Springville City

Culinary Water Master Plan

2013 Update

DRAFT

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Executive Summary

Summary of System

Table 1 – Summary of Key System Calculations

	Existing	10-yr w/ PI System	Build-out w/ PI System
Area (acres)	Current City Boundary	Current City Boundary	Master Plan Study Area
Gross Area	9,220	9,220	10,088
Irrigable area	1,686	1,419	1,392
Connections (ERCs)			
Residential	9,112	12,800	20,430
Non-residential	1,537	2,481	5,349
Large User	1,460	1,460	1,460
Total	12,109	16,741	27,239
Source Requirements			
Peak Day (gpm)			
Indoor	6,727	9,301	15,133
Outdoor	6,676	5,618	5,513
TOTAL	13,404	14,919	20,646
Existing City Source (gpm)	13,586	13,586	13,586
Surplus / (Deficit)	182	(1,333)	(7,060)
Average Yearly (ac-ft)			
Indoor	5,449	7,534	12,258
Outdoor	3,153	2,653	2,603
TOTAL	8,602	10,187	14,861
Existing City Source (ac-ft)	18,569	18,569	18,569
Surplus / (Deficit)	9,967	8,382	3,707
Storage Requirements (gal)			
Equalization			
Indoor	4,843,667	6,696,544	10,895,776
Outdoor	4,801,537	4,040,380	3,964,964
TOTAL	9,645,204	10,736,924	14,860,740
Fire Suppression	720,000	720,000	720,000
Emergency	1,000,000	1,000,000	1,000,000
TOTAL	11,365,204	12,456,924	16,580,740
Existing City Storage (gal)	12,650,000	12,650,000	12,650,000
Surplus / (Deficit)	1,284,796	193,076	(3,930,740)
Population			
Planning Department	31,416	41,093	58,004
Water Model	31,084	42,931	67,436

As can be seen in Table 1, while the number of connections (ERCs) is anticipated to rise in the future following the population forecasts discussed later in this report, the amount of irrigable area served by the drinking water system is anticipated to decrease. This is due to the City's previous decision to construct a partial secondary water(pressurized irrigation) system to satisfy outdoor watering needs for the west fields area of the City. Construction of this system will both reduce the amount of storage and source required for the future drinking water system, and will delay construction of drinking water capital facilities.

Chapter 1 – Introduction

Preface

A water system represents a major capital investment for a community. As development and growth continues in Springville, it is important to periodically review and update the master plan in order to adequately plan for expansion of the system as well as identify problem areas.

Purpose

The purpose of this plan is to provide Springville City with a summary of necessary capital improvements to meet Springville City's existing and future water distribution system needs. This master plan addresses future water system infrastructure needs in general and provides planning direction to the City as growth and development occur. The recommendations herein are based on conclusions that were reached using growth projections and computer modeling of the City's existing and future water system. The time frame for these improvements extends from the present time to build out, which is expected to occur within approximately 30 years (approximately year 2040).

Background

The most recent previously-adopted water system master plan was prepared by Hansen Allen & Luce (HAL) and adopted in May, 2006. The primary purpose of the analysis performed for that plan was to develop an integrated drinking water system and secondary water system study/master plan. That study was to evaluate and help the City determine which of the following options would be most beneficial to the City:

- No secondary water system (i.e. indoor and outdoor demand would be met through the drinking water system).
- A partial secondary water system (i.e. the secondary water system would be developed primarily in the largely undeveloped "West Fields" including both current areas within the City boundaries and areas that could potentially be annexed into the City). Under this alternative both indoor and outdoor demands would be met by the drinking water system in the mostly developed portions of the City. In the developing areas of the City, a secondary water system would be constructed that would meet outdoor demands. The drinking water system in these areas would be sized to meet indoor demands only.
- A city-wide secondary water system (i.e. indoor demands would be met with the drinking water system, and outdoor demands would be met with a City-wide secondary water system).

It was determined in that study that a partial secondary water (i.e. pressurized irrigation) system was the preferred option. Since that time the City has been working toward implementing a secondary water system in the West Fields area of the City. (The West Fields area is a large portion of Springville City that is mostly undeveloped, which will allow a significant portion of the secondary system to be installed as development occurs. For the purposes of this master plan the West Fields area includes the area in the City's Annexation Declaration Boundary that is west of approximately 400 West. The

pressure irrigation boundary shown on the **Master Plan Study Area map** in the Appendix defines the West Fields area as used in this report.)

Most of the projects identified in the previous capital facilities plan have been completed. This report will independently analyze and review the culinary water system and identify projects necessary to improve the system and plan for future growth. We will also provide other information that will be necessary calculate a new impact fee. The impact fee analysis will be completed separately by others.

Scope

The scope of the work performed in updating the water system master plan included the following:

- Update of the City's GIS database with more accurate field collection and historical knowledge data of the existing system.
- Update of the City's water system model to reflect new development.
- Review of water meter billing records to identify existing water system demands.
- Update of calculations of water system demands.
- Analysis of the computer model to determine existing deficiencies and future needs in the water distribution system.
- Development and evaluation of alternative solutions to correct existing deficiencies and future needs
- Preparation of a capital improvements plan to help the City implement the identified solutions to existing deficiencies and future needs, including creation of the 10-yr Impact Fee Facilities Plan (IFFP) for the purpose of determining impact fees.

Periodic Updates

This document is a working document. Some of the recommended improvements identified in this report are based on the assumption that development and/or potential annexation will occur in a certain manner. If future growth or development patterns change significantly from those presumed and documented in this report, the recommendations may need to be revised. The status of development should be reviewed at least every five years. This report and the associated recommendations should also be updated every five years.

Chapter 2 – Basis of Analysis and Level of Service

Division of Drinking Water Minimum Sizing Requirements

In the Utah Division of Drinking Water System Minimum Sizing Requirements (Section R309-510-5 of the Utah State Code) it states that "If acceptable data are presented…showing that the requirements made herein are excessive for a given project, the requirements may be appropriately reduced… on a case by case basis by the Executive Secretary." After reviewing the available water use records, it was determined that water use in the City's drinking water system closely matches the State's requirements and no reduction of requirements could be justified. For this reason, the minimum sizing requirements set forth in section R309-510 of the Utah State Code were used in this planning effort.

Both present and future needs were evaluated in this master plan. Present water needs were calculated according to Utah Division of Drinking Water (DDW) requirements and compared with actual water use records obtained from billing record data. Future water needs were estimated by identifying locations where development is expected and adding the incremental increase in water demand associated with the development to the current demand. The City's build-out water demand was estimated by applying this process throughout the City's proposed service area.

In order to facilitate the analysis of the drinking water system, a computer model of the system was prepared and analyzed in two parts. First, the performance of existing facilities with present water demands was analyzed. Next, projected future demands were added to the drinking water system and the analysis was repeated. Recommendations for system improvement were prepared based on the results of this analysis. This report is organized to follow the outline of the DDW requirements found in section R309-510 of the Utah Administrative Code entitled "Minimum Sizing Requirements".

Key System Design Criteria

Key system design criteria used for the City's drinking water system per DDW requirements as well as local fire suppression authority requirements are listed below. These design criteria were used in evaluating system performance and recommending future water system improvements.

State DDW Requirements

- Source Capacity
  - Indoor Use
    - Peak Day Demand - Maintain 800 gpd (=0.56 gpm) per indoor ERC served
    - Average Yearly Demand - Maintain 146,000 gallons (0.45 acre-feet) per year per indoor ERC served
  - Outdoor Use
    - Peak Day Demand - Maintain 3.96 gpm of source capacity per irrigated acre where system supplies outdoor use
    - Average Yearly Demand - Maintain 1.87 acre-ft per year per irrigated acre where system supplies outdoor use

    - Source yield - Assume 80% of normal precipitation for watershed when assessing springs
- Storage Capacity
    - Indoor Use - Maintain 400 gallons of storage per indoor ERC served
    - Outdoor Use - Maintain 2,848 gallons of storage per irrigated acre where system supplies outdoor use
    - Fire Suppression Storage – Determined by Local Fire Suppression Authority (see Springville City Fire Department Requirements below)
    - Emergency Storage – Determined by the City (Springville City has elected to provide 250,000 gallons of emergency storage per tank group)
- Distribution
    - Maintain 20 psi in all areas of the system during peak instantaneous usage
    - Maintain 20 psi in all areas of the water system during maximum day usage with imposed fire flows
    - New service areas added after January 1, 2007 are required to meet the following additional requirements:
        - 30 psi during peak instantaneous demand
        - 40 psi during peak day demand

Springville Fire Department Requirements

- Maintain 1,000 gpm fire flows in residential areas
- Maintain 1,500 gpm fire flows in non-residential areas
- Provide fire suppression storage for 2 hour duration (1,500 gpm for 2 hours = 180,000 gallons per tank group)

Additional City Criteria

City staff requested more stringent targets than the Utah State Code for the analysis and planning of the drinking water system in these areas:

1. State Code states that "in assessing minimum flow rates of springs, watersheds should be assumed to have received only 80 percent of normal precipitation". City staff, however, has decided to assume the lowest average monthly flow rate on record to be the reliable flow rate from City spring sources. As will be discussed, this provides a more stringent standard than meeting State Code.
2. The desired minimum pressure in the system is 50 psi instead of 20 psi, except during fire flow when the minimum pressure is allowed to drop to 20 psi. The desired maximum pressure in the system at any time is 110 psi.
3. Minimum desired pressures in the system to be maintained without the use of wells providing pressure head.

Chapter 3 – Service Area and Population Analysis

Service Area

Located in south-central Utah County, Springville City boundaries currently encompass an area of approximately 15 square miles. Based on the City's General Plan, the projected future annexation boundary covers an area of approximately 17 square miles. In addition to the area within the City's boundaries, the City's water system also serves drinking water to four residential subdivisions and a campground up Hobble Creek Canyon that are located outside the City limits.

The City's current boundary is shown on the **Master Plan Study Area map** in the Appendix. The City plans to expand its service area in the future to include additional lands to the west as shown on the same map. Future needs have been estimated based on current land use classifications established by the City's general plan as shown on the **General Plan Land Use map** in the Appendix. It is understood that the service boundary or the proposed land use densities may change depending upon development. These factors may require periodic adjustments to this plan and the recommended culinary water capital facilities projects.

Current Population

For much of its history, Springville's population remained fairly constant with periods of moderate growth followed by moderate population decline. During the period from 1990 to 2010, however, Springville experienced rapid growth. For example, during the 1990s, Springville's average annual growth rate (AAGR) was 4.6%. According to US Census data, the population of Springville City in 2010 was 29,466 while in 2000 the population was 20,424. This marks a 44.3% increase during this period, or an AAGR of 4.4%. During the last few years, however, due to the economic downturn the growth rate has fallen off. It is estimated that the current population of the City is approximately 32,000.

Projected Growth Rate

An essential element in the development of a master plan is the projection of the City's population growth rate. The population growth rate gives the planner a glimpse of the future demands that may need to be accommodated by the City's utility systems.

