15E Tank. This new tank will be constructed high enough in elevation to serve all 3 zones (Zone 15E being the highest pressure zone). Water will be pumped to this new tank and will serve all 3 of these Zones.

   Within the aforementioned future higher pressure zones as well as several other high pressure zones (Zones 12W & 11NE) the culinary water system will provide distribution, source and storage for all culinary and pressure irrigation needs. Only a single pipeline system will be required to be installed within these higher areas. However, each service line will be provided with a pressure irrigation meter and a culinary water meter. Due to the steep slopes and the relatively small amounts of developable land in these higher areas it does not seem prudent to construct individual systems for the culinary as well as the pressure irrigation system.

7. Updates to Master Plan and Capital Facilities Plan

We recommend that Santaquin City update this plan as needed but at intervals of not more than every 5 years. An interim update may be needed if planned land uses change significantly.

APPENDIX A
EXISTING SYSTEM MAPS


Zone 12E Booster(N)
Zone 12E Tank
See Inset 2
Summit Ridge Well
Cemetery Well
See Inset 1
Zone 10 Tank (E)
Zone 11E Tank
Zone 11W Tank
Santaquin City Springs
Date: 8/30/2013
Santaquin
Culinary Water System
Existing System
FIGURE A-1
Pipes
2"
4"
6"
8"
10"
12"
14"
16"
18"
20"
22"
24"
Well
Spring
PRV
Pump
Tank
Study Area
City Boundary
0
3,000
6,000
FEET

