DRINKING WATER SYSTEM MASTER PLAN

(HAL Project No.: 348.08.100)

May 2012

HANSEN ALLEN & LUCE inc
ENGINEERS

SPANISH FORK CITY

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Project Engineer

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GLOSSARY OF TECHNICAL TERMS

Average Daily Flow: The average yearly demand volume expressed in a flow rate.

Average Yearly Demand: The volume of water used during an entire year.

Build-out: The development density when it reaches a maximum allowed by planned development.

Demand: Required water flow rate or volume.

Distribution System: The network of pipes, valves, and appurtenances contained within a water system.

Drinking Water: Water of sufficient quality for human consumption. Also referred to as Culinary or Potable water.

Dynamic Pressure: The pressure exerted by water within the pipelines and other water system appurtenances when water is flowing through the system.

Equivalent Residential Connection: A measure used in comparing water demand from non-residential connections to residential connections.

Head: A measure of the pressure in a distribution system that is exerted by the water. Head represents the height of the free water surface (or pressure reduction valve setting) above any point in the hydraulic system.

Headloss: The amount of pressure lost in a distribution system under dynamic conditions due to the wall roughness and other physical characteristics of pipes in the system.

Irrigated Acreage (Acres): The area of land, in acres, that is irrigated.

Irrigation Water: Water used solely for outdoor watering. Not for human consumption.

Peak Day: The day(s) of the year in which a maximum amount of water is used in a 24-hour period.

Peak Day Demand: The average daily flow required to meet the needs imposed on a water system during the peak day(s) of the year.

Peak Instantaneous Demand: The flow required to meet the needs imposed on a water system during maximum flow on a peak day.

Pressure Reducing Valve (PRV): A valve used to reduce excessive pressure in a water distribution system.

Pressure Zone: The area within a distribution system in which water pressure is maintained within specified limits.

Service Area: Typically, this is the area within the boundaries of the entity or entities, which participate in the ownership, planning, design, construction, operation and maintenance of a water system.

Static Pressure: The pressure exerted by water within the pipelines and other water system appurtenances when water is not flowing through the system, i.e., during periods of little or no water use.

Storage Reservoir: A facility used to store, contain and protect water until it is needed by the customers of a water system. This is also referred to as a Storage Tank.

Transmission Pipeline: A pipeline that transfers water from a source to a reservoir or from a reservoir to a distribution system.

Water Conservation: Planned management of water to prevent waste.

ABBREVIATIONS

ac-ft	acre-feet
cfs	cubic feet per second (ft^3/s)
DDW	The State of Utah Division of Drinking Water
E	East
ERC	Equivalent Residential Connection
GIS	Geographic Information System
gpd	Gallons per Day
gpd/conn	Gallons per Day per Connection
gpm	Gallons per Minute
HAL	Hansen, Allen & Luce, Inc.
MG	Million Gallons
N	North
PI	Pressurized Irrigation
PRV	Pressure Reducing Valve
psi	Pounds per Square Inch
S	South
SCADA	Supervisory Control And Data Acquisition
W	West

CHAPTER I

INTRODUCTION

PURPOSE

The purpose of this master plan is to provide specific direction to Spanish Fork City, based on City demand data and standards established by the Utah Division of Drinking Water (DDW), for decisions that will be made over the next 5 to 10 years to help the City provide adequate water to customers at the most reasonable cost. A DDW Hydraulic Model Design Elements & System Capacity Expansion Report Certification is provided in Appendix A.

SCOPE

The scope of this master plan includes a study of the City's drinking water system and customer water use including: build-out growth projections, source requirements, water rights, storage requirements, distribution system requirements and water quality. From this study of the water system, an implementation plan with recommended improvements has been prepared. The implementation plan includes conceptual-level cost estimates for the recommended improvements.

The conclusions and recommendations of this study are limited by the accuracy of the development projections and other assumptions used in preparing the study. It is expected that the City will review and update this master plan as needed.