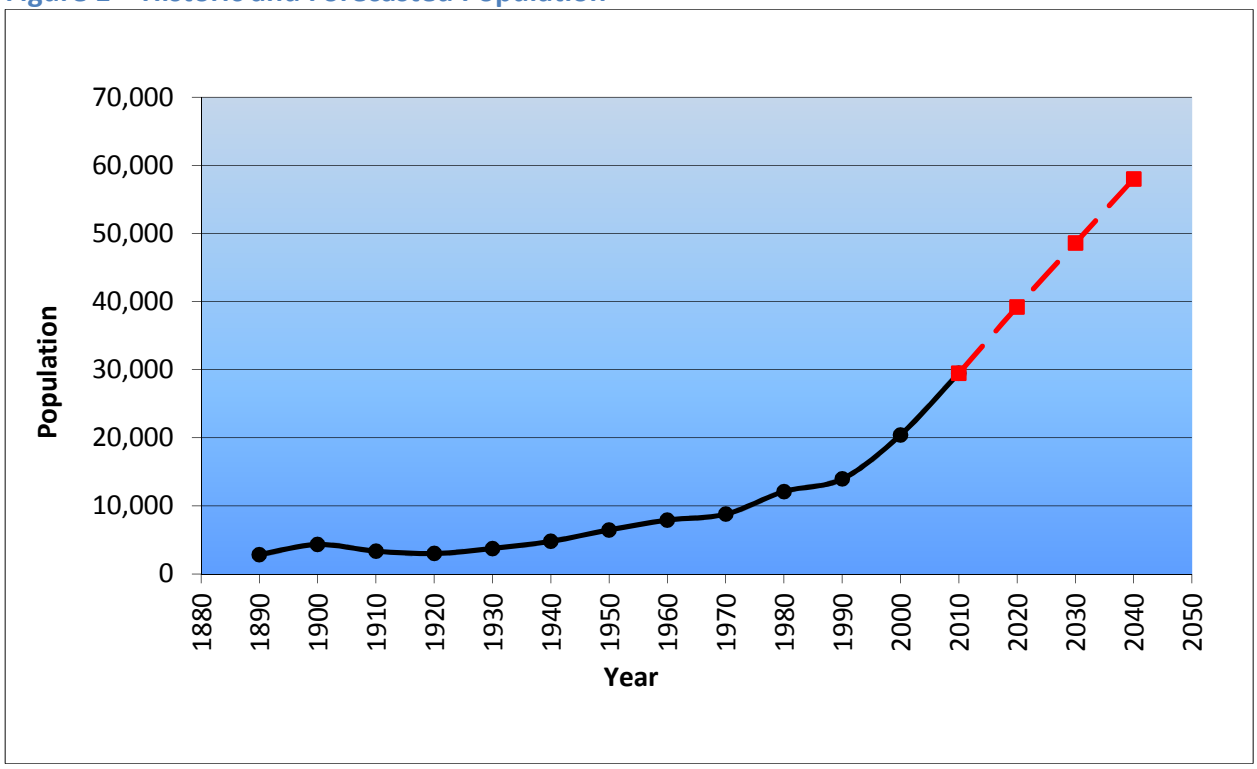
Projecting the number of future culinary water connections with any degree of accuracy can be a very subjective process, especially with the fluctuating growth trends that the City has seen in recent years. With this in mind, this plan uses several resources including Census figures, water connection data from the City's Billing Summaries, growth predictions from the City's Community Development Department and parcel data, to evaluate the growth trends and to provide a projection of how growth will occur in the future.

Table 2 and Figure 1 show the historic growth rate and provide an idea of how the community has grown based on Census counts from 1890 through 2010, and estimates from 2020 through 2040.

Table 2 – Population and Growth Rate

Year	Population	Compound AAGR (from previous decade)
1890	2849	N/A
1900	4322	4.26%
1910	3356	-2.50%
1920	3010	-1.08%
1930	3748	2.22%
1940	4796	2.50%
1950	6475	3.05%
1960	7913	2.03%
1970	8790	1.06%
1980	12101	3.25%
1990	13950	1.43%
2000	20424	3.89%
2010	29466	3.73%
2020	39214	2.90%
2030	48609	2.17%
2040	58004	1.78%

Figure 1 – Historic and Forecasted Population



It is important to remember that projections are susceptible to change based on certain unforeseeable events such as changes in the economy, or natural or human-caused catastrophes. Many factors influence these projections, and the estimates shown may vary substantially from the actual population experienced. It is also important to understand that projected population figures are not the corner stone of this master plan. If the maximum number of system connections projected is reached earlier or later than projected, then future improvements to support growth may either come earlier or later. Impact Fees should not be significantly affected if the actual rate of growth varies from the rate used in the plan.

Length of Planning Period

This culinary water master plan uses an approximate 30-year planning period since it is anticipated that build-out conditions will occur within the City in approximately 30 years (i.e. approximately year 2040). Revenue sources should be carefully evaluated each year as the City Council sets budgets and anticipates system requirements.

Chapter 4 – Culinary Water Connections and Irrigable Area

Equivalent Residential Connection (ERC)

Water use will vary from connection to connection throughout a water system. In order to avoid the complexity of analyzing each connection, a simple basic unit of water use can be defined for the purposes of comparison. This basic unit is called an Equivalent Residential Connection (ERC). An ERC quantifies the typical water use of one single family residential connection within the system. This is the most common type of connection in the City.

Once defined, an ERC can be applied to various water users within the system. Water consumption from other users can be described as having more or less impact than a typical residence by stating its use in ERC terms. Some commercial connections can have an impact on the water system of several typical residences.

Existing Connections

Existing Residential Connections

The parcel database was used to determine the number of residential parcels. The parcel database has sufficient information to identify parcels with multiple residential households. For example, a duplex was assigned two ERCs even though it may have only one physical connection. The parcel database at the end of the year 2012 indicated the City had 9,112 residential connections or **9,112 ERCs**.

Existing Non-Residential Connections

The parcel data also indicated the City had 497 non-residential connections. To convert the non-residential connections into ERCs, the winter water use of the non-residential connections were compared against the winter water use of a typical residential connection, as determined from billing data. (The winter meter readings were chosen since it was assumed that no outside usage would occur during the winter months and outdoor usage was analyzed separately on a per-parcel basis as is described below.)

The heaviest water users (hereinafter termed "large users") were analyzed individually. In this way ERC multipliers were determined for the non-residential connections. These ERC multipliers are shown in in Table 12 in the Appendix. Using these factors, at the end of the year 2012 it was calculated that the City had **1,537 non-residential ERCs**.

Existing Large Users

Large users were determined from winter usage water meter readings obtained from the City's water meter billings. When these meter readings were sorted and graphed it became apparent that around a usage of 1700 (corresponding to 1700 kgal used during this period, or approximately 10,000 gallons per day) that there was a dramatic upswing in the usage curve. It was therefore decided that any user with a reading of 1700 or more should be considered a large user. The actual water demand for each of these large users was assigned individually to the model on the parcel to which they were located. (Table 14 in the Appendix provides additional information for the large users identified.) Using this data,

it was calculated that at the end of the year 2012 the City had **1,460 ERCs from large users**.

Projected Culinary Water ERCs

The ERC concept can also be applied to undeveloped land in order to estimate the amount of water needed in areas of growth or redevelopment. Consequently, ERC's have been applied to the undeveloped areas within the City's planned future service area boundaries and ERC values have been estimated for all the undeveloped land uses.

The nonresidential water uses will vary greatly and can be difficult to estimate. Therefore we have had to make several assumptions in order to estimate the ERC values in these areas; these assumptions are described below. It should be remembered, however, that land use and zoning may change over time. As changes take place the ERC values may need updating. Our recommendation is that this should be reviewed about every five years.

Future Residential Connections

The parcel database, land use, zoning, and annexation plan information were used along with information in the City's general plan to estimate the future potential residential connections at build-out. The area of undeveloped residential zoned parcels and residential parcels with potential to be redeveloped before build-out were divided by the baseline units per acre provided by City Community Development personnel. Table 13 showing these densities is included in the Appendix.

Existing residential developed or subdivided parcels too small to be subdivided into three times the number of existing units according to the current zoning ordinance were left unchanged. (This accounts for a major portion of the developed areas of the City.) It was assumed that an existing home, subdivision or development would not be redeveloped just to maximize the density allowed by the zoning ordinance unless an existing structure could be razed and replaced with at least three new structures.

It was determined that some parcels based on their existing use would not redevelop, regardless of the general plan land use. These uses include cemeteries, parks, schools, and churches. For these land uses the existing number or ERCs was used for the future model. Using these calculations it is estimated that there will be **20,430 residential ERCs** at build-out within the planned culinary water service area.

Non-Residential Connections

The quantity of potential connections from non-residential zoned parcels that are undeveloped was calculated by using the ratio of acres per connection in existing non-residential areas in the City. (This ratio is approximately two.) The number of connections per developable parcel was calculated using the parcel database. The minimum parcel size was 4,000 square feet and a number of connections less than 1 was rounded up to 1. Using the parcel database and the above criteria, the total number of potential future connections at build-out was calculated. It is estimated that there will be **5,349 non-residential ERCs** at build-out within the planned culinary water service area.

Future Large User Connections

It was assumed that all existing large users on the system would continue to exist and have the same water demand in the future. While it is probable that additional large users may contribute to the system at build-out, it is impossible to forecast the magnitude or locations of these future large users. Therefore, no additional large users were assumed and we estimated **1,460 ERCs from large users** at build-out.

A Summary of existing and future connections is shown in Table 3.

Irrigable Area

Existing Irrigable Area

The number of acres of land the water system irrigates is required to calculate outdoor water use based on State of Utah sizing requirements. Unlike determining the number of connections a water system serves, it is not necessary to calculate an equivalent unit for irrigated area. The existing land use data in the parcel database was used to estimate the total irrigated area in the City. Based on the land use type, a percentage of the parcel's land was considered irrigable. Table 12 showing these percentages is included in the appendix. The total estimate of land irrigated by the City's existing water system is **1,686 acres.**

Future Irrigable Area

The same method for calculating the existing irrigated acreage was used to calculate the future potential irrigated acreage. Using the parcel data, 30 percent of the acreage of future developable parcels was subtracted to account for transportation infrastructure. The remaining acreage was multiplied by the assumed percentage of land that is irrigable based on the general plan zoning. Table 13 showing these percentages is included in the appendix. The total estimate of irrigable land within the City's planned service boundary is 2,832 acres. However, as was previously stated, the City is planning on operating a pressurized irrigation or secondary water system to handle the outdoor irrigation needs for the West Fields area of the City. Therefore, only **1,392 acres** of irrigable land will be served by the future build-out water system.

A Summary of existing and future irrigable area is shown in Table 3

Table 3 – Existing and Future Connections and Irrigable Area

	Existing	Build-out w/ PI System
Area (acres)	Current City Boundary	Master Plan Study Area
Gross Area	9,220	10,088
Irrigable area	1,686	1,392
Connections (ERCs)		
Residential	9,112	20,430
Non-residential	1,537	5,349
Large User	1,460	1,460
Total	12,109	27,239

Chapter 5 – Water Rights Analysis

Existing Water Rights

Springville City currently owns a number of water rights that are designated for municipal use which are tied to the City's water sources. Table 4 and Table 5 present summaries of the current municipal, irrigation, and stock water rights held by the City. The City also owns water shares through irrigation companies. These water shares are listed and quantified in Table 6.

Table 4 – Municipal Water Rights

Water Right Number	Flow (cfs)	Volume (ac-ft)	Notes
51-1111 (a26443) also includes 51-6666, 51-6990, 51-7242	0.4405	102.9	City Wells
51-1455 (a28365) also includes 51-1486, 51-1493	11.000	Undetermined 7,963.636*	City Wells
51-2530 (a29656) also includes 51-3679	6.022	144.28	City Wells
51-2780 (a28366)	3.000	439.03	City Wells
51-5224	8.000	Unevaluated 2,038.24**	Hobble Creek (used for City's Plat A irrigation system)
51-5328	1.000	723.967*	Jurg Springs
51-5329	5.500	Unevaluated 3,982.00* 2,069***	Burt Springs
51-5330	0.400	289.587*	Konold Springs
51-5520 #	4.000	1,068 #	Bartholomew Springs
51-6027 same water as 51-1028 (power generation)	5.500	Unevaluated 3,982.00* 1,947***	Spring Creek Canyon Springs
51-6970 (a28367) also includes 51-1024, 51-1025, 51-1088	3.280	1,745.78	City Wells
51-7463 (a24494)	unevaluated	37.2	Little Spring Creek (for use in pressurized irrigation system)
	Total:	**18,568.62**	Using 10-yr average spring flows

* Potential volume if sources are able to produce designated flow rate year round. Actual volume may be limited by either source capacity (i.e., a spring may not be able to produce the designated flow rate year round) or by demand.

** W.U.C. indicates that 8 cfs is diverted 24 hours for 5 days out of each 8-1/3 days from April 1 to October 31. This would equal 128.45 days with an estimated volume of 2,038.24 ac-ft.

*** 10-year average yield of the spring from 1999-2009

Springville Irrigation Company water right used by Springville City based on City ownership of 267 shares. Each share equals 4 ac-ft resulting in an annual volume of 1,068 ac-ft.

Table 5 – Irrigation and Stock Water Rights

Water Right Number	Flow (cfs)	Volume (ac-ft)	Notes
51-1001	0.243	40.45*	Cedar, Kolob & Mud Springs
51-1322+	4.57	Unevaluated Underground Water Drain	Underground water drain
51-1401	3.29	39.24	Underground water
51-3775	0.015	Unevaluated <10	Underground well
51-4255	0.045	8.55*	Unnamed spring stream
51-5230	6.0	20	Roundy Springs
51-5450	2.97	13.796*	Little Spring Creek
51-5454	0.5	33.56*	Right Fork Little Spring Creek
51-5457	0.5	20.0*	Right Fork Little Spring Creek
51-6025	6.5	498.52**	Hobble Creek / Highline Ditch
51-6212	7.0	6.08*	Spring Creek, Canyon Creek
51-6219	7.0	114.678*	Spring Creek, Canyon Creek
	Total:	**804.87**	Does not include 51-1322, assumes 10 ac-ft for 51-3775, & maximum volume for 51-6025

* Calculated based on a duty application of 4 ac-ft/irrigated acre, 0.45 ac-ft/family, and 0.028 ac-ft/animal unit

** This is the maximum possible volume calculated based on irrigation of 122.53 acres and stockwatering of 300 ELUs. However, this right is supplemented with an unspecified quantity of Strawberry water which may reduce the volume of the right.