Inset 1

Inset 2

Santaquin

Culinary Water System

Existing System

FIGURE A-1 INSETS

Pipes
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

- Well
- Spring
- PRV
- Pump
- Tank
- Study Area
- City Boundary

N

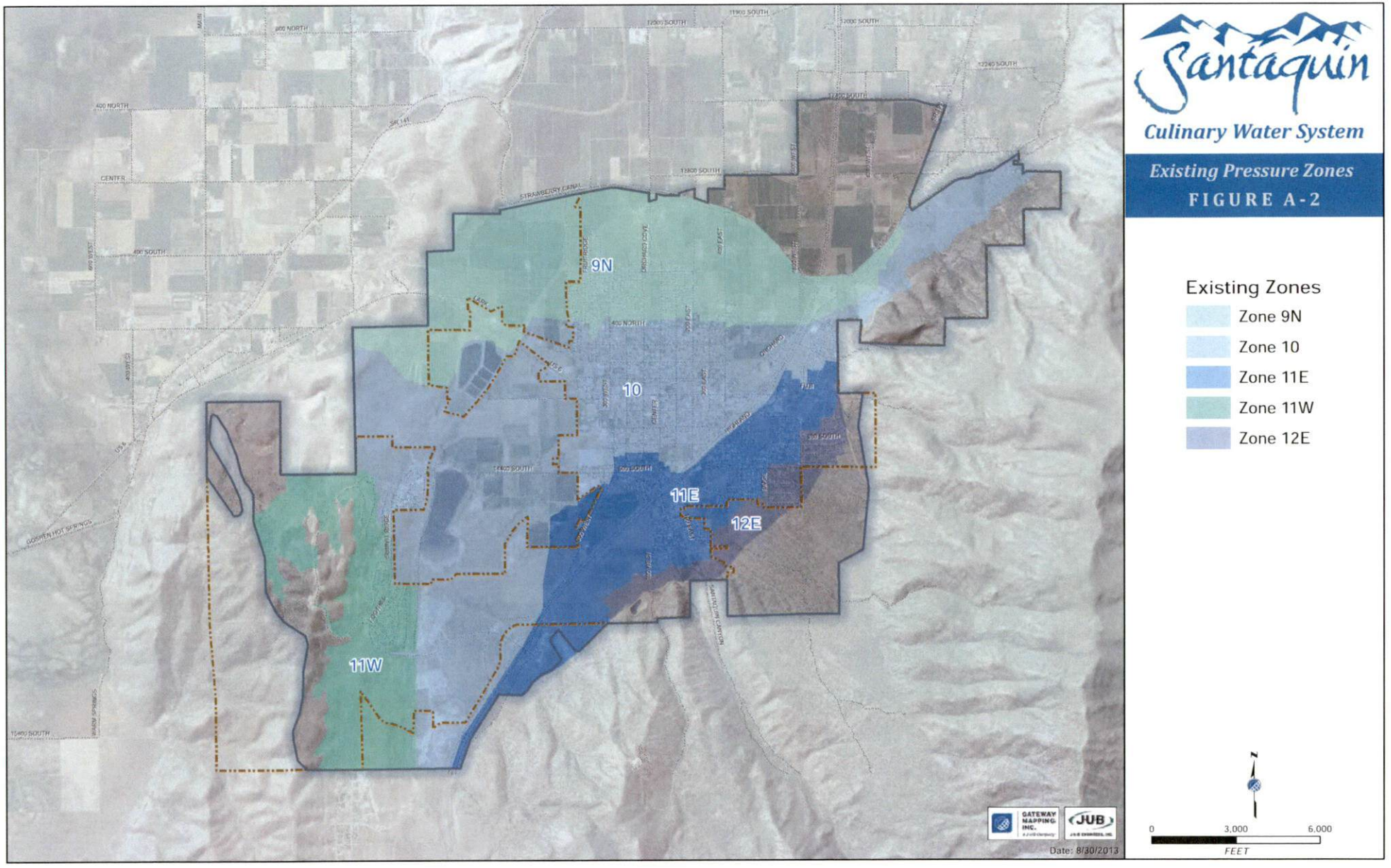
0 3,000 6,000

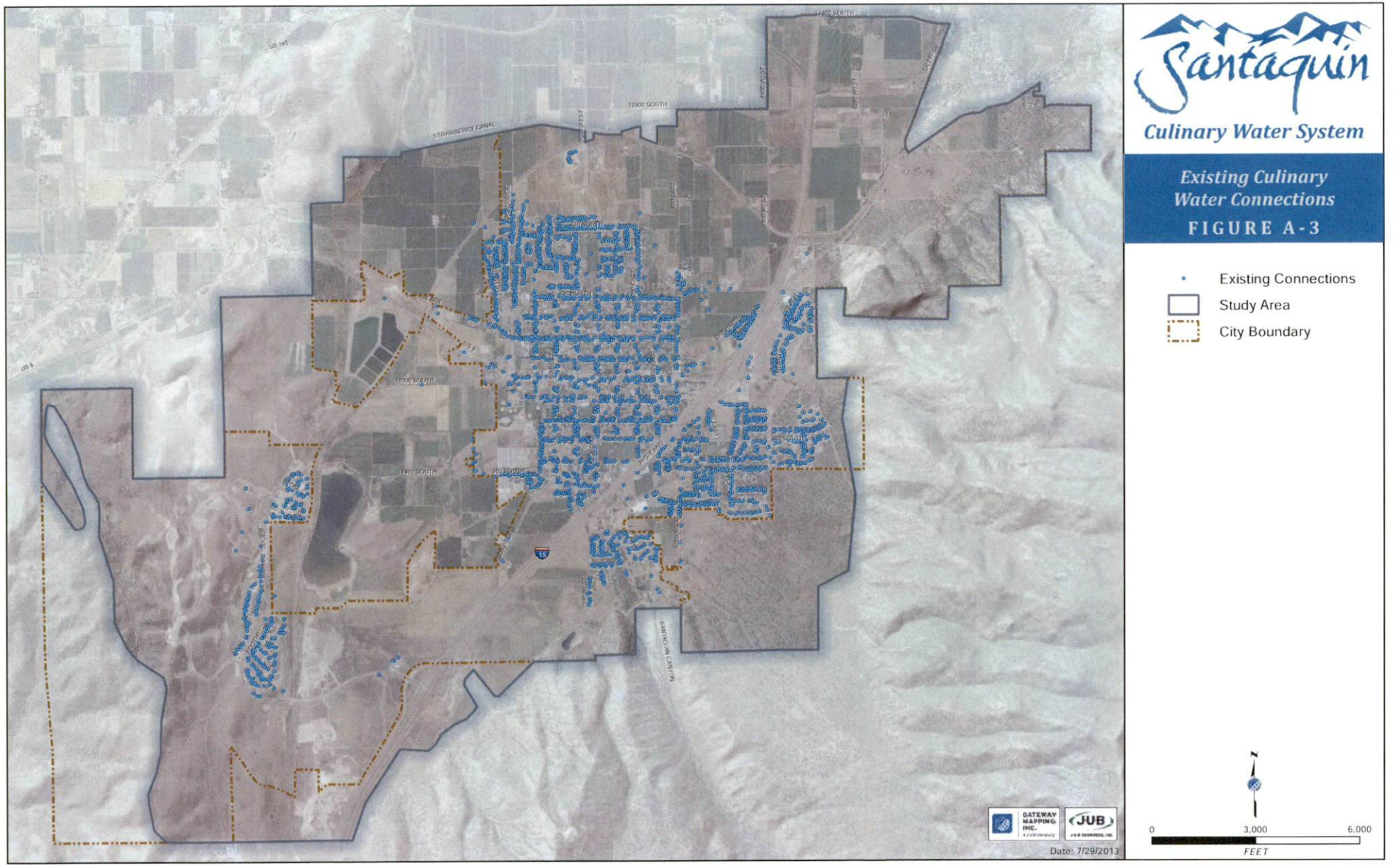
FEET

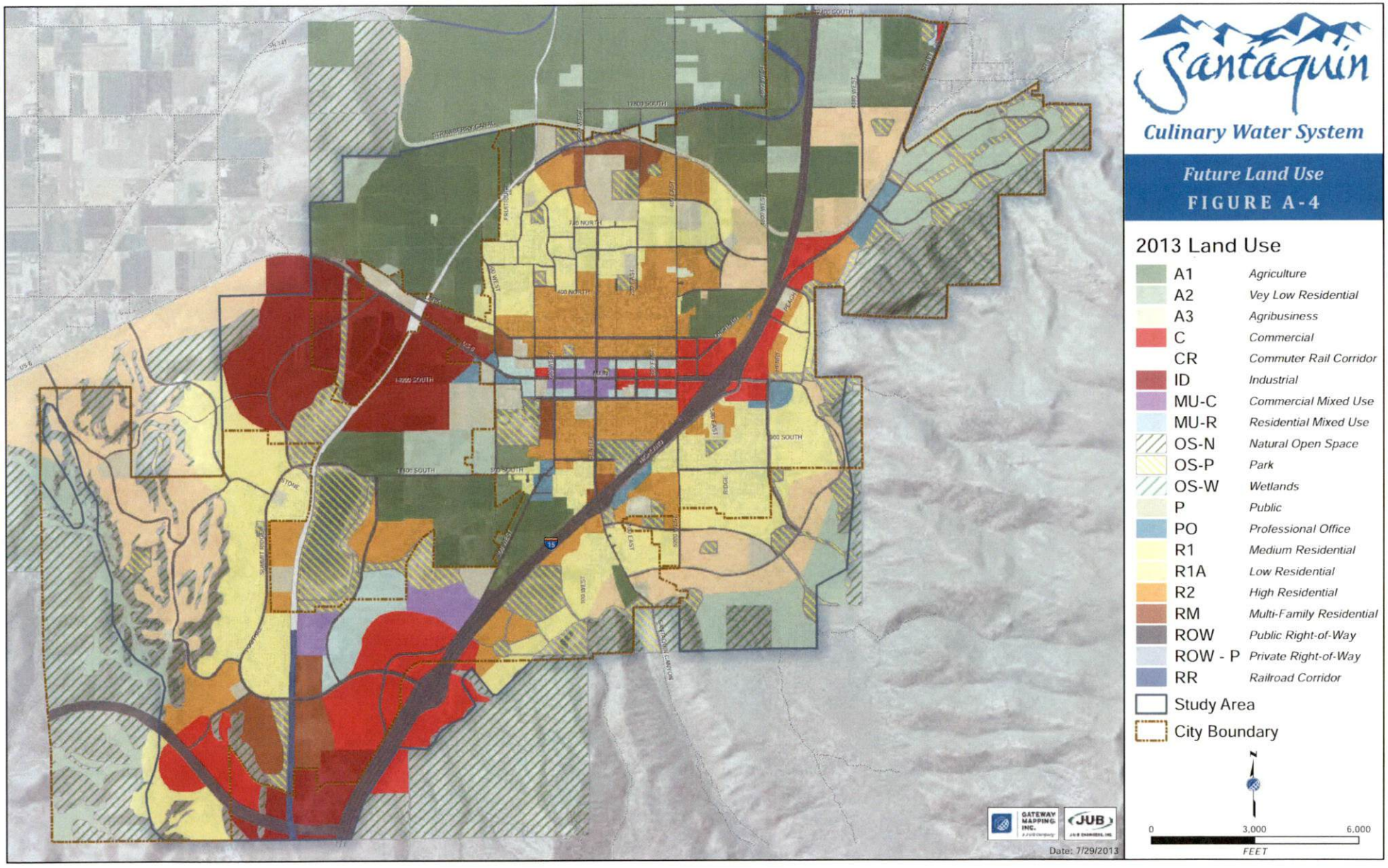
GATEWAY MAPPING, INC.

JUB

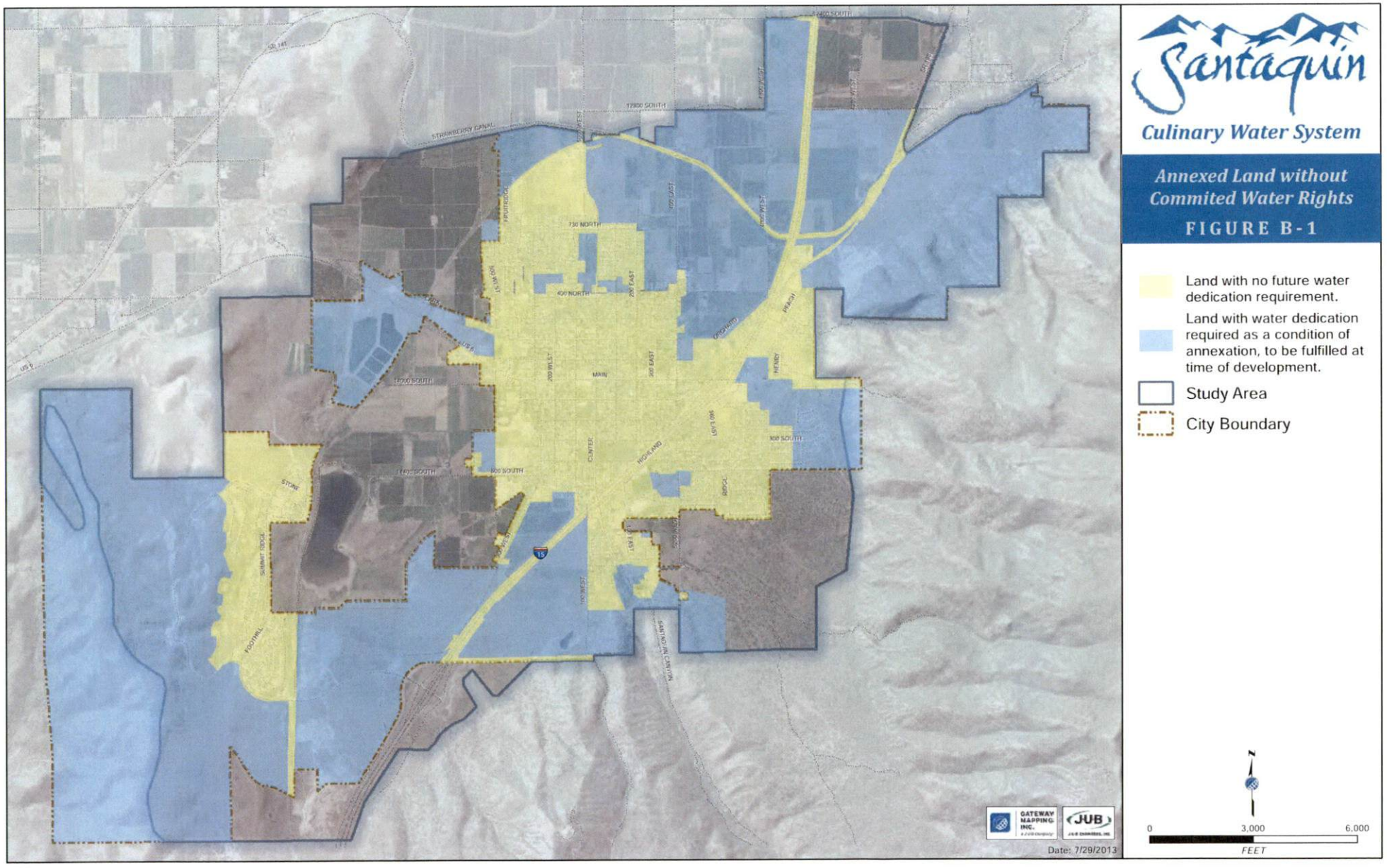
Date: 8/30/2013


Santaquin
Culinary Water System
Existing Pressure Zones
FIGURE A-2
Existing Zones
Zone 9N
Zone 10
Zone 11E
Zone 11W
Zone 12E
9N
10
11E
12E
11W
GATEWAY MAPPING, INC.
JUB
Date: 8/30/2013
0
3,000
6,000
FEET