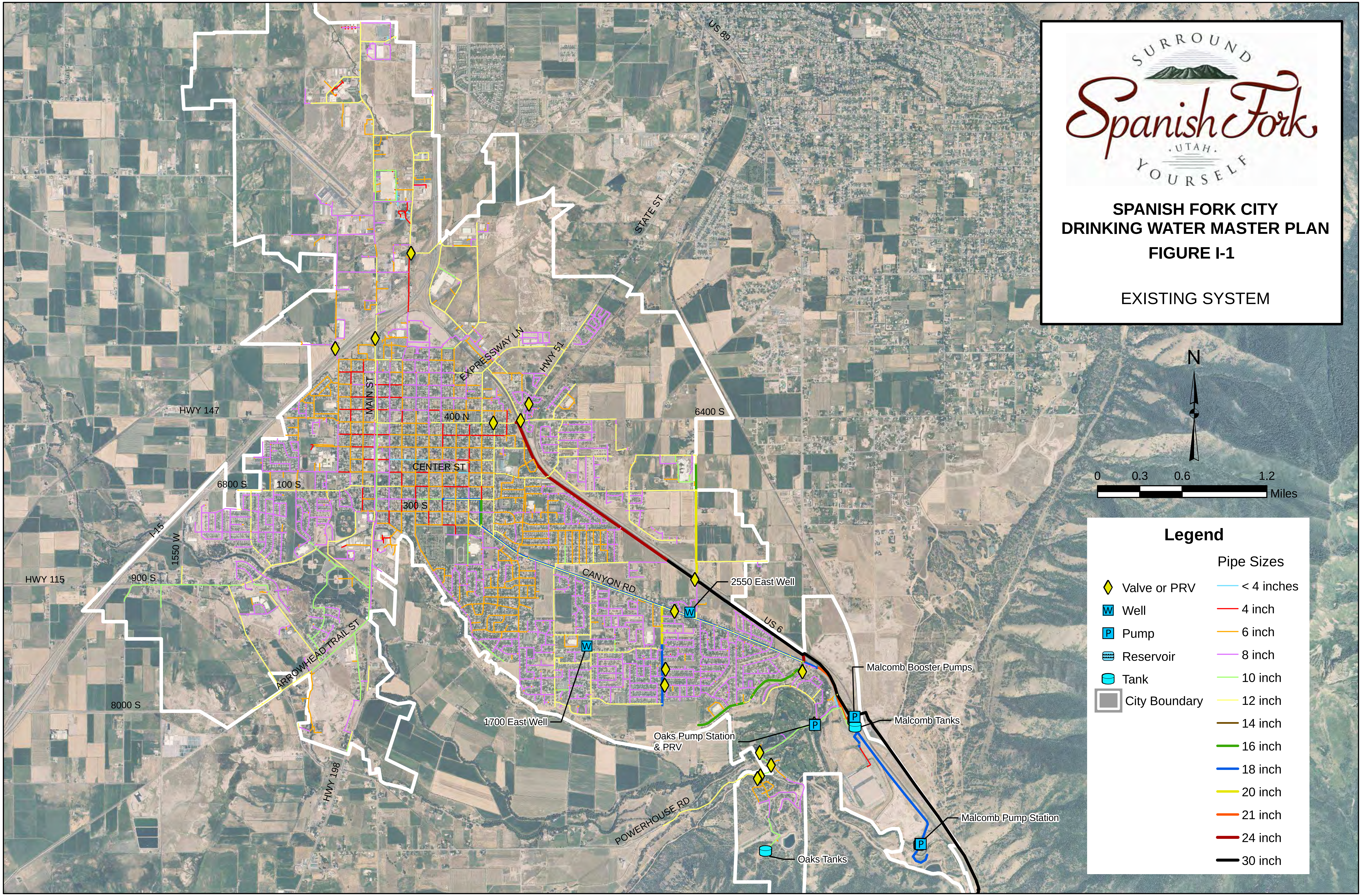
BACKGROUND

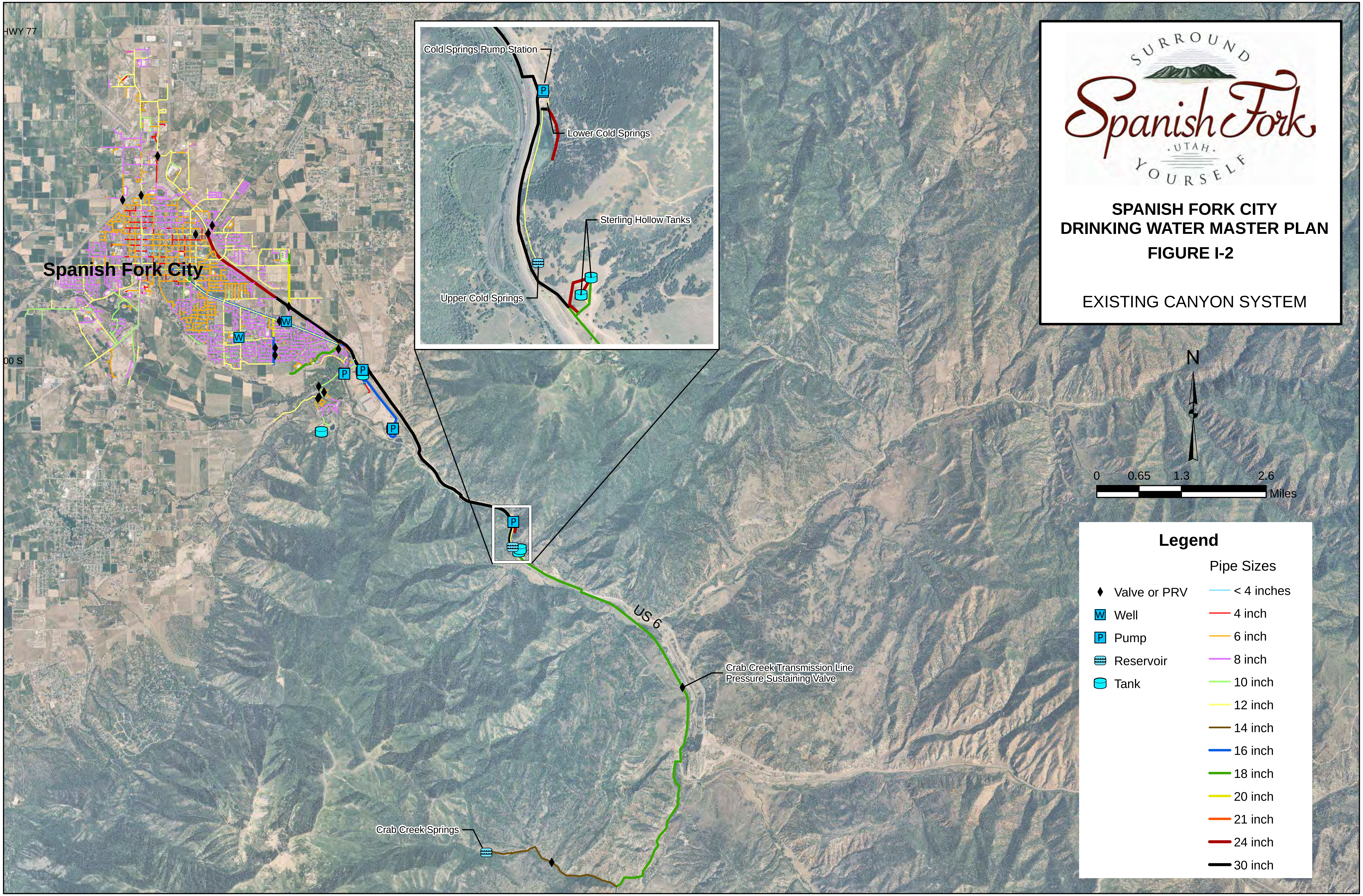
Spanish Fork City is located in central Utah within the south central portion of Utah County. The City is bordered by Utah Lake to the northwest and the Wasatch Mountains to the east. The City varies in elevation above mean sea level from about 4500 feet in the northwest to 5200 feet in the southeast foothills. Spanish Fork City covers an area of 15.4 square miles and has experienced rapid growth over the last 20 years. During that time the population has increased from just over 11,000 in 1990 to 34,691 as of the 2010 U.S. Census.