+ Change application a28531 has been submitted to the State Engineer, requesting to change the point of diversion to City Wells, as well as to change the use to municipal from irrigation. The State Engineer has not yet acted upon this application. This right is part of 20 different supplemental groups and no sole supply has been evaluated at this time. It is believed that the sole supply for this right may be small.

Table 6 – Irrigation Company Shares Owned by Springville City

Irrigation Company	Water Allocated (acre-feet/share)	Shares Owned by Springville City	Water Allotment (acre-feet/year)
Springville Irrigation	4.00	1430.56*	5722.23
Mill Pond	4.37	147.58	644.92
Wood Springs	4.0	118.00	472.00
Big Hollow	6.17	12.00	74.02
Matson Springs	4.00	17.00	68.00
East Bench Canal	4.00	22.00	88.00
Coffman Springs	4.00	11.64	46.56
East Jordan	4.00	10.00	40.00
Mapleton Irrigation	4.00	0.38	1.52
Wash Creek	4.00	5.00	20.00
		Total:	**7,177.25**

* Total number of shares owned by Springville City, as provided in a summary from the City dated September, 2004, in the Springville Irrigation Company is 1465.88 shares. However, Springville Irrigation Company assumes that 267 shares are tied to the water right (WR 51-5520) used by Springville City for Bartholomew Springs. This has already been included in Table 4.

Based on this information, the City currently holds more than 26,550 acre-feet of water rights that are used or may be used in the future in either the drinking water system or the pressurized irrigation system. However, only 18,568.62 acre-feet are currently designated for municipal use. Some of the irrigation rights have "unevaluated" water right volumes. Water right 51-1322 is part of twenty supplemental groups and sole supply has not yet been determined. It is believed that the actual volume of this right may be small. Water right 51-3775 is believed to have less than ten acre-feet. Water right 51-6025 is for irrigation of 122.53 acres and stock watering of 300 livestock units. However, this right is supplemented with an unspecified quantity of Strawberry water which may reduce the volume of the right available for municipal use.

Existing Required Water Right

State DDW requirements state that a community should have adequate water right to supply each ERC served with 0.45 acre-feet per year for indoor water use, plus 1.87 acre-feet per year per irrigated acre. Based on 12,109 total ERCs and 1,686 irrigable acres, the total required is:

[12,109 ERCs * (0.45 af / ERC)] + [1,686 ac * (1.87 af/ac)] = **8,602 acre-feet required**

Based solely on this requirement, the City has sufficient water rights for the existing system.

Projected Required Water Right at Build-out (2040)

The projected required water right at the end of the planning period is calculated by using the same factors, but the projected number of culinary water ERCs and irrigated acres are substituted in the calculations.

[27,239 ERCs * (0.45 af / ERC)] + [1,392 ac * (1.87 af/ac)] = **14,861 acre-feet required**

Based solely on this requirement, it appears that the City has sufficient water rights for the future culinary water system. **It should be remembered, however, that additional water rights will be required to supply the outdoor demand needs supplied by the <u>pressure irrigation system</u> which are <u>not accounted for here</u>.**

Future Water Rights

The City requires that water rights be turned over to the City as a condition of issuing a building permit on an undeveloped parcel of land (see Springville City Code 11-3-307 and 11-6-124 included in the Appendix). This is to help ensure that the City acquires sufficient water rights to meet the water needs of its residents. City code requires building permit applicants to transfer one equivalent share of Springville Irrigation Company water for each acre applicable to the building permit.

Water Rights Recommendations

- The City should continue its plans to construct a pressure irrigation system. Although the pressure irrigation system will also require water rights, irrigation water rights do not require a change of use from surface to ground water with associated "haircuts."
- The City should continue to monitor and perfect water rights and shares as land in the City is developed.
- Redundancy should be incorporated into the water system so that the system is able to meet all of the demand objectives at build-out with a major source unavailable.
- Water conservation is a reasonable way to reduce the overall required water right as it would reduce the required culinary water rights per ERC. The City has already implemented a water user rate structure with overage steps to encourage conservation.
- The City should consider adopting a Time of Day Watering Ordinance which limits landscape irrigation in most cases between the hours of 10:00 P.M. and 8:00 A.M in order to increase irrigation efficiency. The City should also consider implementing landscape requirements that will reduce irrigation demands and reduce the overall usage. These efforts will allow the City to

serve more people with the same amount of water rights in future years.

- The amount of water rights required should be reviewed periodically to account for possible decrease in average water usage due to water conservation.
- The City has the capability to use water from some individual sources in excess of the water rights tied to those sources. The City should consider changing the points of diversion of other water rights to these sources where this capability exists.
- The City should consider adding the City wells as additional points of diversion to many of its water rights that are presently tied only to springs. Thus, during drought conditions, the City can draw more heavily on the City wells without exceeding the water rights tied to the wells.
- In general, it is recommended that all water rights be reviewed every five year

Chapter 6 – Water Source Capacity Analysis

Existing Source Capacity

The City currently receives drinking water from four springs and six wells. The springs are located east of the City in Hobble Creek Canyon and Spring Creek Canyon, while the wells are located within City limits. In addition to groundwater supplied by the springs and wells, water for outdoor uses is provided in several areas through irrigation shares via flood irrigation.

The Utah Division of Drinking Water recommends that spring flows be rated at the low flow during an 80 percent of average precipitation year. An 80 percent of average precipitation year produces a lowest monthly average flow of 15,244 gpm. It was decided by City staff, however, that the City should be conservative and instead plan for the worst case scenario. The summer of 2003 had the lowest spring flow averages on record with the water sources producing a lowest monthly average of 10,768 gpm and total year demand of 9,852 acre-feet.

Since that time (2003), the production capacity of the 400 South Well was increased from 1,500 gpm to 3,000 gpm, and the City completed drilling a new well on Canyon Road equipped to pump 2,000 gpm with an average flow of 1,500 gpm. These additions bring the lowest monthly average flow to 13,586 gpm. Table 7 summarizes the City's existing water sources and capacities.

Table 7 – Existing Water Source Capacities

Source	Average Flow (gpm)	80% Precipitation Year Average Flow (gpm)	Summer 2003 Lowest Monthly Average (gpm)	Total Year 2003 Demand (ac-ft)
Bartholomew Springs	2,063	1,204	448	1,663
Burt Springs	2,400	1,346	766	1,892
Konold Springs	188	188	188	361
Spring Creek Canyon Springs	1,659	1,086	764	1,314
200 North Well	3,000	3,000	3,000	545
400 South Well	3,000	3,000	3,000 *	886
900 South Well	3,000	3,000	3,000	2,823
1000 South Well	570	570	570	174
Canyon Road Well	1,500	1,500	1,500 **	0 **
Evergreen Well	350	350	350	194
TOTAL	**17,730**	**15,244**	**13,586**	**9,852**

* Production capacity of the 400 South Well was increased to 3,000 gpm in 2005
** Canyon Road Well was first placed into service for the 2008 water season

Existing Required Water Source Capacity

State DDW requirements state that a community should have an adequate water source capacity to supply a peak day demand. Peak day demand is the anticipated water demand on the day of highest water use. The peak day requirements have an indoor use component and an outdoor use component.

Existing Indoor Peak Day Demand

The indoor peak day requirement is 800 gallons per day (gpd) per ERC. Currently the City has 12,109 total ERCs. Therefore the total indoor peak day demand is:

[12,109 ERCs * (800 gpd per ERC)] /(1440 gpm per gpd) = **6,727 gpm**

Existing Outdoor Peak Day Demand

The outdoor requirement is based on irrigated acres and irrigated crop consumptive use. As described previously, the total estimated irrigated area by the existing system is 1,686 acres. The peak day use for the Springville area for calculation of the peak day demand is 3.96 gpm per irrigated acre. Therefore, the current outdoor peak day demand is:

1,686 acres * 3.96 gpm per acre = **6,676 gpm**

Existing Total Peak Day Demand

Adding the indoor and outdoor peak day demands gives a total peak day demand average flow:

6,727 gpm + 6,676 gpm = **13,404 gpm**

Existing Surplus or Deficit

The existing source capacity surplus or deficit is determined by subtracting the existing required source capacity from the total available source capacity, as follows:

13,586 gpm - 13,404 gpm = **182 gpm**

EXISTING SURPLUS = 182 gpm

Projected Required Water Source Capacity

Projected required water source capacity at the end of the planning period (build-out) is determined from the same information and calculations explained for the existing scenario, except the projected number of culinary water ERCs and irrigable area are substituted in the calculations.

Projected Total Peak Day Demand (build-out, year 2040) = **20,646 gpm**

The projected source capacity surplus or deficit is determined by subtracting the projected total peak day demand from the total available source capacity, as follows:

13,586 gpm – 20,646 gpm = **(7,060) gpm**

PROJECTED SHORTAGE = 7,060 gpm

Table 8 – Source Capacity Summary

Source Requirements	Existing	Build-out w/ PI System
Peak Day (gpm)		
Indoor	6,727	15,133
Outdoor	6,676	5,513
TOTAL	13,404	20,646
Existing City Source (gpm)	13,586	13,586
Surplus or (Deficit)	182	(7,060)
Average Yearly (ac-ft)		
Indoor	5,449	12,258
Outdoor	3,153	2,603
TOTAL	8,602	14,861
Existing City Water Rights (ac-ft)	18,569	18,569
Surplus or (Deficit)	9,967	3,707

Water Source Recommendations

- As can be seen, during drought conditions such as those experienced during 2003 and again in 2013, the City has only a very slight surplus in water source capacity. It is therefore critical that all wells be maintained and stay operational during these times in order to meet peak demands when spring sources run at diminished levels.
- Additional water sources need to be developed in order to meet projected growth both at build-out and within the short-term planning windows. The City should begin looking for appropriate well sites immediately and continue to develop groundwater for the drinking water system.
- It is recommended that the groundwater wells be located as close as possible to storage tanks in order to minimize pumping costs and so that the wells pump to a storage tank instead of directly into the distribution system.
- Based on an assumed source yield of 2500-3000 gpm for each new well, the City will need to drill three new groundwater wells or increase capacity in the existing wells. Suggested locations for new wells are near the 200 North, 400 South and 900 South wells. If wells in these locations are unable to produce this flow, additional wells would be necessary and the costs would increase.

Costs for the additional water sources are included in the list of future projects in the Appendix.

Chapter 7 – Water Storage Capacity Analysis

Existing Water Storage Volume

The City's total culinary water storage capacity is identified in Table 9:

Table 9 – Existing Water Storage

Tank	Volume (Gallons)	Volume (MG)
Bartholomew Tank	1,400,000	1.4
Upper Spring Creek Tank	2,000,000	2
Hobble Creek 1 Tank	2,000,000	2
Hobble Creek 2 Tank	2,000,000	2
Lower Spring Creek 1 Tank	1,000,000	1
Lower Spring Creek 2 Tank	2,000,000	2
Rotary Tank	2,000,000	2
Jurg Springs Tank	250,000	0.25
TOTAL	**12,650,000**	**12.65**

Tank Groups

While the total volume of existing storage is 12.65 MG (as shown in Table 9), this total storage is not available to all areas of the system. Instead, based on the configuration of the system (tank location, water sources, pressure zones, pipe network, etc.) the storage should instead be viewed in terms of "tank groups." Each group serves a different area of the City. The tanks in each group are in the same location except for the Bartholomew, Rotary Tanks and Jurg Springs tanks which are all located up Hobble Creek Canyon and together serve that area. There are four existing tank groups as shown in Table 10.