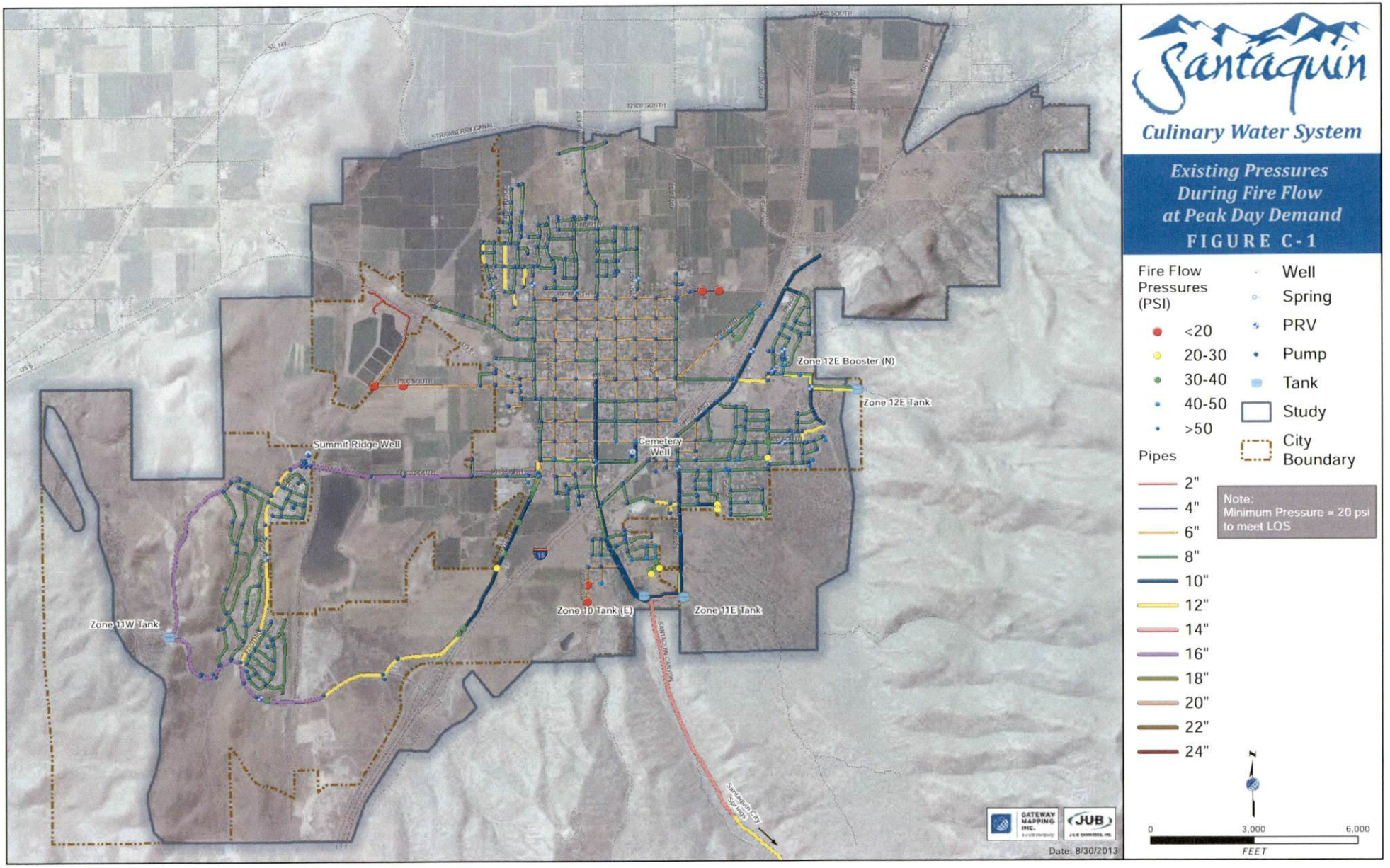

Santaquin
Culinary Water System
Existing Culinary Water Connections
FIGURE A-3
Existing Connections
Study Area
City Boundary
N
0
3,000
6,000
FEET
GATEWAY MAPPING INC.
JUB
Date: 7/29/2013

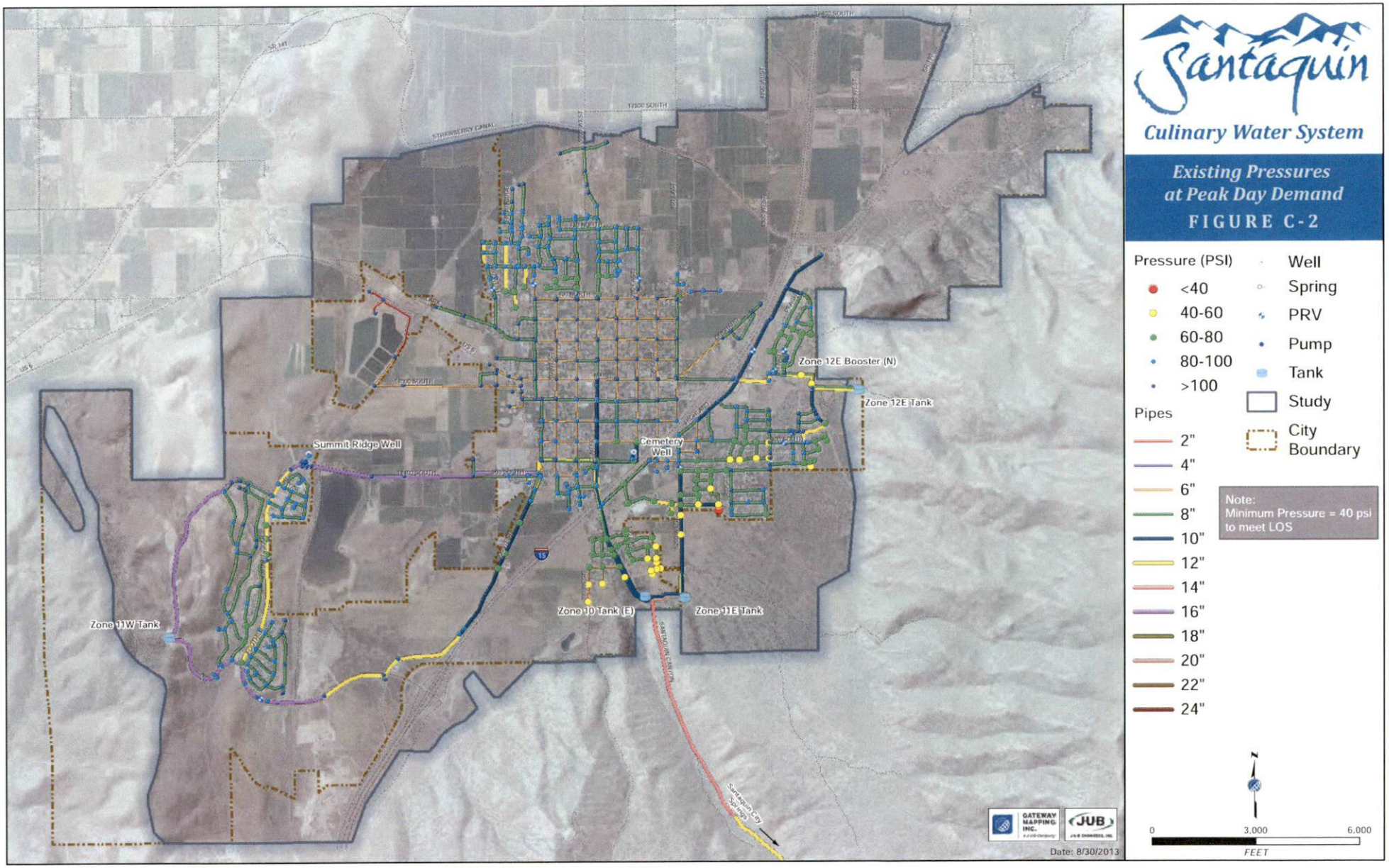

Santaquin
Culinary Water System
Future Land Use
FIGURE A-4
2013 Land Use
A1 Agriculture
A2 Vey Low Residential
A3 Agribusiness
C Commercial
CR Commuter Rail Corridor
ID Industrial
MU-C Commercial Mixed Use
MU-R Residential Mixed Use
OS-N Natural Open Space
OS-P Park
OS-W Wetlands
P Public
PO Professional Office
R1 Medium Residential
R1A Low Residential
R2 High Residential
RM Multi-Family Residential
ROW Public Right-of-Way
ROW - P Private Right-of-Way
RR Railroad Corridor
Study Area
City Boundary
N
0
3,000
6,000
FEET
GATEWAY MAPPING INC.
JUB
Date: 7/29/2013

APPENDIX B
ANNEXED LAND WITHOUT COMMITED WATER RIGHTS MAP


Santaquin
Culinary Water System
Annexed Land without Commited Water Rights
FIGURE B-1
Land with no future water dedication requirement.
Land with water dedication required as a condition of annexation, to be fulfilled at time of development.
Study Area
City Boundary
N
0
3,000
6,000
FEET
GATEWAY MAPPING INC.
JUB
Date: 7/29/2013
12300 SOUTH
STRAWBERRY CANAL
730 NORTH
400 NORTH
MAIN
CENTER
HIGHLAND
1400 SOUTH
800 SOUTH
900 SOUTH
SUMMIT RIDGE
FOOTHILL
SANTAQUIN CANYON

APPENDIX C
EXISTING SYSTEM PRESSURES MAPS


Zone 12E Booster (N)
Zone 12E Tank
Summit Ridge Well
Cemetery Well
Zone 11W Tank
Zone 10 Tank (E)
Zone 11E Tank
Santaquin City Springs
Date: 8/30/2013
Santaquin
Culinary Water System
Existing Pressures During Fire Flow at Peak Day Demand
FIGURE C-1
Fire Flow Pressures (PSI)
<20
20-30
30-40
40-50
>50
Pipes
2"
4"
6"
8"
10"
12"
14"
16"
18"
20"
22"
24"
Well
Spring
PRV
Pump
Tank
Study
City Boundary
Note:
Minimum Pressure = 20 psi to meet LOS
N
0
3,000
6,000
FEET