Figures I-1 and I-2 illustrate the extent of the Spanish Fork water distribution system. Figure I-3 illustrates the extent of the pressure zones in the system. The Spanish Fork network is comprised of six pressure zones and was reported to contain just over 9,800 connections in 2010. The distribution network includes approximately 193 miles of pipe, with diameters ranging from 2 to 30 inches. Spanish Fork currently receives drinking water from two wells and three springs. Several of the City's existing drinking water sources are located within Spanish Fork Canyon. Water from these sources is supplied via a pipeline which extends from the sources to the City. Apart from the five sources currently used within the distribution system, the City owns additional sources which fall into two categories: past sources which are currently inactive, and sources which provide water to the City's pressurized irrigation system.

WATER SYSTEM MASTER PLANNING APPROACH

The Spanish Fork water distribution network is made up of a variety of components including pumps, storage facilities, valves, and pipes. The City water system must be capable of responding to daily and seasonal variations in demand while concurrently providing adequate capacity for firefighting and other emergency needs. In order to meet these goals, each of the


SURROUND
Spanish Fork
UTAH
YOURSELF
SPANISH FORK CITY
DRINKING WATER MASTER PLAN
FIGURE I-1
EXISTING SYSTEM
N
0 0.3 0.6 1.2
Miles
Legend
Pipe Sizes
Valve or PRV
Well
Pump
Reservoir
Tank
City Boundary
< 4 inches
4 inch
6 inch
8 inch
10 inch
12 inch
14 inch
16 inch
18 inch
20 inch
21 inch
24 inch
30 inch
US 89
STATE ST
EXPRESSWAY LN
HWY 51
MAIN ST
400 N
HWY 147
6400 S
CENTER ST
6800 S
100 S
300 S
I-15
1550 W
HWY 115
900 S
CANYON RD
2550 East Well
US 6
ARROWHEAD TRAIL ST
Malcomb Booster Pumps
8000 S
1700 East Well
Malcomb Tanks
Oaks Pump Station
& PRV
HWY 198
POWERHOUSE RD
Malcomb Pump Station
Oaks Tanks



HWY 77
00 S
Spanish Fork City
Cold Springs Pump Station
Lower Cold Springs
Sterling Hollow Tanks
Upper Cold Springs
US 6
Crab Creek Transmission Line
Pressure Sustaining Valve
Crab Creek Springs
SURROUND
Spanish Fork
UTAH
YOURSELF
SPANISH FORK CITY
DRINKING WATER MASTER PLAN
FIGURE I-2
EXISTING CANYON SYSTEM
N
0
0.65
1.3
2.6
Miles
Legend
Pipe Sizes
Valve or PRV
Well
Pump
Reservoir
Tank
< 4 inches
4 inch
6 inch
8 inch
10 inch
12 inch
14 inch
16 inch
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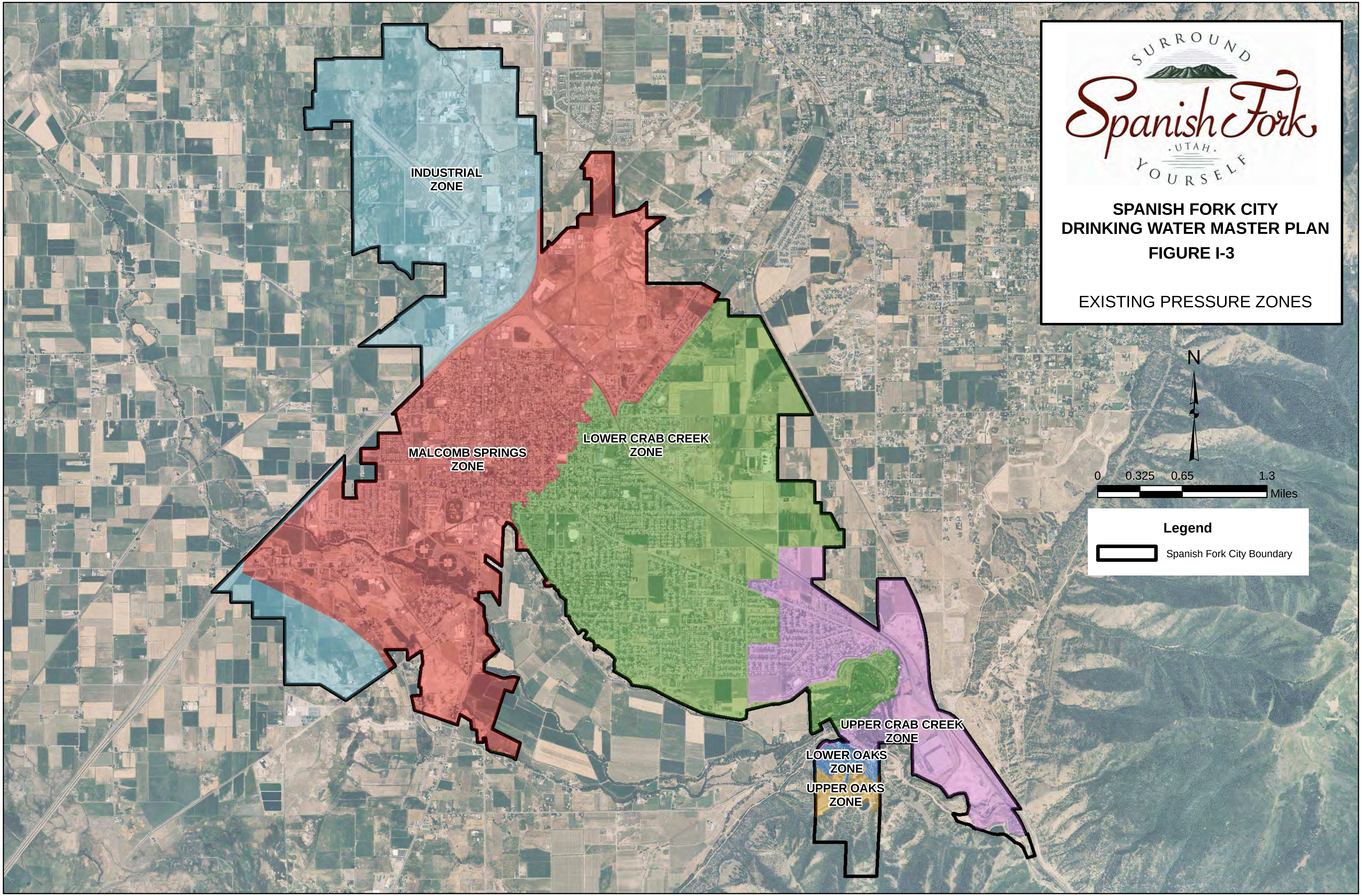
20 inch
21 inch
24 inch
30 inch