Table 10 – Tank Groups

Tank Group	Tank	Volume	Fire	Emergency
Canyon	Bartholomew Tank	1,400,000	180,000	250,000
	Rotary Tank	2,000,000		
	Jurg Springs Tank	250,000		
Upper Spring Creek	Upper Spring Creek Tank	2,000,000	180,000	250,000
Hobble Creek	Hobble Creek 1 Tank	2,000,000	180,000	250,000
	Hobble Creek 2 Tank	2,000,000		
Lower Spring Creek	Lower Spring Creek 1 Tank	1,000,000	180,000	250,000
	Lower Spring Creek 2 Tank	2,000,000		
TOTAL (gallons)		**12,650,000**	**720,000**	**1,000,000**

Existing Required Water Storage Capacity

According to DDW standards, storage tanks must be able to provide:

- Equalization storage volume to make up the difference between the peak day flow rate and the peak instantaneous demand
- Fire suppression storage volume to supply water for firefighting
- Emergency storage, if deemed necessary by the City

Existing storage requirements for the City's water system are addressed within the following sections.

Equalization Storage

The need for equalization storage is usually highest on days of peak water use. Equalization storage is used to meet peak demands during the time when demand exceeds the capacity of the sources. Equalization storage requirements have been calculated according to DDW minimum sizing requirements outlined by Utah Administrative Code R309-510-8. DDW requires 400 gallons per ERC for indoor equalization storage plus 2,848 gallons per irrigated acre for outdoor use storage.

(12,109 ERCs * 400 gal/ERC) +(1,686 acres * 2,848 gal/acre) = **9,645,204 gal**

Fire Suppression Storage

Fire suppression storage is required for water systems that provide water for firefighting. Storage requirements for fire protection vary from community to community. In general, fire flow requirements are set by the local Fire Chief or are based on building size, and type of construction. The statewide minimum fire flow for one and two family dwellings under 3,600 square feet is 1,000 gpm; fire flows of 1,500 gpm or greater are required for all other buildings.

The water system should be managed so that storage volume associated with fire flow is available to fulfill fire flow requirements whenever or wherever it is needed. It is recommended that the minimum fire suppression storage be available at any point in the system at all times. This can be accomplished by designating minimum storage tank water levels that will provide reserve storage to meet a fire flow demand. Typical daily water fluctuations in the tanks should not be allowed below the minimum established levels except during fire or emergency situations.

The City's Fire Chief has indicated that for storage planning purposes the required fire flow should be **1,500 gpm for a duration of 2 hours.**

Because one tank cannot provide fire flow for every area of the City, the appropriate fire suppression storage volume should be available in each of the four tank groups.

(1,500 gpm) * (2 hours) * (60 min/hour) = 180,000 gal * (4 tank groups) = **720,000 gal**

Emergency Storage

DDW standards suggest that emergency storage be considered in the sizing of storage facilities. Emergency storage is intended to provide a safety factor that can be used in the case of unexpectedly high demands, pipeline failures, equipment failures, electrical power outages, water supply

contamination, or natural disasters. Springville City has elected to provide **250,000 gallons of emergency storage** in each of the four tank groups.

250,000 gal * (4 tank groups) = **1,000,000 gal**

Existing Surplus or Deficit

The existing source storage capacity surplus or deficit is determined by subtracting the existing required storage capacity from the total available storage capacity, as follows:

12,650,000 gal - (9,645,204 gal + 720,000 gal + 1,000,000 gal) = 1,284,796 gal = **1.28 MG**

EXISTING SURPLUS = 1.28 MG

Projected Required Water Storage Capacity

Projected required culinary water storage capacity at the end of the planning period is determined from the same factors explained for existing storage above, except the projected number of culinary water ERCs and irrigable area are substituted in the calculations.

Total Projected Required Storage (year 2040) = 16,580,740 gal = **16.58 MG**

The projected source capacity surplus or deficit is determined by subtracting the projected required water storage capacity from the total available water storage capacity, as follows:

12.65 MG - (16.58 MG) = **(3.93)**

PROJECTED SHORTAGE = 3.93 MG

Table 11 – Storage Summary

Storage Requirements (gal)	Existing	Build-out w/ PI System
Equalization		
Indoor	4,843,667	10,895,776
Outdoor	4,801,537	3,964,964
TOTAL	9,645,204	14,860,740
Fire Suppression	720,000	720,000
Emergency	1,000,000	1,000,000
TOTAL	11,365,204	16,580,740
Existing City Storage (gal)	12,650,000	12,650,000
Surplus or (Deficit)	1,284,796	(3,930,740)

Regulatory Considerations

Proposed regulations regarding disinfection could indirectly affect the amount of required water storage facilities. The Safe Drinking Water Act of 1987 requires water produced from wells to be disinfected at the source. This provision of the Act has not yet been implemented, but could be in the future. The Utah Division of Drinking Water staff has indicated that water systems which are consistently meeting disinfection requirements may be granted an exemption from the mandatory disinfection requirement.

If the City is required to disinfect water at each source in the future, the number and location of storage facilities and/or pipe line routing for the water system would be impacted. For water to be effectively disinfected by chlorination, chlorine should be introduced into the water for some time period before it is consumed. This time period between the introduction of the chlorine and water use is referred to as the contact time. While the amount of contact time that would be required of the City can be calculated, historically a contact time of at least 30 minutes or greater has been required. How the mandatory disinfection requirement will be applied to groundwater is not yet clear, but achieving the required contact time with City wells that pump directly into the water distribution system is unlikely.

It may be necessary to route the piping from the wells directly to the storage tanks. Chlorine would be introduced to the water before it is pumped into the reservoir and the average storage time in the reservoir would provide the required contact time. We recommend that the City periodically contact Division of Drinking Water staff to get the most updated information about this potential impact to the system.

Storage Location Considerations

Another issue that impacts the effectiveness of the storage tanks is the location of the tanks from the wells and the location of the tanks from where the water is demanded. Much of the storage is located east of the City whereas most of the wells and the demands are located west in the valley. The distance, elevation differences and small pipe sizes between the wells and the higher tanks make it inefficient to convey the water from some of the wells to the tanks. Furthermore, during periods of peak demand, the same transmission lines may not be adequate to convey the water from the tanks down to the demand in the City. This may make some of the storage ineffective because it cannot get to where it is needed.

Water Storage Recommendations

As has been demonstrated, the City will need additional storage for the build-out future system. The City should begin looking for suitable storage sites and obtain the needed property.

- We recommend that a 3 MG to 4 MG tank should be constructed near the location of the existing Lower Spring Creek Tanks (approx. 400 S and 2000 E).
- We also recommend that an additional tank of at least 1.5 MG be constructed at approximately 400 N 1100 E. This tank could be fed directly by the 200 North well with a new transmission line from the well to the tank. A larger tank at this site, however, would give the City additional future storage capacity and could be filled by other sources. (A new transmission line in 400

North from the new tank to the West Fields is discussed in the future distribution system recommendations section.)

- We recommend that the minimum fire suppression storage be available for fire or emergency situations at any location in the system at all times by not allowing the volume designated for fire suppression to be used during typical daily water fluctuations in the tanks. This can be controlled via SCADA.
- It is recommended that the City periodically contact Division of Drinking Water staff to get the most updated information about regulations regarding contact time of disinfected water produced from wells.

Costs for the proposed storage facilities are included in the list of future projects in the Appendix.

Chapter 8 – Water Distribution System Analysis

Computer Model

A computer model of the City's water distribution system was developed to analyze the performance of the existing and future distribution systems and to prepare solutions for existing facilities not meeting the system requirements. The software used for the model was InfoWater by Innovyze. InfoWater is a GIS-based computer program that models the hydraulic behavior of piping networks. The pipe, tank, well and valve data used to develop the model were obtained from the previous models prepared by HAL in 2006 and other updated information supplied by the City.

Computer Model Scenarios

Computer model scenarios were developed for several phases of water system development. These are further described below:

1. Existing System – The first scenario was the development of a model of the existing system. This model was used to identify deficiencies in the existing system.
2. Existing Corrected System – The second scenario was developed to identify corrections necessary to improve existing system deficiencies.
3. Build-out Future System – The third scenario was the development of a build-out future model to determine improvements necessary to provide sufficient water volume and pressure needed during the "build-out" condition.
4. IFFP System – The fourth scenario was the development of a model to determine demands placed on the system with development of the 10-yr IFFP area.

The future models were developed to assist in creating a plan for the distribution system for the build-out condition. This plan recommends the water line sizes that are necessary to provide an adequate flow of water at the preferred pressures. In areas of new development, the exact layout of the pipes is not known. In these areas, a simple pipe framework is shown to represent that a pipe system will be installed, to show approximate sizes and to provide a location to attach demands. It is recognized that as the City develops, the location and direction of these lines may change. If the pipe layout or land use assumptions are modified, the system analysis should be revised.

Model Components

The two basic elements of the computer model are pipes and nodes. A pipe is described by its inside diameter, overall length, minor friction loss factors, and a roughness value associated with friction head losses. A pipe can contain elbows, bends, valves, pumps, and other operational elements. Nodes are the end points of a pipe and they can be categorized as junction nodes or boundary nodes. A junction node is a point where two or more pipes meet, where a change in pipe diameter occurs, or where flow is put in or taken out of the system. A boundary node is a point where the hydraulic grade is known (i.e. a reservoir or PRV).

The computer model of the water distribution system is not an exact replica of the actual water system and it is not necessary to include all of the distribution system pipes in the model to accurately simulate

its performance. Pipeline locations used in the model are approximate and every pipeline may not be included in the model even though efforts were made to make the model as complete and accurate as possible.

Pipe Network

The existing pipe network was based upon the locations and pipe sizes shown in the City's GIS. Future pipeline locations were based on master-planned street locations as well as the previous model prepared by HAL in 2006. Pipe numbering and junction node numbering is generally arbitrary. The elevation information used by the model is based upon digital LiDAR elevation data from the City's GIS.

Pipe roughness coefficients were assigned a Hazen-Williams roughness value of 135. While some pipes may have a coefficient greater or less than this value, there was inadequate information available to determine specific values.

Water Demands

Water demands were input into the water system model from the GIS based parcels database from Utah County and a spreadsheet where the demands were calculated. Demands were calculated in the spreadsheet using data from the parcel GIS database for each parcel. Large parcels in the undeveloped West Fields area of the City were divided into smaller sub-parcels in order to better distribute demands for the future model. Water demands were then assigned to the nearest node or junction in the model located at the intersection or end of a pipeline using GIS nearest neighbor analysis functions. Demand data sets were created in the model for the appropriate demand conditions for each scenario.

Water Sources and Storage Tanks

The sources of water as viewed by the model are the storage tanks and the wells. When the wells are off, the entire water system model is fed by gravity from the storage tanks. When the wells are on, the system is fed by the wells and storage tanks. Depending on which combination of wells is on and what the system demands are, in the low demand scenarios the wells can be meeting demands and fillings some of the tanks at the same time.

Pressure Zones

In order for water piping, valves, appliances, and sprinkler systems to operate properly, it is necessary to maintain water system pressures within an appropriate range. Since water pressure naturally increases the lower in elevation the pipes are from the storage tanks, pressure controls are needed to reduce pressures at about every 100 feet of drop in elevation in the system. This would make it possible to maintain the City specified pressure range between 50 and 110 psi. A developer planning to cross a pressure zone elevation boundary should be informed of the situation and the City should require a PRV station to be installed by the developer.

Results

The model output primarily consists of the computed pressures at nodes and flow rates through pipes. The model also provides additional data related to pipeline flow velocity and head loss to help the modeler evaluate the performance of the various components of the distribution system.

The output data are not a complete indication of system performance. The model provides a steady state analysis of the system, looking only at one demand condition for each scenario. Variations in the demand conditions over time are not shown. Each analysis is made for a single instant in time, so many outcomes from the model can be achieved depending on the situation modeled. The approach of the water system model is to look at the most demanding conditions that the water system is expected to experience. If the water system can provide service for these conditions, it is expected to be able to provided service during less demanding conditions.

Analysis Methodology

A properly designed water distribution system is capable of supplying the necessary quantity of water to any given location in the system under the full range of expected operating conditions. The model was used to analyze the performance of the water system for current and projected future demands under three main operating conditions:

1. High pressure conditions
2. Peak instantaneous conditions, and
3. Peak day plus fire flow conditions.

Each of these conditions put the water system into a worst-case situation so the performance of the distribution system could be analyzed for compliance with State and City minimum requirements. Each of the conditions is discussed below.