Santaquin

Culinary Water System

Existing Pressures at Peak Day Demand

FIGURE C-2

Pressure (PSI)
- <40
- 40-60
- 60-80
- 80-100
- >100

Pipes
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

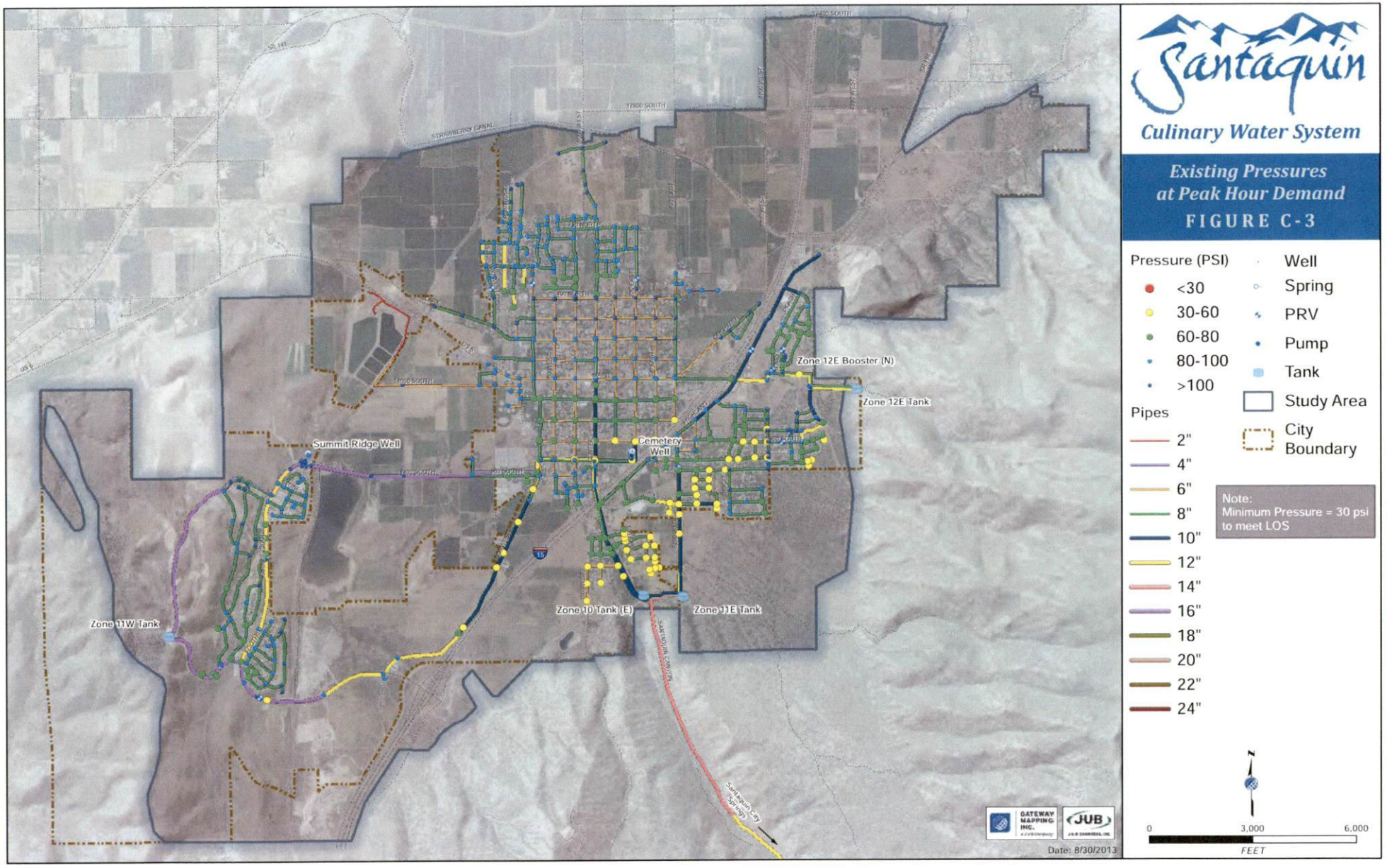
- Well
- Spring
- PRV
- Pump
- Tank
- Study
- City Boundary