SURROUND
Spanish Fork
UTAH
YOURSELF
SPANISH FORK CITY
DRINKING WATER MASTER PLAN
FIGURE I-3
EXISTING PRESSURE ZONES
INDUSTRIAL ZONE
MALCOMB SPRINGS ZONE
LOWER CRAB CREEK ZONE
UPPER CRAB CREEK ZONE
LOWER OAKS ZONE
UPPER OAKS ZONE
N
0 0.325 0.65 1.3
Miles
Legend
Spanish Fork City Boundary

distribution system components must be designed and operated properly. Furthermore, careful planning is required in order to ensure that the distribution system is capable of meeting the City's needs over the next several decades.

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 of Spanish Fork's build-out water demand was estimated by applying this process throughout the Policy Declaration Boundary for the City.

In order to facilitate the analysis of Spanish Fork's 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 AND PERFORMANCE FINDINGS

Summaries of the key water system design criteria and performance findings for the Spanish Fork City drinking water system are included in Table I-1. The design criteria were used in evaluating system performance and in recommending future water system improvements. Table I-2 presents the design flows analyzed in the drinking water model.

TABLE I-1
KEY SYSTEM DESIGN CRITERIA

	CRITERIA	2010 EXISTING REQUIREMENTS	ESTIMATED BUILD-OUT REQUIREMENTS
EQUIVALENT RESIDENTIAL CONNECTIONS	Calculated	12,031	27,488
SOURCE			
Peak Day Demand	State Requirements	6,716 gpm	15,490 gpm
Average Yearly Demand	State Requirements	5,419 ac-ft	12,497 ac-ft
STORAGE			
Equalization	State Requirements	4.8 MG	11.2 MG
Fire Suppression	Highest fire flow volumes	3.2 MG	3.2 MG
Total		8.0 MG	14.4 MG
DISTRIBUTION			
Peak Instantaneous	Measured Flow Ratio	10,000 gpm	23,200 gpm
Minimum Fire Flow	@ 20 psi	1,000 gpm	1,000 gpm
Max Operating Pressure	City Preference	125 psi	125 psi
Min. Operating Pressure	City Preference	50 psi	50 psi

TABLE I-2
DESIGN FLOW SUMMARY

DEMAND	INDOOR DEMAND PER ERC	OUTDOOR + INDOOR DEMAND PER ERC	TOTAL EXISTING DEMAND	TOTAL BUILD-OUT DEMAND	FLOW RATIO
Average Day	0.28 gpm	0.56 gpm	3,360 gpm	7,748 gpm	1.0
Peak Day	0.56 gpm	1.11 gpm	6,716 gpm	15,490 gpm	2.0
Peak Instantaneous	0.83 gpm	1.67 gpm	10,000 gpm	23,200 gpm	3.0

CHAPTER II

CONNECTIONS

EXISTING CONNECTIONS

According to billing records obtained for years 2007 through 2010, the Spanish Fork distribution network contains a total of 9,124 billed connections. In order to provide a convenient basis for comparing the demands in each zone, the billing data was used to calculate Equivalent Residential Connections (ERCs). An ERC is a measure used in comparing water demands from non-residential connections to residential connections. By definition, a residential connection represents 1 ERC. Spanish Fork ERC calculations were based on the demand data available for the Lower Crab Creek pressure zone because the demands in that zone are primarily residential. During August 2010 the average demand per connection within the Lower Crab Creek Zone was 0.19 gpm/conn. By dividing the total Spanish Fork demand by the Lower Crab Creek Zone per connection demand, the total number of existing ERCs was computed to be **12,031**. Demand allocation within the model distribution network was performed using GIS. Billing addresses were used to link monthly meter demand data to meter locations. In this way, demands within the distribution system model were allocated based on actual usage. Table II-1 provides a listing of the total existing ERCs located within each pressure zone.

TABLE II-1
EXISTING ERCS

PRESSURE ZONE	ERCs
Industrial	1,843
Malcomb Springs	5,071
Lower Crab Creek	4,023
Upper Crab Creek	1,041
Lower Oaks	51
Upper Oaks	1
TOTAL	**12,031**

CONNECTIONS PROJECTED AT BUILD-OUT

Spanish Fork City has more undeveloped land within the Policy Declaration Boundary than developed land. As part of the build-out analysis, it was necessary to determine the additional demand that will be contributed by the currently undeveloped areas as the City expands. This was accomplished on a per zone basis by determining the existing ERC density of each pressure zone and assuming that same density for the undeveloped areas to calculate build-out ERCs for each zone. The amount of undeveloped land remaining in each pressure zone was determined by reviewing an aerial image of the area within the City’s Policy Declaration Boundary. Table II-2 provides a summary of the build-out ERCS projected for each pressure zone.

TABLE II-2
BUILD-OUT ERCS

PRESSURE ZONE	ERC
Industrial	8,658
Malcomb Springs	7,722
Cold Springs	5,195
Lower Crab Creek	2,293
Upper Crab Creek	3,159
Lower Oaks	187
Upper Oaks	234
TOTAL	**27,448**

CHAPTER III

SOURCES

EXISTING SOURCES

The following paragraphs outline the water rights owned by the City of Spanish Fork along with the corresponding sources. A summary of Spanish Fork water rights for the drinking water system is shown in Table III-1.