High Pressure Conditions

Static conditions are usually the worst case for high pressures in a water distribution system. In the wintertime, water demand during night time hours is very low, tanks are nearly full, and movement of water through the system is minimal. Under these conditions, the water system approaches a static condition and water pressure in the distribution system is dependent only upon the elevation differences and pressure regulating devices. Another condition similar to static conditions that can also cause high pressures in Springville City's water system occurs in the summer during nighttime hours when demand is low and wells are filling storage tanks. Springville City has wells tied directly to the distribution system at elevations lower than the tanks. During times of low demand, the wells increase the pressure in the system high enough to reverse the flow coming down out of the tanks. The highest pressures are reached when pumps are on, tanks are full, and demand is low. City staff have chosen a target value of 110 psi as the highest pressure to be allowed anywhere in the system. These high pressure conditions were simulated with the model to analyze the systems existing and future conformance to this requirement.

Peak Instantaneous Demand Conditions

Peak instantaneous demand is the highest flow demanded by water users on the water system at any given time and generally creates the worst-case for low pressures within a distribution system. In Springville, the peak instantaneous demand condition normally occurs on a peak demand day on the hottest days of the year in July and August. Peak instantaneous demand is used to size the pipelines in the distribution system, but in reality the peak flow does not occur at one time for all the pipes in the

system. For the purpose of simulating peak instantaneous demand in the model to find inadequate pipes, a demand twice that of the peak day was used for both indoor and outdoor demand. The high demand creates high velocities in the distribution pipes which increases head loss in the pipes and thereby reduces pressure. State DDW rules require that the water distribution system meet the following:

- Maintain 20 psi in all areas of the system during peak instantaneous demand
- New service areas added after January 1, 2007 are required to maintain 30 psi during peak instantaneous demand

Usually, these minimum required pressures at peak instantaneous demand are too low for customer satisfaction. Therefore Springville City has chosen a preferred minimum of 50 psi.

Peak Day Demand plus Fire Flow Conditions

Even though peak instantaneous conditions are the worst-case for the lowest pressure and highest demand for the entire system, the peak day plus fire flow can be the worst-case condition for the lowest pressure and highest demand for specific locations in the system. This condition occurs when a fire hydrant is being used on a day of high water demand. The distribution system should be capable of delivering the required fire flow to the specified location within the system, while supplying the peak day demand to the entire distribution system. As stated in the source capacity analysis, peak day flows are equal to twice the average day flow and the Springville City Fire Department requires the following:

- Maintain 1,000 gpm fire flows in residential areas
- Maintain 1,500 gpm fire flows in non-residential areas

For the purposes of the model fire flow demands were assigned and calculated based on zoning and land use; residential zones were assigned a fire flow demand of 1000 gpm and 1500 gpm was assigned to non-residential zones. In accordance with the State Code and Insurance Service Office (ISO) standards, the fire flow should be delivered while maintaining 20 psi minimum residual pressure at the delivery point and to all service connections within the distribution system.

Identifying every pipe which is not capable of supplying the required fire flow is beyond the scope of this study. While the computer analysis is useful for providing general indications of the fire flow capacity, it does not calculate the capacity at every fire hydrant nor does it identify every water line where fire flow capacity is inadequate. The computer analysis checks fire flow capacity at model junction nodes which are generally placed at the intersections of two or more pipes. Fire flow capacity at fire hydrants between model junction nodes could be less than the computer analysis indicates. The computer analysis should not replace physical fire flow tests at fire hydrants as the primary method of determining fire flow capacity.

Existing Water System

The distribution system consists of all pipes, valves, fittings and other appurtenances used to convey water from the water sources and storage tanks to water users. A map of the existing system is shown

in on the **Existing Water System map** in the Appendix. The existing pipes range in size from approximately 2 inches to 30 inches in diameter. The water system has multiple pressure zones. Some system facilities such as Bartholomew Springs, Bartholomew Tank and Rotary Tank, as well as pressure zones are located in Hobble Creek Canyon and are not shown on the **Existing Water System map** due to scale.

Existing Distribution System Analysis and Results

High Pressure Conditions

In general the City's goal of 110 psi maximum pressures are realized except there are a few areas at the bottom of some pressure zones where this pressure is exceeded.

Peak Instantaneous Demand Conditions

Even though many smaller lines exist throughout the system, the system is looped well enough that few deficiencies occur. A weakness in the existing system, however, is the transmission lines from the tanks to high demands lower in the system. When the wells are off, the small transmission lines from the reservoirs do not allow sufficient water from the tanks to feed the lower portions of the system during peak instantaneous conditions. The system also has difficulty supplying the higher elevations in the area near the Evergreen Cemetery under this scenario. In the existing model scenarios, the wells had to be on for the system to be able to meet peak instantaneous demand. With the wells on, State minimum and City desired pressures are met throughout the system.

Peak Day Demand plus Fire Flow Conditions

Even though the system as a whole performed well under peak day plus fire flow demand, several areas in the system locally could not support the fire flow requirements. In general, these areas are where there are dead-end or non-looped lines smaller than eight inches.

Existing Deficiencies and Proposed Solutions

Locations for proposed projects to correct situations where the model calculates that the existing system cannot meet the established level of service are identified on the **Projects to Correct Existing Deficiencies map** found in the Appendix. Following the map, also in the Appendix, is a table summarizing the deficiencies in the existing distribution system together with proposed corrections and associated costs. Project numbers in the table correspond to those shown on the map.

Projected Distribution System Analysis

The projected distribution system analysis is performed using the same assumptions as used in the existing system analysis, except that the projected number of connections and irrigable area for build-out was used for the demand.

Future Network

In areas of new development, the exact layout of the pipes is not known. In these areas, a simple pipe framework is shown to represent that a pipe system will be installed, to show approximate sizes, and to provide a location to where water demands have been allocated. It is recognized that as the City develops, the location and direction of these lines may change. It is important that if the pipe layout is

modified, the system analysis should be revised.

Future Needs and Proposed Solutions

For the existing water system to be able to meet the demands at build-out, several distribution system improvements need to be implemented. The primary additional distribution needs for build-out system are:

- A new transmission line in 400 North from a new tank at about 440 North 1050 East to new development in the West Fields area.
- A new parallel transmission line in Canyon Road from the Hobble Creek Tank to about 800 East 900 South. This pipeline is needed in order to meet the City's desired minimum pressure goal of 50 psi while supplying peak instantaneous demands without the wells pumping. (The previous master plan recommended installing an additional parallel pipeline in Canyon Road. Due to space constraints imposed by the numerous other utility lines already installed in Canyon Road, we therefore recommend replacing the existing 16-inch steel pipeline with an upsized line instead.)

A map of the future distribution system network is shown in on the **New Facilities for Build-out map** in the Appendix.

Upsizing Costs

In addition to these projects, numerous pipelines will be installed as part of the growth and land development process in presently undeveloped areas of the City. Per City code developments are required to install 8-inch lines at the developer's expense as part of development. There will be, however, several pipelines that will need to be installed with sizes larger than this minimum size. Based on the City code, it was therefore assumed that the City will pay for the cost of up-sizing pipelines larger than 8-inches in diameter installed by development. These upsizing costs are included in the future distribution system cost calculations. In reality, the City will only pay upsizing costs for the difference in size above what is required to fulfill the needs of each individual development, as determined during the development review process. If, for example, a developer proposes to construct a multi-family, commercial, or industrial development that will have water demands sufficient to require greater than the typical minimum required water line size, then the City will only pay the difference between the size required to supply the development and the master-planned size.

Distribution pipeline costs are provided in tables in the Appendix. The locations of the recommended projects are shown on the New Facilities for Build-out map, also in the Appendix.

Water Distribution System Recommendations

- Construct the distribution system improvements to correct existing deficiencies and provide for future demand by completing the projects outlined in this report.
- Proceed with the partial secondary water alternative to meet future water demands.
- Update the drinking water system impact fees and proceed with the scheduling and planning for the construction of the drinking water system master plan projects.
- Continue updating the existing water system computer model to reflect new construction and additional demand.

Chapter 9 – Impact Fee Facilities Plan (IFFP)

Required improvements have been identified in prior sections of this report. Based on this information, it is now possible to identify those improvements that qualify to be used in the calculation of impact fees as outlined in Section 11-36a of the Utah Code.

Purpose of the IFFP

The purpose of this Impact Fee Facilities Plan (IFFP) is to define future projects that are eligible for impact fees, develop cost allocations for those projects related to impact fees, and estimate the value of available capacity in the existing system facilities that are eligible for reimbursement through impact fees.

10-Year Improvement Plan

The prior chapters identified all capital facility projects needed to provide service to various parts of the City at projected build-out. Most of these projects will need to be constructed in phases as development occurs. The future projects list summarizes those future projects that are anticipated be constructed to address existing needs and meet the needs of growth within the 10-year planning window based on the 10-year IFFP planning area. (The purpose of the 10-year IFFP area is to help with planning but in reality growth may occur in locations outside of this area within the 10-year growth window. The IFFP anticipated boundary is shown on the Master Plan Study Area map in the Appendix.) In accordance with the requirements of state law, those projects recommended in the capital facilities plan that fall outside of the 10-year planning window have not been included in the impact fee facilities plan. A more detailed breakdown of costs for the larger projects in the tables is contained in the appendix of this report.

Types of Recommended Improvements

The recommended improvements identified in this IFFP include only major system facilities (system improvements). Local water pipelines (project improvements), typically associated with development projects, are not included in this report nor are they eligible for impact fees. This report defines system improvements and project improvements for Springville's water system. The definition of system improvements and project improvements is presented below.

Project Improvements

Per City code, developers are required to install 8-inch pipelines as part of development. These pipelines are project improvements. Pipelines larger than these are termed system improvements.

System Improvements

System improvements include pipelines or other facilities such as tanks or wells that typically service multiple developments.

Service Area

For the purpose of this IFFP, all of Springville City will be included in one Service Area.

Level of Service

See Chapter 2 for the defined level of service for the various water system components.

Project Cost Attributable To Future Growth

To satisfy the requirements of state law, the list of future projects table in the Appendix provides a breakdown of the capital facility projects and the percentage of the project costs attributed to existing and future users. As defined in Section 11-36-304, the impact fee facilities plan should only include "the proportionate share of the costs of public facilities [that] are reasonably related to the new development activity." While most projects from the capital facilities plan outlined in previous chapters are required to meet future growth, some projects also provide a benefit to existing users. Projects that benefit existing users include those projects addressing existing capacity needs and maintenance related projects.

For most projects, the division of costs between existing and future users is easy because 100 percent of the project costs can be attributed to one category or the other (e.g. infrastructure needed solely to serve new development can be 100 percent attributed to new growth, while projects related to existing condition or capacity deficiencies can be 100 percent attributed to existing user needs). For projects needed to address both existing deficiencies and new growth, the costs were divided using one of two methods:

1. Existing facility replacement - Where an existing facility requires replacement, existing users have been assigned the cost of replacement based on their needs and future users have been assigned the cost of upsizing the pipeline to accommodate additional future growth. For example, an existing pipeline that is undersized and needs to be replaced may require a new pipeline to accommodate existing flows of 25 gpm. However, to accommodate future flows of 100 gpm, the replacement would be increased in size to a larger pipeline to accommodate the larger flows. In this case, 25 percent of the costs of the project would be assigned to existing users and 75 percent assigned to future growth.
2. New facility - Where a new facility is being added (i.e. no existing facility exists), costs have been divided between the two categories based on the ratio of flow needed for each type of user. For example, if existing peak flow through a proposed facility will be 10 gpm but the ultimate capacity of the pipeline needs to be 50 gpm to meet new growth, 20 percent of the costs have been assigned to existing users and 80 to future growth.

It should be noted that the future projects costs table does not include bond costs related to paying for impact fee eligible improvements. These costs should be added as part of the impact fee analysis.

Source

As can be seen in Table 1 – Summary of Key System Calculations, the existing system has essentially no excess source capacity (only 182 gpm). Therefore new sources will need to be developed in order to accommodate additional growth. Based on the information shown in Table 1, new growth within the next 10-year period will require a new source of 1,333 gpm. Based on existing well yields within the city of approximately 2500-3000 gpm per well, it is calculated that new growth will be responsible for

approximately 50% of the cost of a new well.

Storage

It appears that there is sufficient storage capacity to meet the needs of the projected 10-year growth demands, provided that the partial secondary system is placed into service during this 10-year period in order to satisfy outdoor demands. Even with the secondary water system in operation, however, there will not be a very large surplus of storage capacity at the end of the 10-year growth period and the City should be working toward constructing new storage by the end of the 10-year period.

Project Cost Attributable To 10-Year Growth

As summarized in the future projects list, the total cost of future projects in the impact fee facility plan that are attributable to future growth in the next ten years is approximately $3.1million.

Existing Capacity Available To Serve New Growth

In addition to using capacity in new projects contained in the impact fee facility plan, future growth will also utilize a portion of excess capacity in existing facilities.