Note:
Minimum Pressure = 40 psi to meet LOS

N

0 3,000 6,000

FEET



Santaquin

Culinary Water System

Existing Pressures at Peak Hour Demand

FIGURE C-3

Pressure (PSI)
- <30
- 30-60
- 60-80
- 80-100
- >100

Pipes
- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

- Well
- Spring
- PRV
- Pump
- Tank
- Study Area
- City Boundary

Note:
Minimum Pressure = 30 psi to meet LOS

N

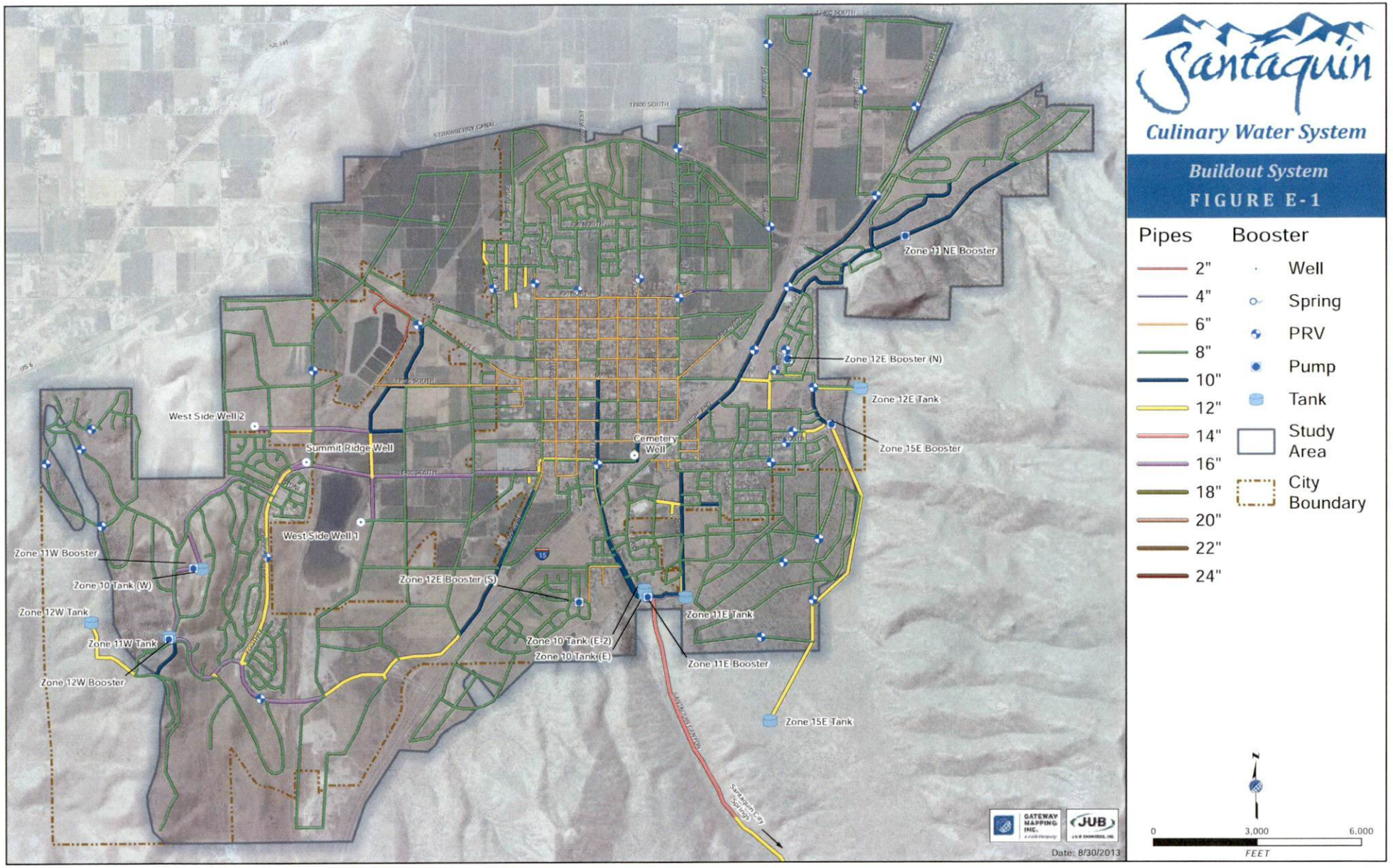
0 3,000 6,000

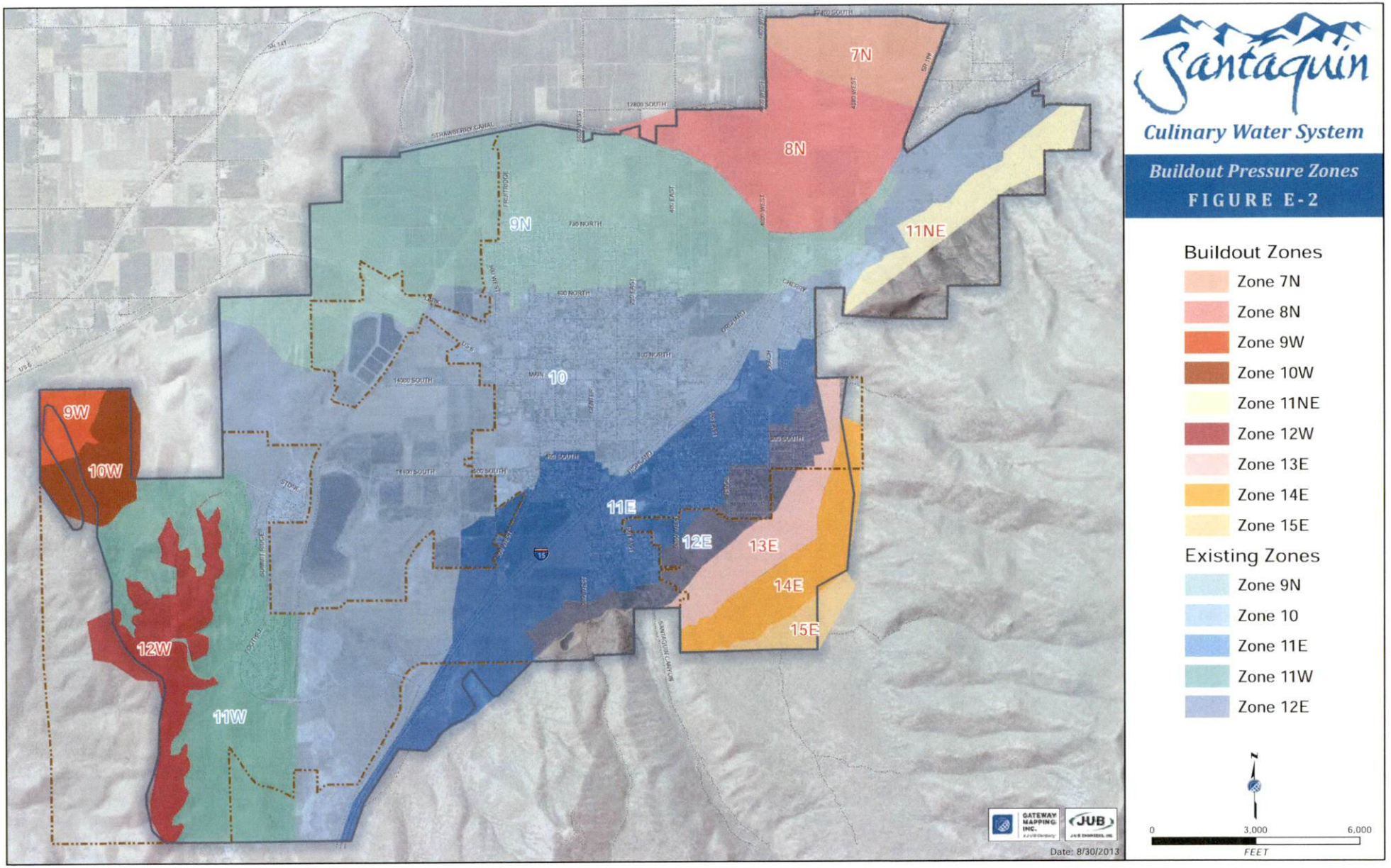
FEET

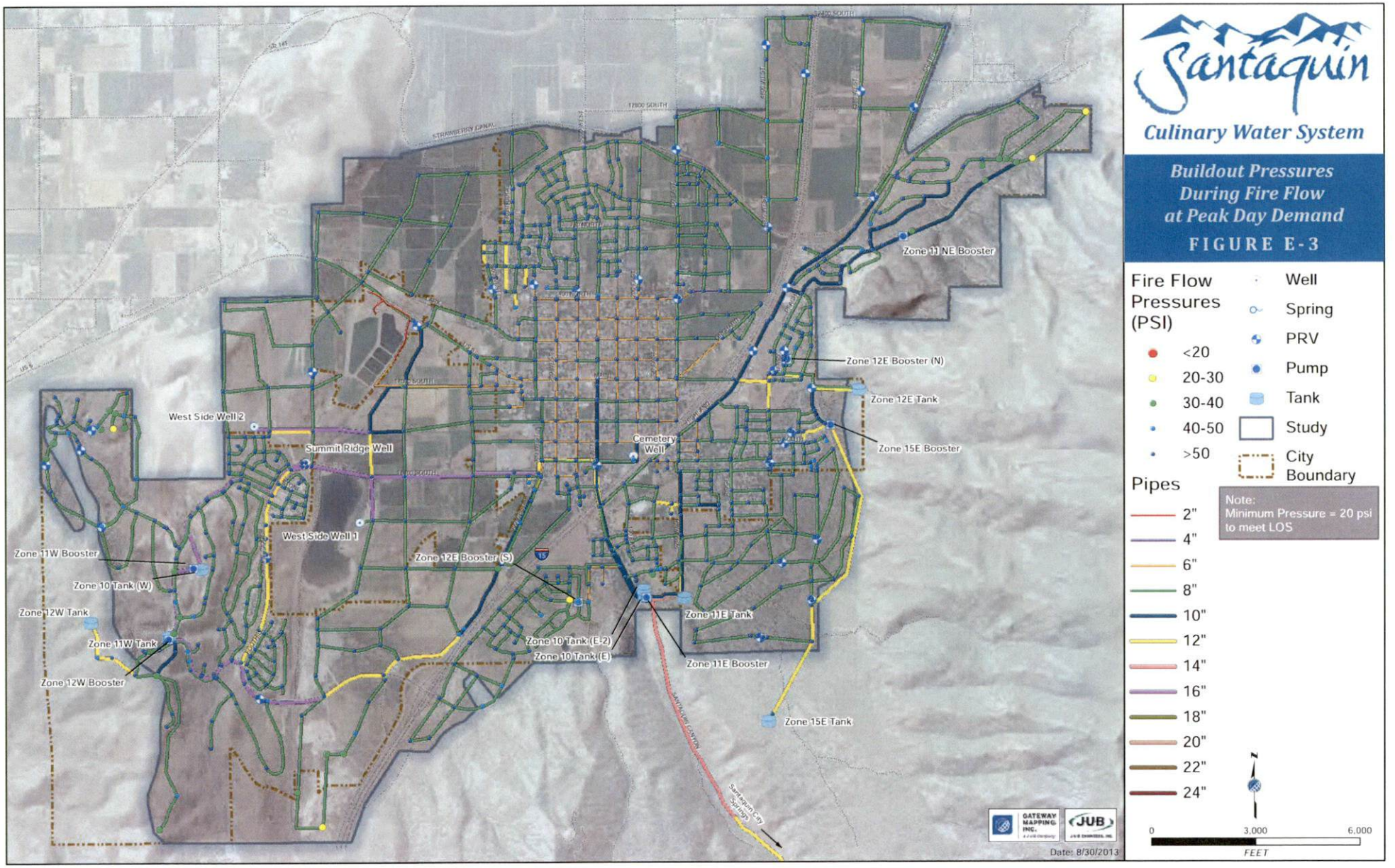
APPENDIX D
HISTORIC PROJECTS

Name and Description	Approximate Year of Construction
400 South Pressure Zone Change	2008
16" Water Line 500 South	2008
Summit Ridge Well Upgrade	2009
Municipal Culinary Water Improvements Project	1992
Water Distribution, Storage, Treatment & Development	
Chlorinator House and Installation	1964
Culinary Water Line Replacement	1964
Reinforced Concrete Reservoir (200K gal)	1940
Water Works System Replacement	1935

APPENDIX E
FUTURE SYSTEM MAPS AND TABLE


Santaquin
Culinary Water System
Buildout System
FIGURE E-1
Pipes
2"
4"
6"
8"
10"
12"
14"
16"
18"
20"
22"
24"
Booster
Well
Spring
PRV
Pump
Tank
Study Area
City Boundary
Zone 11 NE Booster
Zone 12E Booster (N)
Zone 12E Tank
Zone 15E Booster
West Side Well 2
Summit Ridge Well
Cemetery Well
West Side Well 1
Zone 11W Booster
Zone 10 Tank (W)
Zone 12W Tank
Zone 11W Tank
Zone 12W Booster
Zone 12E Booster (S)
Zone 10 Tank (E-2)
Zone 10 Tank (E)
Zone 11E Tank
Zone 11E Booster
Zone 15E Tank
Santaquin City Springs
GATEWAY MAPPING INC.
JUB
Date: 8/30/2013
N
0
3,000
6,000
FEET


7N
8N
9N
10
11NE
9W
10W
11E
12E
13E
14E
15E
12W
11W
Santaquin
Culinary Water System
Buildout Pressure Zones
FIGURE E-2
Buildout Zones
Zone 7N
Zone 8N
Zone 9W
Zone 10W
Zone 11NE
Zone 12W
Zone 13E
Zone 14E
Zone 15E
Existing Zones
Zone 9N
Zone 10
Zone 11E
Zone 11W
Zone 12E
0
3,000
6,000
FEET
GATEWAY MAPPING, INC.
JUB
Date: 8/30/2013



Santaquin

Culinary Water System

Buildout Pressures During Fire Flow at Peak Day Demand

FIGURE E-3

Fire Flow Pressures (PSI)

- <20
- 20-30
- 30-40
- 40-50
- >50

Pipes

- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

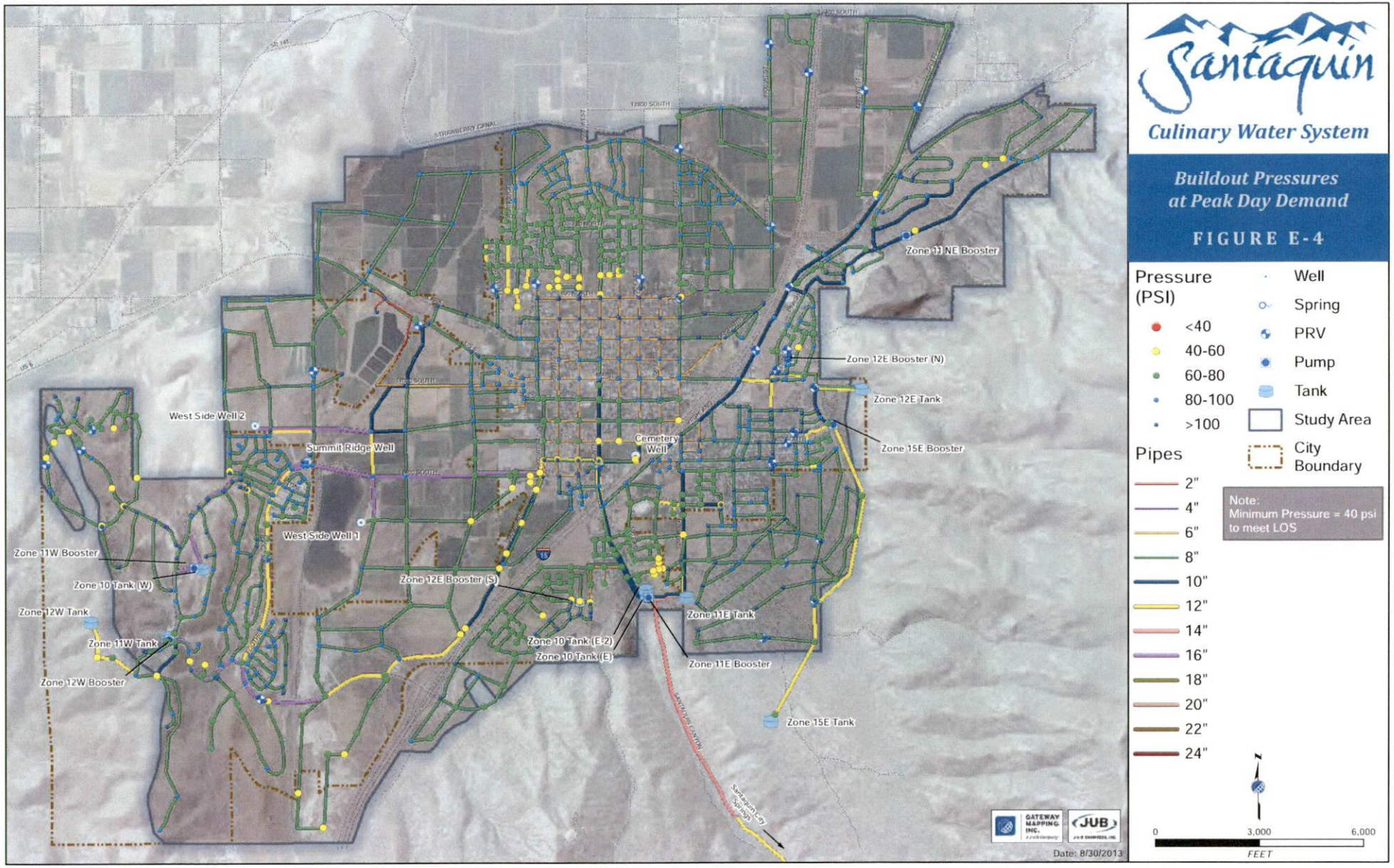
- Well
- Spring
- PRV
- Pump
- Tank
- Study
- City Boundary