TABLE III-1
SUMMARY OF SPANISH FORK WATER RIGHTS

Water Right Number	Flow (gpm)	Volume (ac-ft)	Status	Use	Source
51-1200	9,355	10,468	Approved (a26429)	Municipal	Wells
51-1250					
51-1495					
51-1552					
51-1559					
51-1560					
51-1561					
51-1563					
51-1739					
51-1751					
51-2016					
51-2328					
51-3483					
51-5523	214	345	Certified	Municipal	Cold Springs
51-6298	2,020[1]	3,258	Decree	Municipal	Malcomb Springs
51-6497	1,501	2,421	Decree	Municipal	Cold Springs
51-6944	2,222[1]	3,584	Certified	Municipal	All Springs
51-7805	220	355	Approved (a27887)	Municipal	All Springs

1. Water rights 51-5523, 51-6221, 51-6298, and 51-6944 vary depending upon the flow in the Spanish Fork River

The water rights listed in Table III-1 sum to approximately 15,532 gpm and 20,431 acre-feet. However, several of the wells under water right a26429 are used within the City's pressurized irrigation system and are not approved for use in the drinking water system. The water under this water right can be used in either the PI or drinking water system. Individual wells, however, are required to be DDW approved to be used in the drinking water system. Table III-2 provides a listing of the drinking water approved sources, along with the associated water rights.

TABLE III-2
WATER RIGHTS ASSOCIATED WITH ACTIVE DRINKING WATER SOURCES

Number	Flow (gpm)	Volume (ac-ft)	Priority Date	Drinking Water Sources (Minimum Reliable Flow)				
				Crab Creek (1,400 gpm)	Cold Springs (4,000 gpm)	Malcomb Springs (2,300 gpm)	1700 E Well (1,700 gpm)	2550 E Well (1,000 gpm)
WR 51-6944	1,005 – 2,222[1]	3,584	1853	X	X	X		
WR 51-7805	220	355	2003	X	X	X		
WR 51-6497	1,501	2,421	1951		X			
WR 51-5523	214	345	1983		X			
WR 51-6298	987 - 2,020[1]	3,258	1902			X		
a26429[2]	9,355	10,468	2002				X	X

1. Flow allowed for water rights 51-6944, 51-6221, 51-5523, and 51-6298 are dependent upon the flow in the Spanish Fork River.
2. Change application a26429 includes the following water rights: 51-1200, 51-1250, 51-1495, 51-1552, 51-1559, 51-1560, 51-1561, 51-1563, 51-1739, 51-1751, 51-2016, 51-2328, and 51-3483.

The total physical source capacity of all the drinking water system sources is 10,400 gpm and about 14,000 ac-ft/year. Currently Cold Springs is being redeveloped and is not available to the drinking water system. This reduces the total current source capacity to 6,400 gpm and about 7,700 ac-ft/year. The water rights for Cold Springs do not cover the physical capacity of Cold Springs. It is recommended that the City move additional Strawberry Project water (similar to water right 51-6497) or move additional canal company irrigation stock (similar to water right 51-5523) to Cold Springs. The amount moved should be enough to cover the full capacity of the springs including the full developed capacity of Cold Springs. It is anticipated that this should be an additional 1,000 to 4,000 gpm and 1,600 to 6,450 ac-ft/year.

It is recommended that the City continue to monitor and perfect water rights and shares as land in Spanish Fork City is developed. It is also recommended that redundancy be incorporated into the drinking water system so that the drinking water system is able to meet all of the demand objectives at build-out with a major source unavailable.

Wells and Booster Stations

There are two wells and four pump stations in the Spanish Fork drinking water system. Figure I-1 shows the location of the wells and pump stations. An analysis of past electricity costs for each pumping facility was conducted to gain a better understanding of how much each water from each source costs. Understanding that it costs 2.6 times more to pump water from the 2550 East well than it does to pump water from Malcomb Springs can help the City use less expensive water first. The pumping capacity and pumping cost for each drinking water system well and pump station is found in Table III-3.

TABLE III-3
EXISTING WELLS AND BOOSTER PUMP STATIONS

Pump Station Name	Pumping Capacity (gpm)	Electric Pumping Cost (cost per gpm per month)
Malcomb Springs Pump Station*	3,000	$1.67
Cold Springs Booster Pump Station	4,000	$2.50
Malcomb Booster Pump Station	2,500	$2.50
Oaks Booster Pump Station	900	$2.50
1700 East Well	1,700	$3.60
2550 East Well	1,000	$4.38

*Pump station is planned to be transferred to City Power and costs will be $0.84 per gpm per month.

EXISTING SOURCE REQUIREMENTS

DDW standards require that distribution network water sources must be able to meet the expected water demand for two conditions: peak day demand and average yearly demand. Each of these criteria will be addressed in the following paragraphs.

Existing Peak Day Demand

Peak day demand is the water demand on the day of the year with the highest water use and is used to determine the required source capacity under existing and build-out conditions. The two primary descriptors in characterizing peak day demand are the diurnal demand curve and average peak day demand. The peak day diurnal curve, in non-dimensional form, is shown on Figure III-1 and was obtained by dividing the instantaneous flow values by the daily average flow. The measured peak month average demand was found to be 0.19 gpm/ERC, which corresponds to a total flow of 2,358 gpm. Production data for the peak month, however, has been over 3,000 gpm. Peak day water demand is about 20 percent higher than peak month based on production data. Over the last couple of years the City has had up to 40 percent unaccounted water use. It is most likely due to water leakage in transmission lines and pipelines in the distribution system. It is recommended that the City work to find leaks and other sources of unaccounted water loss in the drinking water system and repair them. Using the DDW requirements for peak day demand of 800 gpd per ERC gives a total existing peak day demand requirement of 6,716 gpm. This demand requirement is sufficiently conservative to account for variability of the peak day demand, unaccounted water, safety factor, and source redundancy. 6,716 gpm is at least 60 percent higher than actual demand even with the high unaccounted water.