Source

As has been discussed previously in this report, the existing system has essentially no excess source capacity (182 gpm).

Storage

It appears that there is sufficient storage capacity to meet the needs of the projected 10-year growth demands, provided that the partial secondary system is placed into service during this 10-year period in order to satisfy outdoor demands.

Distribution

As discussed in previous chapters of this document, the existing system was analyzed using a computer model developed to determine the capacity of the system and the needed improvements to maintain the level of service. Existing infrastructure was analyzed relative to needed improvements to develop the list of capital projects necessary to serve new growth. While there may be capacity within individual distribution lines throughout the City, due to the nature of looped water systems, it difficult to determine exactly which pipelines have excess capacity. In general, the system has capacity to meet both existing and 10-yr growth demands without the need for major distribution system projects being required other than those already discussed.

Appendix

Table 12 – Existing Land Use Data

EXIST_PROP_TYPE	%_IRRIGABLE	Redevelopable in Future?	Persons/Unit	Exist ERC Multiplier
ADJOINING PARCEL > 1 ACRE	50%	Y		-
AG-OTHER USE	0%	Y		-
AGRICULTURAL	0%	Y		-
APARTMENT 4-PLEX	40%	Y	3.13	1.00
APARTMENT 5-8 PLEX	35%	Y	2.59	1.00
APARTMENT 9+ PLEX	30%	Y	2.59	1.00
APT ADJOINING PARCEL	40%	Y		-
APT TRIPLEX	45%	Y	3.13	1.00
CEMETERY	95%	NO		1.00
CHURCH	25%	NO		3.50
COMM GARAGE	15%	Y		3.15
COMM HOTEL	15%	Y		3.15
COMM MANUFACTURING	15%	Y		3.15
COMM MOTEL	15%	Y		3.15
COMM OFFICE	15%	Y		3.15
COMM RETAIL	15%	Y		3.15
COMM SERVICE STATION OR GAR	15%	Y		3.15
COMM STORAGE	15%	Y		3.15
COMM UNKNOWN-MISC	15%	Y		3.15
COMM WHOLESALE	15%	Y		3.15
COMM-BANK	15%	Y		3.15
COMM-CONDO	15%	Y		3.15
COMMERCIAL	15%	Y		3.15
COMM-FOOD	15%	Y		3.15
COMM-HEALTH SERVICES	15%	Y		3.15
COMMON AREA	75%	Y		1.00
DRIVEWAY	0%	Y		-
INDUSTRIAL	10%	Y		8.00
MOBIL HOME-ATTACHED	35%	Y	3.13	1.00
MOBIL HOME-PARK	20%	Y	2.59	1.00
MOBIL HOME-PERMANENT	45%	Y	2.59	1.00
MULTILPE RES + AG > 1 ACRE	40%	Y	3.13	1.00
MULTIPLE RES + COMM	40%	Y	2.59	1.00
MULTIPLE RES + COMM > 1 ACRE	40%	Y	2.59	1.00
PARK	95%	NO		1.00
RES + APT TRIPLEX	45%	Y	3.13	1.00
RES SINGLE + DUPLEX	50%	Y	3.13	1.00
RES SINGLE PUD	20%	Y	2.59	1.00
RES SINGLE PUD > 1 ACRE	20%	Y	2.59	1.00
RESIDENTIAL	55%	Y	3.65	1.00
RESIDENTIAL CONVERSION	55%	Y	3.65	1.00
RESIDENTIAL DUPLEX	50%	Y	3.13	1.00
RESIDENTIAL NURSING HOME	50%	Y		3.15
RESIDENTIAL SINGLE	55%	Y	3.65	1.00
RESIDENTIAL TRIPLEX	45%	Y	3.13	1.00
RESIDENTIAL TWIN HOME	50%	Y	3.13	1.00
RESIDENTIAL-ADJOINING	75%	Y		-
RESIDENTIAL-APT 4-PLEX	40%	Y	3.13	1.00
RESIDENTIAL-SINGLE > 1 ACRE	50%	Y	3.65	1.00
RESIDENTIAL-SINGLE-CONDO	20%	Y	3.13	1.00
SCHOOL	60%	NO		6.00
SECONDARY RESIDENTIAL	75%	Y		-
STREET	0%	NO		-
VACANT	0%	Y		-
VACANT CONDO LOT	0%	Y		-
VACANT SUB LOT	0%	Y		-

Table 13 – General Plan Land Use Data

2012_GENPLAN_LUC	Residential Units/Acre	Persons/Unit	% Residential	% Non-Residential	Base % Irrigable	Net % Irrigated (remove 30% for streets)
AG	0.15	3.65	100%		0%	0%
CEMETERY	-	-			95%	95%
CHURCH	-	-			25%	25%
COM	-	-		100%	15%	11%
COM-RES	12.0	2.59	50%	50%	35%	25%
DETENTION	-	-			95%	95%
IND-MAN	-	-		100%	15%	11%
LDR	3.0	3.65	100%		55%	39%
MDR	6.0	3.13	100%		50%	35%
MHDR	12.0	2.59	100%		40%	28%
MIX	12.0	2.59	50%	50%	30%	21%
MLDR	4.0	3.65	100%		45%	32%
PARK	-	-			95%	95%
SCHOOL	-	-			60%	60%

Table 14 – Large Users

Name	Quantity Billed (kgal)	Service Address	Quantity (gal/day)	Quantity (gpm)
NESTLE FOODS(SECONDARY SPR SYS	-	1530 N MTN SPRINGS PKW #1	-	-
NESTLE FROZEN FOOD COMPANY	2,107.00	815 W RAY KLAUCK WAY(SPRN	13,861.84	9.63
NESTLE FROZEN FOOD COMPANY	107,243.00	815 W RAY KLAUCK WAY	705,546.05	489.96
NESTLES	4,534.00	851 W RAY KLAUCK WAY-WA # 4	29,828.95	20.71
NESTLES	19,590.00	851 W RAY KLAUCK WAY - WA #5	128,881.58	89.50
SUPRA NATURALS	6,161.00	1356 W SPRING CREEK PLACE	40,532.89	28.15
COTT BEVERAGES INC	5,742.00	1198 N SPRING CREEK PL-BLDG B	37,776.32	26.23
PRIORITY DAIRY	7,520.00	1295 S MAIN	49,473.68	34.36
WALKERS #23	3,676.00	1750 W 400 S	24,184.21	16.79
VALTEK COMPANY	2,984.00	1350 N MTN SPRINGS PKW #1	19,631.58	13.63
STEED, ROBERT	2,739.00	3152 E CANYON (2ND METER)	18,019.74	12.51
INNOVATIVE FLEX PAK	2,481.00	1530 N MTN SPRINGS PKW	16,322.37	11.33
W. W. CLYDE	2,476.00	1345 N MAIN (SHOP)	16,289.47	11.31
JAKE'S BROOKSIDE CAR WASH	1,712.00	440 S 400 E	9,953.49	6.91

DEFICIENCIES, SOLUTIONS AND COSTS

ID	LOCATION	PROBLEM	SOLUTION	COST*	PROJECT TIMING	IFFP PROJECT**	% EXIST.	% 10-YR GROWTH	% BEYOND 10-YR GROWTH	EXIST. COST	10-YR COST	BEYOND 10-YR COST
EXISTING SYSTEM DEFICIENCES & PROJECTS TO CORRECT THEM												
1	410 S 457 W	Fire flow residual pressure not met	Connect fire hydrant to existing 30" pipeline	$ 15,473	< 5 YEARS		100%	0%	0%	$ 15,473	$ -	$ -
2	Main St 1695 S	Fire flow residual pressure not met	Connect to existing 10" pipeline in 1600 S	$ 6,476	< 5 YEARS		100%	0%	0%	$ 6,476	$ -	$ -
3	700 S Main Street	Fire flow residual pressure not met	Connect existing 4" pipeline under US-89 to existing 4" pipeline in Main Street	$ 30,895	< 5 YEARS		100%	0%	0%	$ 30,895	$ -	$ -
4	800 S 50 W	Fire flow residual pressure not met	Replace 1300' of 4" pipeline with 8" pipeline	$ 198,072	< 5 YEARS		100%	0%	0%	$ 198,072	$ -	$ -
5	1350 E - 100 N to 200 N, 100 N - 1350 E to 1440 E	Fire flow residual pressure not met	Replace 1450' of 4" pipeline with 8" pipeline (1440 E - Center to 100 N, 100 N - 1440 E to 1350 E, 1350 E - 100 N to 200N)	$ 219,618	< 5 YEARS		100%	0%	0%	$ 219,618	$ -	$ -
6	Chase Lane (350 S)	Fire flow residual pressure not met	Replace 544' of 4" pipeline with 8" pipeline on Chase Lane (350 S) from 800 E to 700 E	$ 83,810	< 5 YEARS		100%	0%	0%	$ 83,810	$ -	$ -
7	1040 E 288 N	Fire flow residual pressure not met	Replace 430' of 4" pipeline with 8" pipeline on 1040 E from 200 N to 288 N	$ 67,435	< 5 YEARS		100%	0%	0%	$ 67,435	$ -	$ -
8	1040 E 385 N	Fire flow residual pressure not met	Replace 290' of 4" pipeline with 8" pipeline on 1040 E from 300 N to 385 N	$ 47,326	< 5 YEARS		100%	0%	0%	$ 47,326	$ -	$ -
9	250 N 900 E	Fire flow residual pressure not met	Install fire hydrant at the intersection of 900 E 250 N	$ 8,543	< 5 YEARS		100%	0%	0%	$ 8,543	$ -	$ -
10	850 E 455 N	Fire flow residual pressure not met	Replace 250' of 4" pipeline with 8" pipeline on 850 E from 400 N to 455 N	$ 41,580	< 5 YEARS		100%	0%	0%	$ 41,580	$ -	$ -
11	970 E - 500 N to 700 N	Fire flow residual pressure not met	Install 355' of 8" pipeline on 600 N from 880 E to 970 E	$ 61,072	< 5 YEARS		100%	0%	0%	$ 61,072	$ -	$ -
			SUB-TOTAL	**$ 780,300**						**$ 780,300**	**$ -**	**$ -**
NEW FACILITIES FOR IFFP (10-YEAR) PROJECTED GROWTH												
12	City wide Pipe Upsizing	Additional distribution lines throughout City to support new development	Distribution lines throughout City installed w/ development	$ 4,316,314	ONGOING	IFFP	0%	23%	77%	$ -	$ 1,011,698	$ 3,304,616
13	1000 E 900 S	Need additonal water source	Additional 900 South Well and pumping station	$ 1,761,471	< 5 YEARS	IFFP	0%	50%	50%	$ -	$ 880,736	$ 880,736
14	900 S (from 1000 E to Hobble Creek Tanks)	Meet peak instantaneous demands w/o the wells running to provide min. desired pressure level of service	900 S transmission line	$ 5,743,267	< 10 YEARS	IFFP	58%	21%	21%	$ 3,318,133	$ 1,212,567	$ 1,212,567
			SUB-TOTAL	**$ 11,821,053**						**$ 3,318,133**	**$ 3,105,001**	**$ 5,397,919**
NEW FACILITIES FOR BUILD-OUT												
15	900 E 400 S	Need additonal water source	Additional 400 South Well pumping station	$ 1,761,470	> 10 YEARS		0%	0%	100%	$ -	$ -	$ 1,761,470
16	2000 E 400 S	Need additional water storage	Tank (4.0 MG)	$ 4,000,000	> 10 YEARS		0%	0%	100%	$ -	$ -	$ 4,000,000
17	200 N (700 E to 1000 E)	Need additonal water source	Additional 200 North Well pumping station	$ 1,761,470	> 10 YEARS		0%	0%	100%	$ -	$ -	$ 1,761,470
18	1100 E 400 N	Need additional water storage	Tank (2.0 MG)	$ 2,000,000	> 10 YEARS		0%	0%	100%	$ -	$ -	$ 2,000,000
19	400 N (from New Tank to 950 W)	Transmit water from new tank to new development on the west side of City	400 N transmission line	$ 2,958,753	> 10 YEARS		0%	0%	100%	$ -	$ -	$ 2,958,753
			SUB-TOTAL	**$ 12,481,694**						**$ -**	**$ -**	**$ 12,481,694**
			TOTAL	**$ 25,083,048**						**$ 4,098,433**	**$ 3,105,001**	**$ 17,879,614**

* All costs include 26% for design, engineering, contingency, and administration costs.