Note:
Minimum Pressure = 20 psi to meet LOS

N

0 3,000 6,000

FEET



Santaquin

Culinary Water System

Buildout Pressures at Peak Day Demand

FIGURE E-4

Pressure (PSI)

- <40
- 40-60
- 60-80
- 80-100
- >100

Pipes

- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

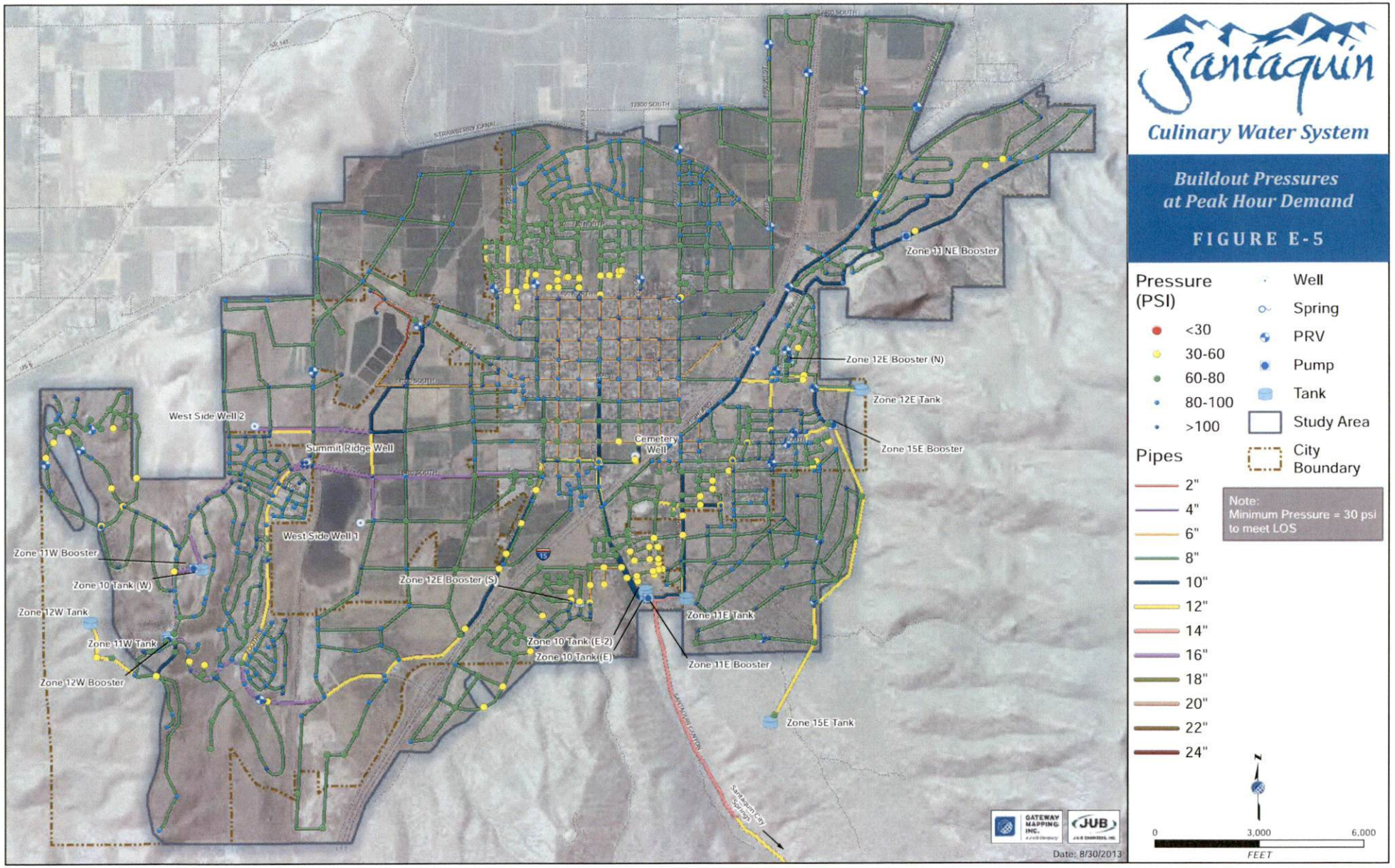
- Well
- Spring
- PRV
- Pump
- Tank
- Study Area
- City Boundary

Note:
Minimum Pressure = 40 psi to meet LOS

N

0 3,000 6,000

FEET



Santaquin

Culinary Water System

Buildout Pressures at Peak Hour Demand

FIGURE E-5

Pressure (PSI)

- <30
- 30-60
- 60-80
- 80-100
- >100

Pipes

- 2"
- 4"
- 6"
- 8"
- 10"
- 12"
- 14"
- 16"
- 18"
- 20"
- 22"
- 24"

- Well
- Spring
- PRV
- Pump
- Tank
- Study Area
- City Boundary

Note:
Minimum Pressure = 30 psi to meet LOS

N

0 3,000 6,000

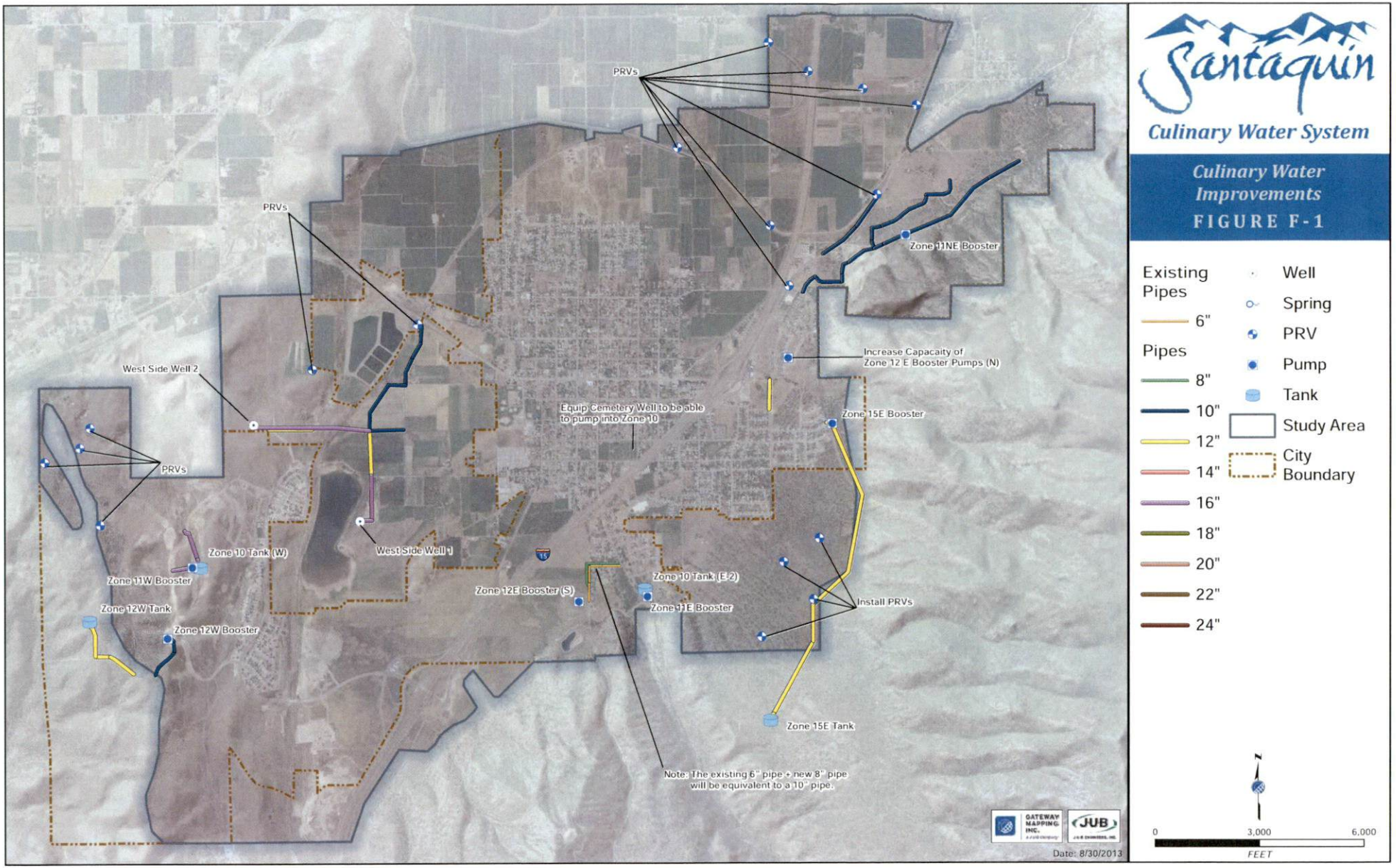
FEET

Table E-1: Future Transmission/Distribution Pipe Flows Tabulation

Pipe Segment	Dia (in)	Segment Length (ft)	Existing Flow (GPM)	Flow at 2023 (GPM)	Buildout Flow (GMP)	% Needed in Next 10 Years
P387, P190, P12953	6 & 8 (=10)	905	28	178	682	26%
P221, P12955	6 & 8 (=10)	536	9	50	214	24%
P12825	10	544	0	4	8	55%
P12715	10	377	0	0	16	0%
P12351	10	1,034	0	0	17	0%
P12717	10	179	0	7	23	31%
P12409	10	2,927	0	0	24	0%
P12327	10	3,915	0	3	31	8%
P12775	10	227	0	0	38	0%
P12329	10	1,019	0	30	97	31%
P12325	10	1,952	0	43	120	36%
P12405	10	514	0	46	130	35%
P12311	10	572	0	40	134	30%
P12299	10	268	0	67	196	34%
P12297	10	832	0	71	202	35%
P12759	10	1,068	0	0	409	0%
P12275	10	1,312	0	0	700	0%
B1921	10	167	0	0	1,211	0%
P11555	10	467	0	0	1,211	0%
P11629	10	5,726	0	0	2,919	0%
P373	10	488	0	1,514	5,821	26%
Total of all existing 10 inch pipes						
Total Length:		**25,026**				
Weighted Average Values:				**47**	**932**	**5%**