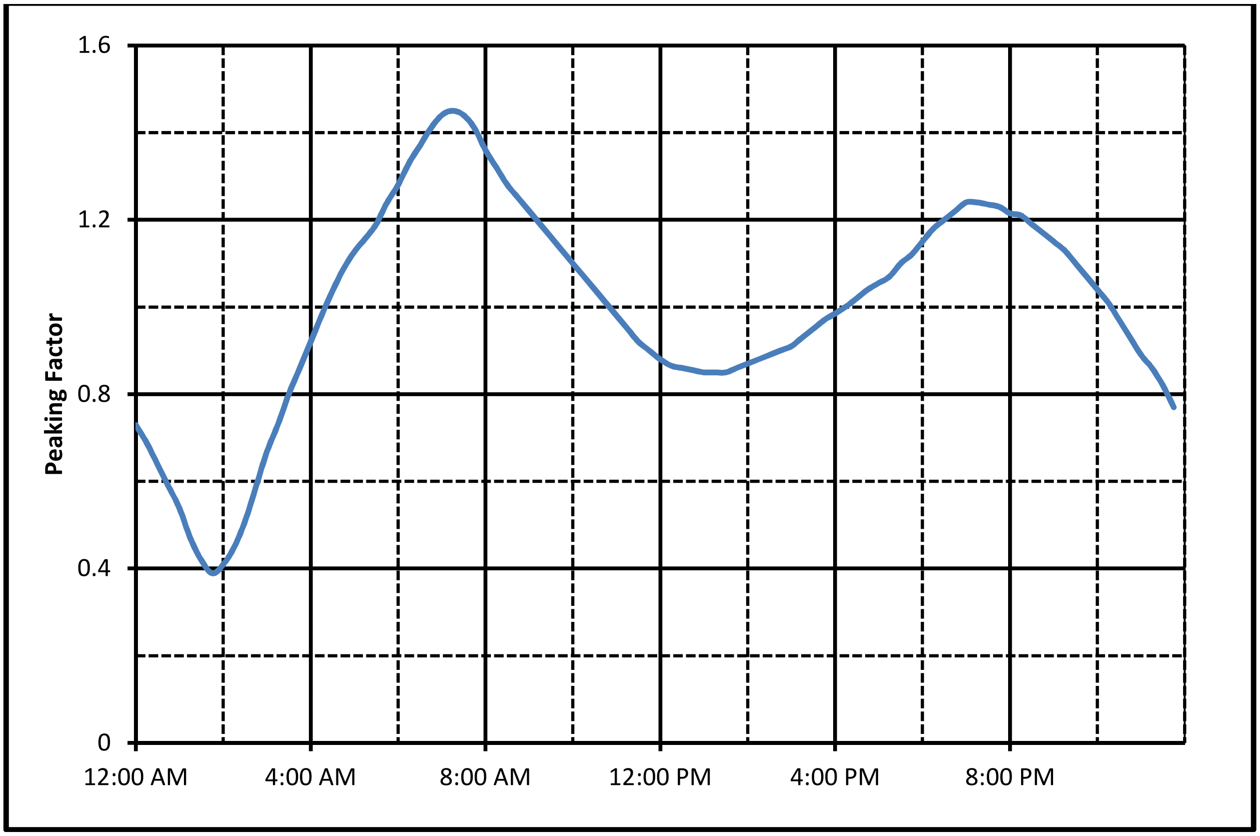


FIGURE III-1: PEAK DAY DIURNAL CURVE FOR SPANISH FORK CITY

In general, demand is elevated during the day with primary and secondary peaks occurring at about 7:00 AM and 7:00 PM, respectively. The minimum demand occurs just before 2:00 AM. The diurnal curve was used in both the existing and future hydraulic computer models.

Existing source requirements and capacities for each pressure zone are summarized in Table III-4. The “ERCs” and “Peak Day Demand (gpm/ERC)” columns are the number of ERCs in each pressure zone and the average demand per ERC, respectively, both as outlined previously. The “Peak Day Demand (gpm)” column is the average demand estimated for each zone on the peak day. The “Average Yearly Demand (gpd/ERC)” column is the average demand per ERC as outlined previously. The “Average Yearly Demand (Ac-Ft/Year)” column is the average yearly demand estimated for each zone.

TABLE III-4
EXISTING SOURCE REQUIREMENTS

Zone	ERCs[1]	Peak Day Demand [2] (gpm/ERC)	Peak Day Demand (gpm)	Average Yearly Demand [2] (gpd/ERC)	Average Yearly Demand (Ac-Ft/Year)
Industrial	1,843	0.56	1,025	400	826
Malcomb Springs	5,071	0.56	2,819	400	2,274
Lower Crab Creek	4,023	0.56	2,237	400	1,804
Upper Crab Creek	1,041	0.56	579	400	467
Lower Oaks	51	1.11[3]	56	800[3]	46
Upper Oaks	1	1.11[3]	1	800[3]	3
TOTAL	**12,031**	**NA**	**6,716**	**NA**	**5,419**

1. ERCs were calculated as noted previously.
2. Demands are based on DDW requirements for peak day indoor demands and outdoor demands.
3. The demand per ERC for the Crab Creek Lower Oaks and Crab Creek Upper Oaks zones is higher because homes in these zones are not served by the City's pressurized irrigation system.

Approximately **6,716** gpm is required to meet the existing peak day demands of Spanish Fork City according to DDW requirements. As presented above, the current source capacity without Cold Springs is 6,400 gpm. It is therefore recommended that Cold Springs be developed and put back into the drinking water system as soon as possible.

In addition to the physical capacity and water right flow rate restrictions, several of the water rights owned by Spanish Fork City also have volumetric restrictions. The volumetric limitations will be reviewed in the following section.

Existing Average Yearly Demand

Water utilities must also be able to supply the average yearly demand. Average yearly demand is the average volume of water used over the course of one year. Based on water use data for April 2007 through April 2010, the average yearly demand for Spanish Fork City was about 2,700 ac-ft. DDW average yearly demand requirement is 400 gpd, 0.28 gpm, or about 0.45 ac-ft per ERC. This produces a total existing average yearly demand requirement of 5,419 ac-ft/year. Even without Cold Springs, water rights and volume capacities of sources associated with drinking water sources sum to 7,700 ac-ft/year. Therefore, under existing conditions the City owns sufficient water rights and sources capable of meeting the annual volume of water required by DDW.