** IFFP projects only include those that are 1) needed to provide service to development within the IFFP boundary, 2) are system improvements, and 3) are not solely to correct exisiting deficiencies

Water Masterplan Update - Cost Estimates

Existing Deficiencies

ID	Location	Description	Pipe Size (in)	Length in pavement (ft)	Length out of pavement (ft)	Unit price (in pavement)	Unit price (out pavement)	Total Pipe Cost
1	410 S 457 W	Pipe	6	20		$ 114.00	$ 86.00	$ 2,280
		Hot Tap 30"x6"					$ 5,500.00	$ 5,500.00
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 12,280
							Design, Engineering, Admin & Contigency	$ 3,193
							Total	**$ 15,473**
2	Main St 1695 S	Pipe	8	10		$ 114.00	$ 86.00	$ 1,140
		Hot Tap 10"x8"					$ 4,000.00	$ 4,000.00
							Sub-Total	$ 5,140
							Design, Engineering, Admin & Contigency	$ 1,336
							Total	**$ 6,476**
3	700 S Main Street	Pipe	8	180		$ 114.00	$ 86.00	$ 20,520
		Hot Tap 8"x8"					$ 4,000.00	$ 4,000.00
							Sub-Total	$ 24,520
							Design, Engineering, Admin & Contigency	$ 6,375
							Total	**$ 30,895**
4	800 S 50 W	Pipe	8	1300		$ 114.00	$ 86.00	$ 148,200
		Fire Hydrant Assembly (2)					$ 9,000.00	$ 9,000.00
							Sub-Total	$ 157,200
							Design, Engineering, Admin & Contigency	$ 40,872
							Total	**$ 198,072**
5	1350 E 100 N to 200 N, 100 N 1350 E to 1440 E	Pipe	8	1450		$ 114.00	$ 86.00	$ 165,300
		Fire Hydrant Assembly (3)					$ 9,000.00	$ 9,000.00
							Sub-Total	$ 174,300
							Design, Engineering, Admin & Contigency	$ 45,318
							Total	**$ 219,618**
6	Chase Lane (350 S)	Pipe	8	544		$ 114.00	$ 86.00	$ 62,016
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 66,516
							Design, Engineering, Admin & Contigency	$ 17,294
							Total	**$ 83,810**
7	1040 E 288 N	Pipe	8	430		$ 114.00	$ 86.00	$ 49,020
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 53,520
							Design, Engineering, Admin & Contigency	$ 13,915
							Total	**$ 67,435**
8	1040 E 385 N	Pipe	8	290		$ 114.00	$ 86.00	$ 33,060
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 37,560
							Design, Engineering, Admin & Contigency	$ 9,766
							Total	**$ 47,326**
9	250 N 900 E	Pipe	8	20		$ 114.00	$ 86.00	$ 2,280
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 6,780
							Design, Engineering, Admin & Contigency	$ 1,763
							Total	**$ 8,543**

10	850 E 455 N	Pipe	8	250		$ 114.00	$ 86.00	$ 28,500
		Fire Hydrant Assembly					$ 4,500.00	$ 4,500.00
							Sub-Total	$ 33,000
							Design, Engineering, Admin & Contigency	$ 8,580
							Total	**$ 41,580**

11	970 E 500 N to 700 N	Pipe	8	355		$ 114.00	$ 86.00	$ 40,470
		Hot Tap 8"x8"					$ 8,000.00	$ 8,000.00
							Sub-Total	$ 48,470
							Design, Engineering, Admin & Contigency	$ 12,602
							Total	**$ 61,072**

New Facilities for Build-out

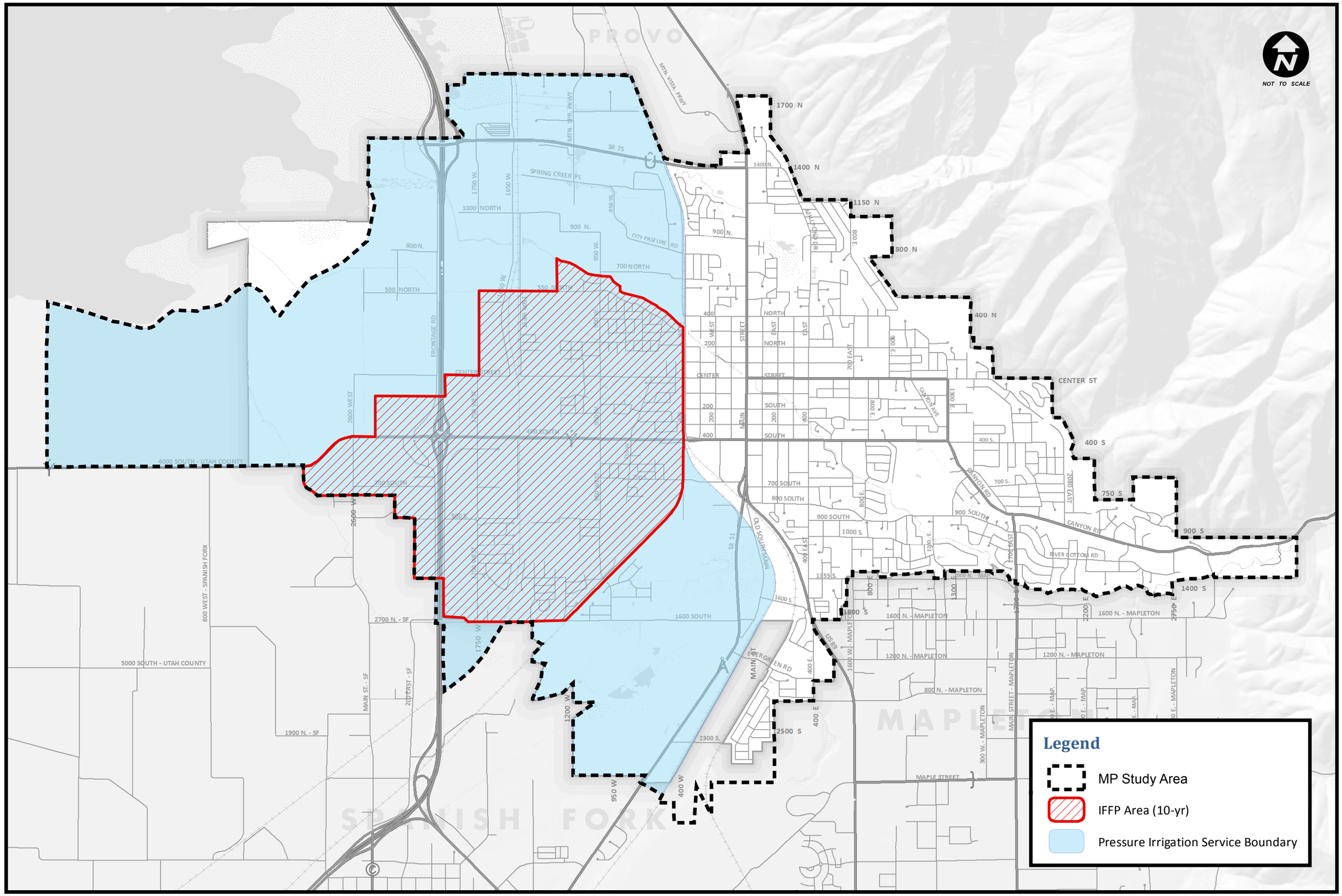
ID	Location	Description	Pipe Size (in)	Length in pavement (ft)	Length out of pavement (ft)	Unit price (in pavement)	Unit price (out pavement)	Total Pipe Cost
14	900 S from 1000 E to Hobble Creek Tanks	900 S Transmission Line	12	1,089		$ 158.00		$ 171,998.80
			24	5,110		$ 285.00		$ 1,456,350.00
			30	7,710		$ 380.00		$ 2,929,800.00
							Sub-Total	$ 4,558,149
							Design, Engineering, Admin & Contigency	$ 1,185,119
							Total	**$ 5,743,267**

ID	Location	Description	Pipe Size (in)	Length in pavement (ft)	Length out of pavement (ft)	Unit price (in pavement)	Unit price (out pavement)	Total Pipe Cost
19	400 N from New Tank to 950 W	400 N Transmission Line	12	2,551	2,120	$ 158.00	$ 129.00	$ 676,570.88
			16	4,059	520	$ 192.00	$ 153.00	$ 858,779.18
			18	1,882		$ 221.00		$ 415,903.57
			20	1,529		$ 236.00		$ 360,857.78
			24	127		$ 285.00		$ 36,105.51
							Sub-Total	$ 2,348,217
							Design, Engineering, Admin & Contigency	$ 610,536
							Total	**$ 2,958,753**

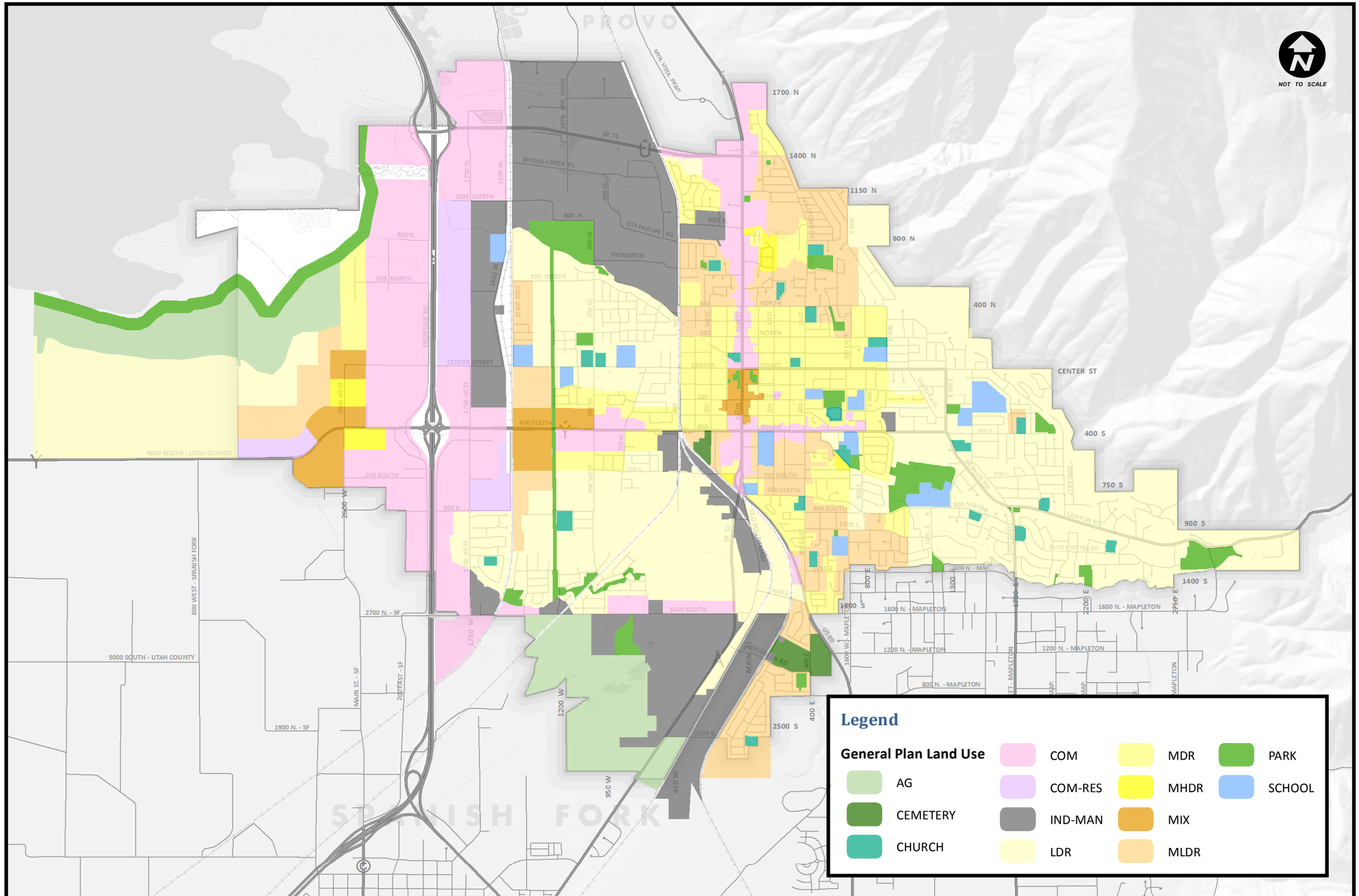
ID	Location	Description	Pipe Size (in)	Length in pavement (ft)	Length out of pavement (ft)	Upsizing Unit price (in pavement)	Upszing Unit price (out pavement)	Total Pipe Cost
12	City Wide Upsizing	Distribution lines though-out the City	8		19,778		$ -	$ -
			10		63,185		$ 20.00	$ 1,263,705.93
			12		10,948		$ 43.00	$ 470,760.02
			16		5,733		$ 67.00	$ 384,139.37
			18		10,569		$ 94.00	$ 993,450.69
			20		2,904		$ 108.00	$ 313,589.96
							Sub-Total	$ 3,425,646
							Design, Engineering, Admin & Contigency	$ 890,668
							Total	**$ 4,316,314**