Pipe Segment	Dia (in)	Segment Length (ft)	Existing Flow (GPM)	Flow at 2023 (GPM)	Buildout Flow (GMP)	% Needed in Next 10 Years
P12055	12	1,263	0	0	3	0%
P12415	12	8	0	5	5	100%
P11717	12	112	0	0	96	0%
P11563	12	198	0	0	322	0%
P11599	12	2,901	0	0	333	0%
P11625	12	22	0	0	703	0%
P11655	12	1,312	0	0	972	0%
P12647	12	859	0	0	1,150	0%
Total of all existing 12 inch pipes						
Total Length:		**6,676**				
Weighted Average Values:				**0**	**498**	**0%**
P12279	14	73	0	0	171	0%
B749	14	751	0	0	1,504	0%
P12731	14	273	0	0	1,769	0%
P12733	14	266	0	0	1,769	0%
Total of all existing 14 inch pipes						
Total Length:		**1,362**				
Weighted Average Values:				**0**	**1,538**	**0%**
P12321	16	405	0	0	2	0%
P12607	16	328	0	0	3	0%
P12137	16	570	0	0	19	0%
P12317	16	366	0	13	42	30%
P11735	16	1,297	0	0	726	0%
P11645	16	115	0	2,558	8,769	29%
Total of all existing 16 inch pipes						
Total Length:		**3,082**				
Weighted Average Values:				**97**	**642**	**15%**

APPENDIX F
SYSTEM PROJECT IMPROVEMENTS MAP


PRVs
PRVs
Zone 11NE Booster
Increase Capacity of Zone 12 E Booster Pumps (N)
West Side Well 2
Equip Cemetery Well to be able to pump into Zone 10
Zone 15E Booster
PRVs
Zone 10 Tank (W)
West Side Well 1
Zone 11W Booster
Zone 12E Booster (S)
Zone 10 Tank (E-2)
Zone 11E Booster
Zone 12W Tank
Zone 12W Booster
Install PRVs
Zone 15E Tank
Note: The existing 6" pipe + new 8" pipe will be equivalent to a 10" pipe.
GATEWAY MAPPING INC.
JUB
Date: 8/30/2013
Santaquin
Culinary Water System
Culinary Water Improvements
FIGURE F-1
Existing Pipes
6"
Pipes
8"
10"
12"
14"
16"
18"
20"
22"
24"
Well
Spring
PRV
Pump
Tank
Study Area
City Boundary
N
0
3,000
6,000
FEET

APPENDIX G
EXISTING SANTAQUIN CITY WATER RIGHTS

TABLE G-1 SUMMARY OF WATER RIGHTS

Water Right #	Application / Claim #	Source	Amount	Type	Status	CERT #	Note
51-1013		Summit Creek & Springs	2.0 cfs	APPL	CERT	1238	Supplimental Group No. 227200 and 230961
53-1496		Utah Lake & Jordan River	807.38 acft 204.40 ac-ft (as shareholder)	SHAR	CERT	1970	
	a25719	Underground Water Well	807.35 acft 204.40 ac-ft (as shareholder)		Approved		Change Application to WR 53-1496, changed POD from Utah Lake and Jordan River to City Wells
53-1675		Utah Lake & Jordan River	121.0 acft	SHAR			49 shares of stock in East Jordan Irr. Company
	a26452a	Underground Water Well	121.0 acft 121 acft, 30.25 ac		Approved		Pertains to WR 53-1675, POD to Summit Ridge Well for Summit Ridge Development from Jordan River
51-1347		Underground Water Well & Spring	2.52 cfs	APPL	CERT	6251	
	a9506	Underground Water Well & Spring	2.52 cfs		Withdrawn		Change Application to WR 51-1347
	t24464	Underground Water Well	2.52 cfs 1824.42 ac ft		Rejected		Change Application to WR 51-1347
	a24465	Underground Water Wells (2) & Spring	2.52 cfs 1824.42 acft		Approved		Change Application to WR 51-1347, POD in part to multiple wells
51-1348		Underground Water Well	2.48 cfs	APPL	CERT	9073	No Proof Due Date on the parenet right
	a6884	Underground Water Well	2.48 cfs		CERT		WR 51-1348, POD to Center Street Well
	a16256	Underground Water Wells (2)	2.48 cfs		Approved		Change Application to WR 51-1348, POD from one city well to another due to diminished production.
51-7045		Utah Lake & Jordan River	224.77 acft	SHAR			portion of 59-3500, based on 45.5 shares of South Jordan Canal Company Stock
	a20673	Underground Water Wells (2) existing	127.1 acft		Withdrawn		Change Application to WR 51-7045, replaced by final action on a35122
	a26290	Underground Water Wells (4; 1 proposed)	224.77 acft		AMENDED		Change Application to WR 51-7045, Changed POD from Utah Lake and Jordan River to City wells.
	a31014	Underground Water Well	224.77 acft		Withdrawn		Change Application to WR 51-7045, was to replace a26290
	t31016	Underground Water Well	224.77 acft		Lapsed Application		Change Application to WR 51-7045
	a35122	Underground Water Wells (5) existing	224.77 acft		Approved		Change Application to WR 51-7045 right evidenced by a26290
51-8394		Underground Water Well	53.84 acft	APPL	CERT	5423	Supplimental Group #227561,
	a36078	Underground Water Well (existing)	53.84 acft		Approved		Change Application to WR 51-8394, POD from underground well to Underground well of Santaquin Special Service District

APPENDIX H
OPINION OF CONCEPTUAL PROJECT COSTS

Table H-1: Culinary Water Projects – Opinion of Conceptual Project Costs

Project Number	Project Name				
Source Projects					
1	**Construct New West Side Well #1 (3.08 MGD)**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Drill New Well	1	each	$450,000	$450,000
	Pump and Motor	1	each	$175,000	$175,000
	16" Piping	2,000	LF	$122	$244,000
	Building	1	each	$175,000	$175,000
	Piping, Fittings, Valves, Meters, Etc.	1	each	$100,000	$100,000
	Electrical	1	each	$175,000	$175,000
	Preliminary Evaluation Report and Drinking Water Source Protection Plan	1	each	$60,000	$60,000
	Telemetry/Control/Monitoring	1	each	$75,000	$75,000
	Treatment Equipment	1	each	$15,000	$15,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	2.30	Acres	$7,500	$17,218
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$375,304
				Total	$1,876,522
2	**Construct New West Side Well #2 (3.08 MGD)**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Drill New Well	1	each	$450,000	$450,000
	Pump and Motor	1	each	$175,000	$175,000
	16" Piping	4,700	LF	$122	$573,400
	Building	1	each	$175,000	$175,000
	Piping, Fittings, Valves, Meters, Etc.	1	each	$100,000	$100,000
	Electrical	1	each	$175,000	$175,000
	Preliminary Evaluation Report and Drinking Water Source Protection Plan	1	each	$60,000	$60,000
	Telemetry/Control/Monitoring	1	each	$75,000	$75,000
	Treatment Equipment	1	each	$15,000	$15,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	5.39	Acres	$7,500	$40,461
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$463,465
				Total	$2,317,327

Project Number	Project Name				
Storage Projects					
3	**Construct Zone 10 Tank (W) (2.19 MG) & Booster Pumps from Zone 10 Tank (W) to Zone 11W Tank**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Earthwork (Cut)	13,541	C.Y.	$10	$135,408
	Earthwork (Fill)	6,770	C.Y.	$10	$67,704
	2.13 Million Gallon Tank	1	each	$1,815,494	$1,815,494
	Piping, Fittings, Valves, Meters, Etc.	1	each	$75,000	$75,000
	Valve Vault	1	each	$40,000	$40,000
	16 Inch Main Line	2,400	LF	$122	$292,800
	Booster Pumpss	2	each	$55,000	$110,000
	Building	1	each	$150,000	$150,000
	Electrical	1	each	$175,000	$175,000
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	1	each	$100,000	$100,000
	Land Acquisition	1	Acres	$30,000	$30,000
	Easement Acquisition	2.75	Acres	$7,500	$20,661
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$769,267
				Total	$3,846,335
4	**Construct Zone 12W Tank (0.58 MG) & Booster Pumps From Zone 11W to Zone 12W Tank**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Earthwork (Cut)	3,942	C.Y.	$10	$39,421
	Earthwork (Fill)	1,971	C.Y.	$10	$19,711
	0.63 Million Gallon Tank	1	each	$683,561	$683,561
	Piping, Fittings, Valves, Meters, Etc.	1	each	$75,000	$75,000
	Valve Vault	1	each	$40,000	$40,000
	10 Inch Main Line	4,000	LF	$69	$276,000
	Booster Pumps	2	each	$45,000	$90,000
	Building	1	each	$150,000	$150,000
	Electrical	1	each	$175,000	$175,000
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	1	each	$100,000	$100,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	3.7	Acres	$7,500	$27,548
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$439,060
				Total	$2,195,302