BUILD-OUT SOURCE REQUIREMENTS

As with existing water source requirements, future water source needs were evaluated on the basis of peak day demand and average yearly demand. Each requirement is addressed separately in the following paragraphs.

Build-Out Peak Day Demand

Table III-5 provides a summary of the build-out source requirements for Spanish Fork City with columns as previously defined. The projected total peak day demand at build-out is **15,490 gpm** for all pressure zones. Even with Cold Springs redeveloped for the drinking water system, total source capacity will be between 12,000 and 16,000 gpm. It is recommended that the City continue to develop well sources with the existing City ground water rights as additional sources are needed.

TABLE III-5
BUILD-OUT SOURCE REQUIREMENTS

Zone	ERCs[1]	Peak Day Demand [2] (gpm/ERC)	Peak Day Demand (gpm)	Average Yearly Demand [2] (gpd/ERC)	Average Yearly Demand (Ac-Ft/Year)
Industrial	8,658	0.56	4,814	400	3,882
Malcomb Springs	7,722	0.56	4,293	400	3,463
Cold Springs	5,195	0.56	2,888	400	2,329
Lower Crab Creek	2,293	0.56	1,275	400	1,028
Upper Crab Creek	3,159	0.56	1,756	400	1,417
Lower Oaks	187	1.11[3]	206	800[3]	168
Upper Oaks	234	1.11[3]	257	800[3]	210
TOTAL	**27,448**	**NA**	**15,490**	**NA**	**12,497**

1. ERCs were calculated as noted previously.
2. Demands are based on DDW requirements for peak day indoor demands and outdoor demands.
3. The demand per ERC for the Crab Creek Lower Oaks and Crab Creek Upper Oaks zones is raised because homes in these zones are not served by the City's pressurized irrigation system.

Build-Out Average Yearly Demand

Spanish Fork City's projected average annual demand at build-out is **12,497 ac-ft.** With Cold Springs redeveloped for the drinking water system, water rights and volume capacities of sources associated with drinking water sources sum to 14,000 ac-ft/year. Therefore, under build-out conditions the City owns sufficient water rights and sources capable of meeting the annual volume of water required by DDW.

It is recommended that redundancy be incorporated into the drinking water system so that the drinking water system is able to meet all of the demand objectives with a major source unavailable. It is further recommended that the City continue to develop well sources with existing ground water rights as additional sources are needed.

SOURCE RECOMMENDATIONS

The following is a list of recommendations presented in this chapter.

- It is recommended that the City move additional Strawberry Project water (similar to water right 51-6497) or move additional canal company irrigation stock (similar to water right 51-5523) to Cold Springs. The amount moved should be enough to cover the full capacity of the springs including the full developed capacity of Cold Springs. It is anticipated that this should be an additional 1,000 to 4,000 gpm and 1,600 to 6,450 ac-ft/year.

- It is recommended that the City continue to monitor and perfect water rights and shares as land in Spanish Fork City is developed. It is also recommended that redundancy be incorporated into the drinking water system so that the drinking water system is able to meet all of the demand objectives at build-out with a major source unavailable.

- It is recommended that redundancy be incorporated into the drinking water system so that the drinking water system is able to meet all of the demand objectives with a major source unavailable

- It is recommended that the City work to find leaks and other sources of unaccounted water loss in the drinking water system and repair them.

- It is recommended that the City continue to develop well sources with the City existing ground water rights as additional source is needed.

- It is recommended that Cold Springs be developed and put back into the drinking water system as soon as possible.

Currently, Cold Springs has several issues keeping it from being used in the drinking water system. The lower spring is adjacent to a pond that rises to a water level that approaches the level of the springs when the springs are not being pumped. This creates a situation where pond water can potentially migrate into the spring collection pipe. Even though replacing the collection pipe and adding a membrane barrier has greatly decreased the potential for cross contamination from the pond, the potential still exists. An overflow for the springs preventing the pond water level rising would further decrease the potential for cross contamination. Water quality tests of the sources of water to the Cold Springs area, including sources into the pond, indicate that all sources are ground water and do not appear to be influenced by surface water (see Appendix B for water quality test results). Therefore, the best possible solution for Cold Springs is to fill in the pond, develop all of the Cold Spring sources, and add an automatic overflow.

CHAPTER IV

STORAGE

EXISTING STORAGE

The City's current drinking water system includes three storage facility locations, each with two storage tanks. The highest storage tanks are two 125,000 gallon tanks that serve the Upper and Lower Oaks Zones. A 5 MG and 3 MG tank are located up Spanish Fork Canyon above Cold Springs in Sterling Hollow. The lowest two storage tanks, a 1 and 2 MG tank, are located at the mouth of Spanish Fork Canyon. The locations of storage facilities are shown on Figure I-1 and the elevations of the storage facilities are shown in Table IV-1.

TABLE IV-1
EXISTING STORAGE TANKS

Name	Type	Diameter (ft)	Volume (MG)	Outlet Level	Emergency Storage Level	Fire Suppression Level	Overflow/ Equalization Level
Sterling Hollow Tank 1	Concrete	150	3.0	4997.0 (0 feet)	5003.0 (6.0 feet)	5008.2 (11.2 feet)	5117.0 (20.0 feet)
Sterling Hollow Tank 2	Concrete	200	5.0	4997.0 (0 feet)	5003.0 (6.0 feet)	5008.2 (11.2 feet)	5118.0 (21.0 feet)
Malcomb Tank 1	Concrete	100	1.0	4795.0 (0 feet)	4801.1 (6.1 feet)	4809.4 (14.4 feet)	4820.0 (25 feet)
Malcomb Tank 2	Concrete	130	2.0	4795.0 (0 feet)	4801.1 (6.1 feet)	4809.4 (14.4 feet)	4820.0 (25 feet)
Oaks Tank 1	Concrete	50	0.125	5242.0 (0 feet)	5245.0 (3.0 feet)	5263.0 (21.0 feet)	5267.0 (25 feet)
Oaks Tank 2	Concrete	50	0.125	5242.0 (0 feet)	5245.0 (3.0 feet)	5263.0 (21.0 feet)	5267.0 (25 feet)