(1) Per linear foot cost of pipe assumed using PVC pipe, dewatering, total import trench backfill and 2 connections and 4 valves every 1000-feet.
(2) Prices include 15% for engineering and design, 10% for contingency and 1% for administration and bond fees.
(3) Presumed that all new development to be out of pavement
(4) Upsizing unit costs equal standard for pipe size less cost for installation of 8 inch pipe

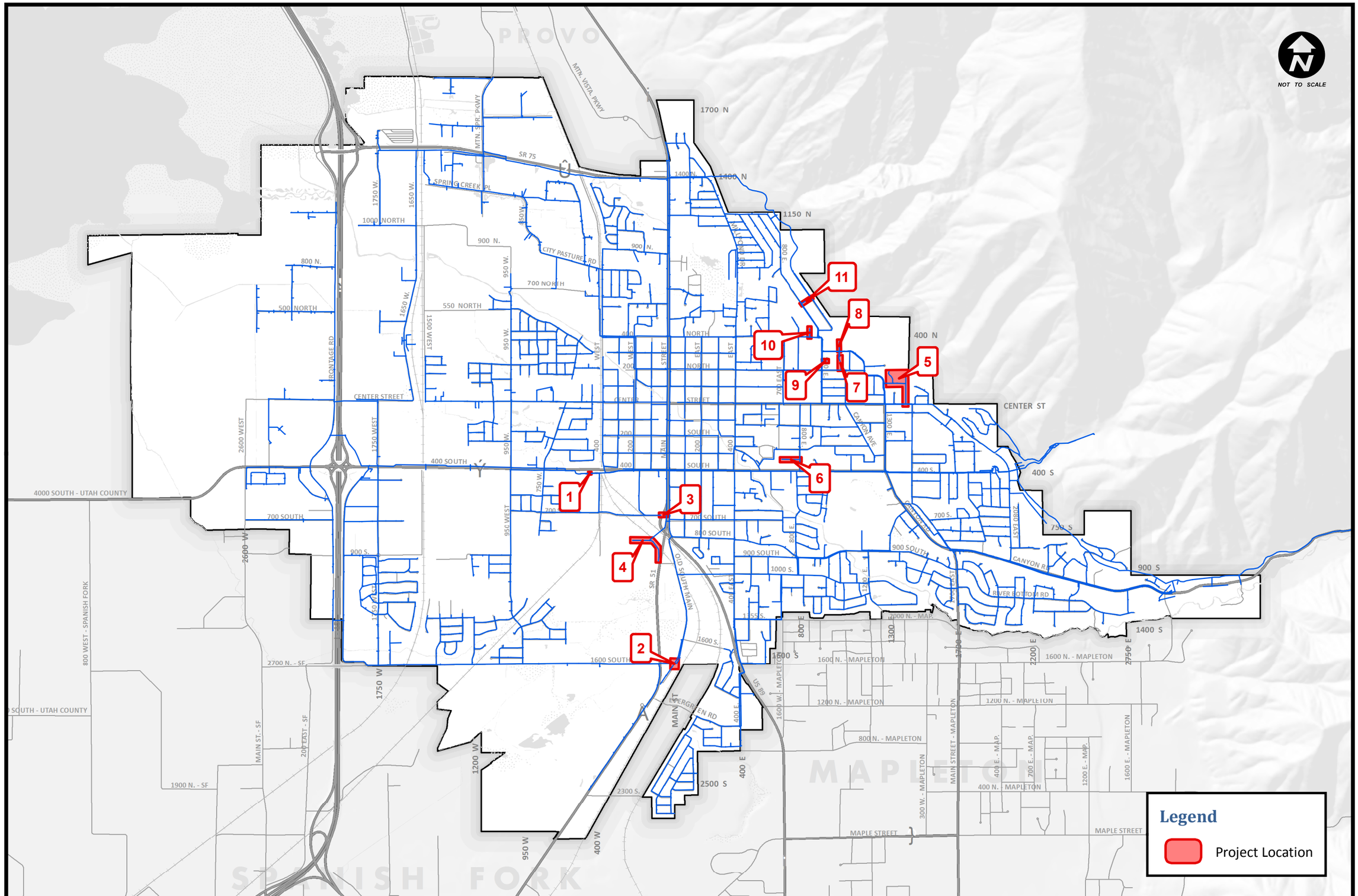
Master Plan Study Area



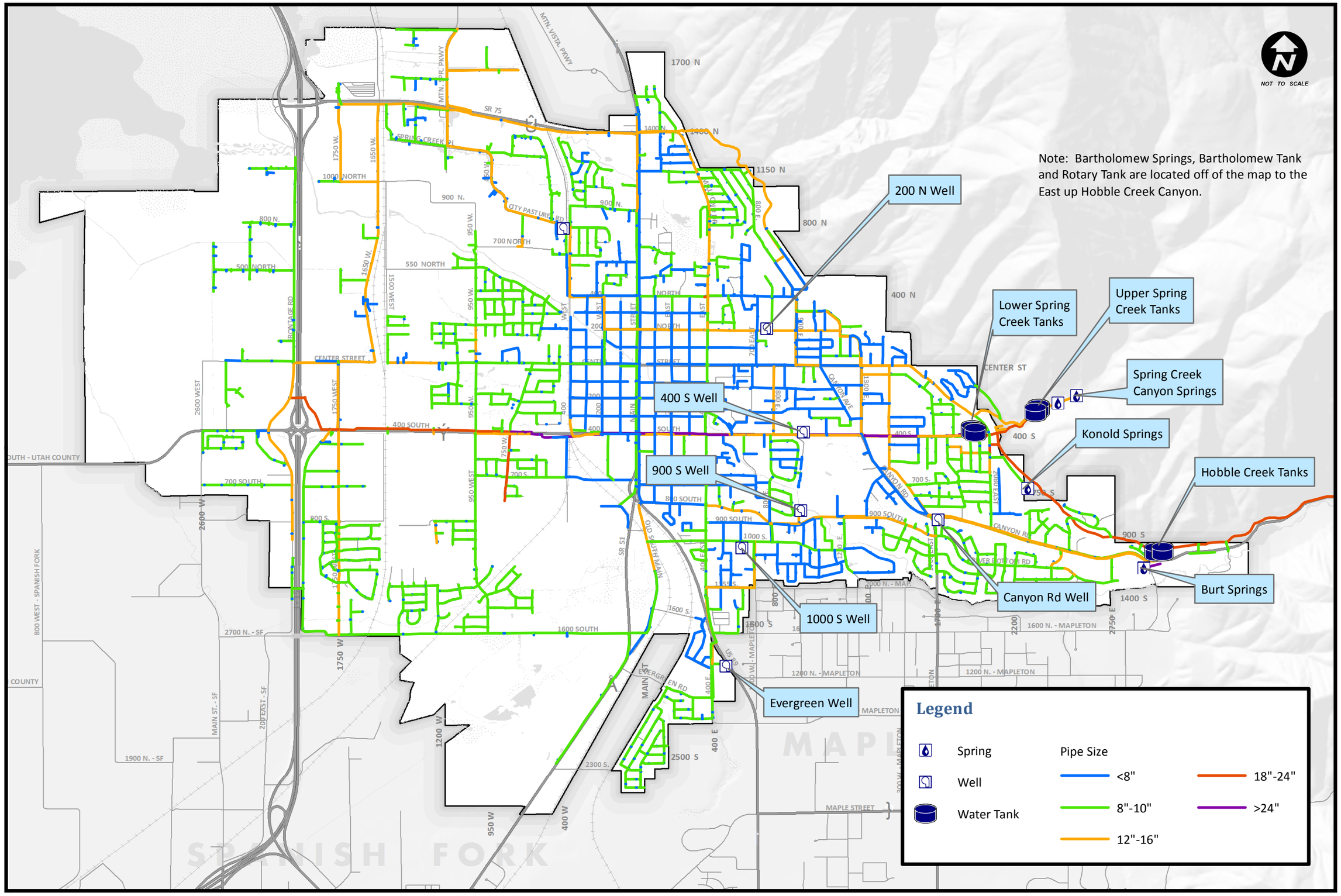
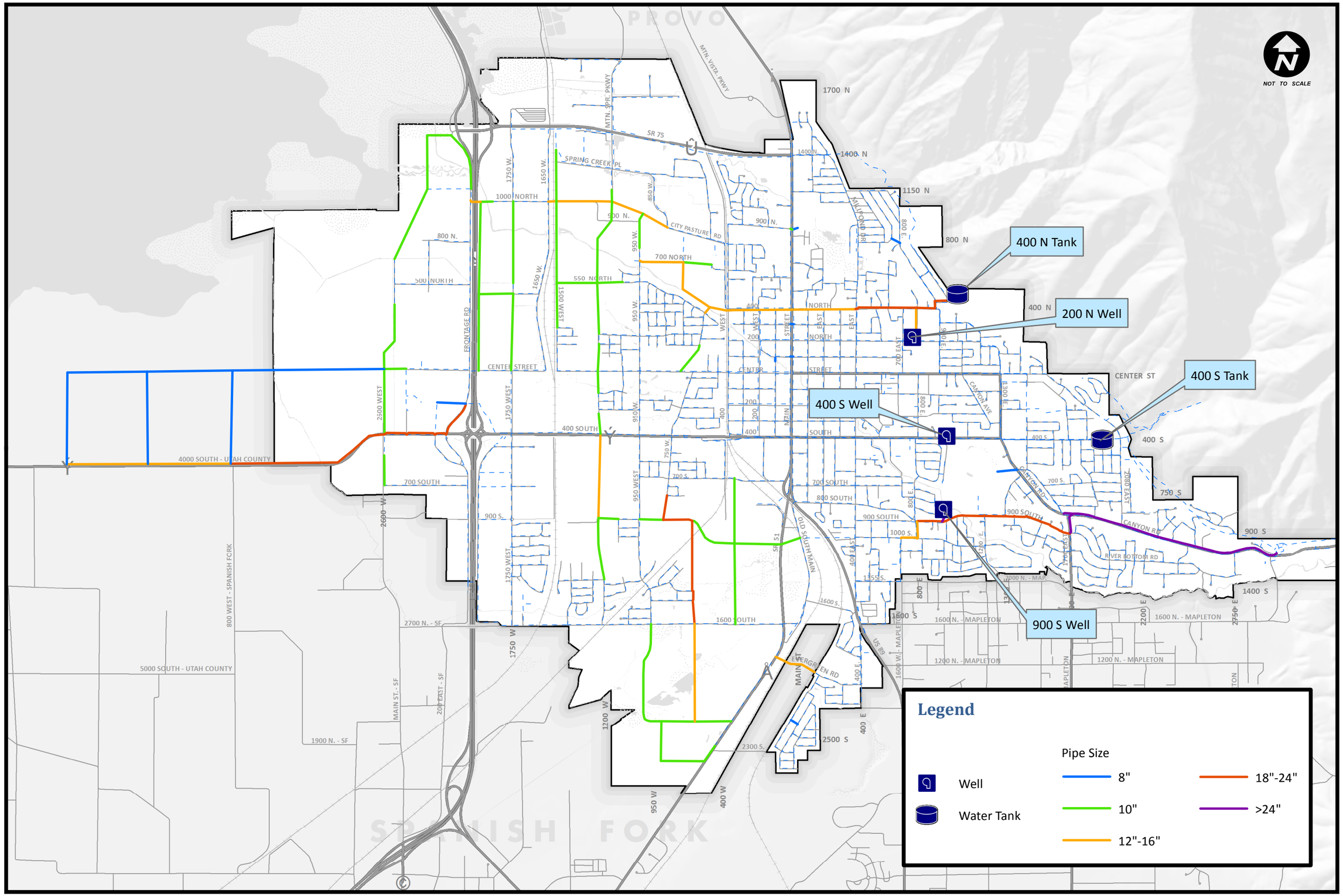
General Plan Land Use



Projects to Correct Existing Deficiencies



Existing Water System



New Facilities for Build-out