Project Number	Project Name				
5	**Construct Zone 15E Tank (0.66 MG); Construct Booster Pumps from Zone 12E to Zone 15E Tank; increase capacity of Zone 12E Booster Pumps**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Earthwork (Cut)	4,123	C.Y.	$10	$41,233
	Earthwork (Fill)	2,062	C.Y.	$10	$20,617
	0.66 Million Gallon Tank	1	each	$716,112	$716,112
	Piping, Fittings, Valves, Meters, Etc.	2	each	$75,000	$150,000
	Valve Vault	2	each	$40,000	$80,000
	PRV & Vault	2	each	$75,000	$150,000
	12 Inch Main Line	9,800	LF	$82	$803,600
	Booster Pumps	2	each	$45,000	$90,000
	Increase Zone 12E Booster Pump Capcities	1	each	$100,000	$100,000
	Building	1	each	$150,000	$150,000
	Electrical	1.5	each	$175,000	$262,500
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	2	each	$100,000	$200,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	9.0	Acres	$7,500	$67,493
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$727,889
				Total	$3,639,444
6	**Construct Zone 10 Tank (E-2) (1.1 MG)**				
	Item Description	Quantity	Unit	Unit Price	Amount
	Earthwork (Cut)	7,329	C.Y.	$10	$73,293
	Earthwork (Fill)	3,665	C.Y.	$10	$36,647
	Demolition of old tanks	1	LS	$100,000	$100,000
	16 Inch Main Line	200	LF	$122	$24,400
	1.17 Million Gallon Tank	1	each	$997,243	$997,243
	Piping, Fittings, Valves, Meters, Etc.	1	each	$60,000	$60,000
	Valve Vault	1	each	$40,000	$40,000
	Telemetry/Control/Monitoring	1	each	$75,000	$75,000
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$351,646
				Total	$1,758,229

Project Number	Project Name				
Transmission/Distribution Projects					
7 Thru 13	**Construct PRV Stations**				
	Item Description	Quantity	Unit	Unit Price	Amount
	PRV Valve	1	each	$25,000	$25,000
	Valve Vault	1	each	$15,000	$15,000
	Piping, Fittings, Valves, Meters, Etc.	1	each	$20,000	$20,000
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$15,000
				Total	$75,000
				Total PRV Stations:	$18
				Total for all PRV Stations:	$1,350,000
14	**Construct Booster Pumps from Zone 10 Tank (E) to Zone 11E Tank**				
	Item Description	Quantity	Unit	Unit Price	Amount
	10 Inch Main Line	200	LF	$69	$13,800
	Piping, Fittings, Valves, Meters, Etc.	1	each	$75,000	$75,000
	Booster Pumps	2	each	$50,000	$100,000
	Building	1	each	$125,000	$125,000
	Electrical	1	each	$150,000	$150,000
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	1	each	$75,000	$75,000
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$150,950
				Total	$754,750
15	**Equip Cemetery Well to Pump into Zone 10**				
	Item Description	Quantity	Unit	Unit Price	Amount
	10 Inch Main Line	100	LF	$69	$6,900
	12 Inch Main Line	100	LF	$82	$8,200
	Piping, Fittings, Valves, Meters, Etc.	1	each	$45,000	$45,000
	Reconfigure Well	1	each	$95,000	$95,000
	Electrical	1	each	$75,000	$75,000
	Telemetry/Control/Monitoring	1	each	$35,000	$35,000
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$66,275
				Total	$331,375

Project Number	Project Name				
16	**Construct VFD Booster Pumps from Zone 10 to Zone 11NE (Transmission Line as a Possible Alternate)**				
	Item Description	Quantity	Unit	Unit Price	Amount
	10 Inch Main Line	200	LF	$69	$13,800
	Piping, Fittings, Valves, Meters, Etc.	1	each	$50,000	$50,000
	Booster Pumps	2	each	$50,000	$100,000
	Building	1	each	$150,000	$150,000
	Electrical	1	each	$150,000	$150,000
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	1	each	$65,000	$65,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	0.5	Acres	$7,500	$3,750
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$153,138
				Total	$765,688
17	**Construct VFD Booster Pumps from Zone 11E to Zone 12E near Ahlin Pond (Transmission Line as a Possible Alternate)**				
	Item Description	Quantity	Unit	Unit Price	Amount
	10 Inch Main Line	100	LF	$69	$6,900
	Piping, Fittings, Valves, Meters, Etc.	1	each	$50,000	$50,000
	Booster Pumps	2	each	$50,000	$100,000
	Building	1	each	$150,000	$150,000
	Electrical	1	each	$150,000	$150,000
	Emergency Generator	1	each	$65,000	$65,000
	Telemetry/Control/Monitoring	1	each	$65,000	$65,000
	Land Acquisition	0.5	Acres	$30,000	$15,000
	Easement Acquisition	0.5	Acres	$7,500	$3,750
	Other Fees: Engineering, Legal, Administrative, Finance 25%				$151,413
				Total	$757,063
18	**Construct 900 South & Pole Canyon Road Parallel 8"**				
	Item Description	Quantity	Unit	Unit Price	Amount
	8 Inch Main Line	1,440	LF	$59	$84,960
	Connect to Existing 10" line	1	each	$4,500	$4,500
	Connect to Existing 6" line	1	each	$3,500	$3,500
	Asphalt Replacement	11,520	SF	$4	$46,080
	Sawcut Asphalt	5760	SF	$1	$5,760
	Other Fees: Engineering, Legal, Administrative, Finance 35%				$50,680
				Total	$195,480

Project Number	Project Name				
19	**Incremental Pipe Costs**				
	Item Description			Unit Price	Amount
	Incremental Costs from 8" to 10"			$9	$225,238
	Incremental Costs from 8" to 12"			$23	$153,537
	Incremental Costs from 8" to 14"			$41	$55,830
	Incremental Costs from 8" to 16"			$63	$194,141
	Other Fees: Engineering, Legal, Administrative, Finance 25%				
				Total	$628,745
				Total Estimated Project Costs:	$20,416,258

Table H-2: Culinary Water Unit Prices Used for Estimated Pipe Installation and Oversizing Reimbursement

Item	Unit	Unit Price
8" Water main	L.F.	$20.00
10" Water main	L.F.	$25.00
12" Water main	L.F.	$30.00
14" Water main	L.F.	$40.00
16" Water main	L.F.	$50.00
20" Water main	L.F.	$80.00
24" Water main	L.F.	$120.00
8" Gate valve	EA.	$1,500.00
10" Gate valve	EA.	$2,500.00
12" Butterfly valve	EA.	$3,000.00
14" Butterfly valve	EA.	$4,000.00
16" Butterfly valve	EA.	$5,000.00
20" Butterfly valve	EA.	$8,000.00
24" Butterfly valve	EA.	$12,000.00
8" Bend/Reducer	EA.	$500.00
10" Bend/Reducer	EA.	$650.00
12" Bend/Reducer	EA.	$800.00
14" Bend/Reducer	EA.	$1,000.00
16" Bend/Reducer	EA.	$1,200.00
20" Bend/Reducer	EA.	$2,000.00
24" Bend/Reducer	EA.	$2,500.00
8" Cross	EA.	$1,200.00
10" Cross	EA.	$1,500.00
12" Cross	EA.	$1,800.00
14" Cross	EA.	$2,200.00
16" Cross	EA.	$2,700.00
20" Cross	EA.	$3,500.00
24" Cross	EA.	$4,500.00
Culinary line bedding material	L.F.	$2.00
Culinary line backfill material	L.F.	$15.86

Table H-3: Sample of Detailed Culinary Water Pipe Costs Used for Estimated Pipe Installation and Oversizing Reimbursement

Item	Unit	Quantity	Unit Price	Cost
12" Water main	L.F.	10,000	$30.00	$300,000
10" Gate valve	EA.	50	$2,500.00	$125,000
12" Butterfly valve	EA.	20	$3,000.00	$60,000
12" Bend/Reducer	EA.	60	$800.00	$48,000
12" Cross	EA.	25	$1,800.00	$45,000
Culinary line bedding material	L.F.	10,000	$2.00	$20,020
Culinary line backfill material	L.F.	10,000	$15.86	$158,640
Incidentals	%	30%		$68,099
			SUBTOTAL (per 10,000 ft of length):	**$824,759**
			SUBTOTAL (per 100 ft of length):	**$8,248**
			SUBTOTAL (per ft of length, rounded):	**$82**

Table H-4: Culinary Water Pipe Costs Used for Estimated Pipe Installation and Oversizing Reimbursement

Item	Unit	Unit Price
8-inch Main Line	L.F.	$59.00
10-inch Main Line	L.F.	$69.00
12-inch Main Line	L.F.	$82.00
14-inch Main Line	L.F.	$101.00
16-inch Main Line	L.F.	$122.00
20-inch Main Line	L.F.	$174.00
24-inch Main Line	L.F.	$249.00
Oversizing 8 to 10 inch Pipes	L.F.	$9.00
Oversizing 8 to 12 inch Pipes	L.F.	$23.00
Oversizing 8 to 14 inch Pipes	L.F.	$41.00
Oversizing 8 to 16 inch Pipes	L.F.	$63.00
Oversizing 8 to 20 inch Pipes	L.F.	$115.00
Oversizing 8 to 24 inch Pipes	L.F.	$189.00