EXISTING STORAGE REQUIREMENTS

According to DDW standards, storage tanks must be able to provide: 1) equalization storage volume to make up the difference between the peak day flow rate and the peak instantaneous demand; 2) fire suppression storage volume to supply water for firefighting; and 3) emergency storage, if deemed necessary. Existing storage requirements for the Spanish Fork drinking 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. For the Oaks Zones, 800 gallons per ERC was calculated for indoor and outdoor equalization storage because the area is not served by the pressurized irrigation system. The total existing equalization storage requirement for the Spanish Fork City drinking water system was calculated to be **4.8 MG.** A summary of existing equalization storage requirements by pressure zone is included in Table IV-2.

TABLE IV-2
EXISTING STORAGE REQUIREMENTS

Zone	RECOMMENDED STORAGE REQUIREMENTS				Existing Storage (MG)	Remaining (MG)
	ERCs	Equalization (MG)	Fire Suppression (MG)	Total (MG)		
Industrial	1,843	0.74	2.00	4.77	5.00[1]	0.23
Malcomb Springs	5,071	2.03				
Lower Crab Creek	4,023	1.61	1.08	3.11	6.00[1]	2.89
Upper Crab Creek	1,041	0.42				
Lower Oaks	51	0.04	0.18	0.22	0.25	0.03
Upper Oaks	1	0.00				
TOTAL	**12,031**	**4.84**	**3.26**	**8.10**	**11.25**	**3.15**

1. Assuming 2.0 MG from Sterling Hollow Tanks reserved for the Malcomb Springs and Industrial Zones

Fire Suppression Storage

Fire suppression storage is required for water systems that provide water for firefighting. All residential homes were assumed to require a fire flow of at least **1,000 gpm for 2 hours.** Larger structures require larger fire flows with all fire flow requirements based on the International Fire Code and fire marshal recommendations. Working with Joe Jarvis, the Fire Marshall for Spanish Fork City, fire flows for the 50 largest buildings were identified (see Appendix C). Existing fire flow requirements by pressure zone are presented in Table IV-2 and Table IV-3.

In addition, the water system should be managed so that the storage volume dedicated to fire suppression is available to meet fire flow requirements whenever or wherever it is needed. This can be accomplished by designating minimum storage tank water levels that provide reserve storage equal to the fire suppression storage required. Even though it is important to utilize equalization storage, typical daily water fluctuations in the tanks should not be allowed below the minimum established levels except during fire or emergency situations.

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. Analysis of Spanish Fork City's water usage

TABLE IV-3
FIRE FLOW DEMAND BY PRESSURE ZONE

Zone	Required Fire Flow (gpm)	Fire Flow Duration (Hours)	Fire Flow Volume (MG)
Industrial	8,000	4	2.00
Malcomb Springs	6,000	4	
Lower Crab Creek	4,500	4	1.08
Upper Crab Creek	4,000	4	
Lower Oaks	1,500	2	0.18
Upper Oaks	1,500	2	

records and comparison with the storage recommendations outlined in Utah Administrative Code R309-510-8 suggest that Spanish Fork City has emergency storage included in the equalization storage recommendation.

BUILD-OUT STORAGE REQUIREMENTS

The storage volumes required at build-out are based on the same equalization and fire suppression requirements as were calculated for the existing conditions. The City's future storage requirements at build-out are presented in Table IV-4.

TABLE IV-4
BUILD-OUT STORAGE REQUIREMENTS

ZONE	RECOMMENDED STORAGE REQUIREMENTS				EXISTING STORAGE (MG)	REMAINING (MG)
	ERCs	Equalization (MG)	Fire Suppression (MG)	Total (MG)		
Industrial	8,658	3.46	2.00	8.55	5.50[1]	-3.05
Malcomb Springs	7,722	3.09				
Cold Springs	5,195	2.08	1.08	5.34	5.50[1]	0.16
Lower Crab Creek	2,293	0.92				
Upper Crab Creek	3,159	1.26				
Lower Oaks	187	0.15	0.18	0.58	0.25	-0.33
Upper Oaks	234	0.19				
TOTAL	**27,448**	**11.16**	**3.26**	**14.47**	**11.25**	**-3.22**

1. Assuming 2.5 MG from Sterling Hollow Tanks reserved for the Malcomb Springs and Industrial Zones

STORAGE RECOMMENDATIONS

Currently, Spanish Fork City has 11.25 MG of storage and a calculated storage requirement of 8.10 MG. Even though there is a surplus of 3.15 MG, the Malcomb Tanks have a shortage and the Sterling Tanks have a surplus. It is recommended that 2.5 MG of storage in the Sterling Tanks be reserved for the Malcolm Springs and Industrial Zones.

Under build-out conditions, storage deficiencies are projected for both the Oaks Tanks and the Malcolm Tanks. The state requirements for indoor equalization storage are quite conservative according to the model. It is therefore recommended that the City consider asking the DDW executive secretary for an exception from the equalization storage requirements. It is recommended that the storage situation be monitored as development occurs. According to the hydraulic model, a 5.0 MG storage tank replacing the Malcomb tanks when replacement is necessary would be sufficient for build-out. At least a 0.6 MG storage tank should replace the Oaks Tanks when they need replacement not only for increased equalization storage but also for more efficient pump operation.

CHAPTER V

DISTRIBUTION SYSTEM

EXISTING DISTRIBUTION SYSTEM

The distribution system consists of all pipelines, valves, fittings, and other appurtenances used to convey water from the water sources and storage tanks to the water users. The existing water system contains over 190 miles of distribution pipe ranging in size from 2 to 30 inches in diameter. Figure V-1 shows distribution of pipes by diameter.

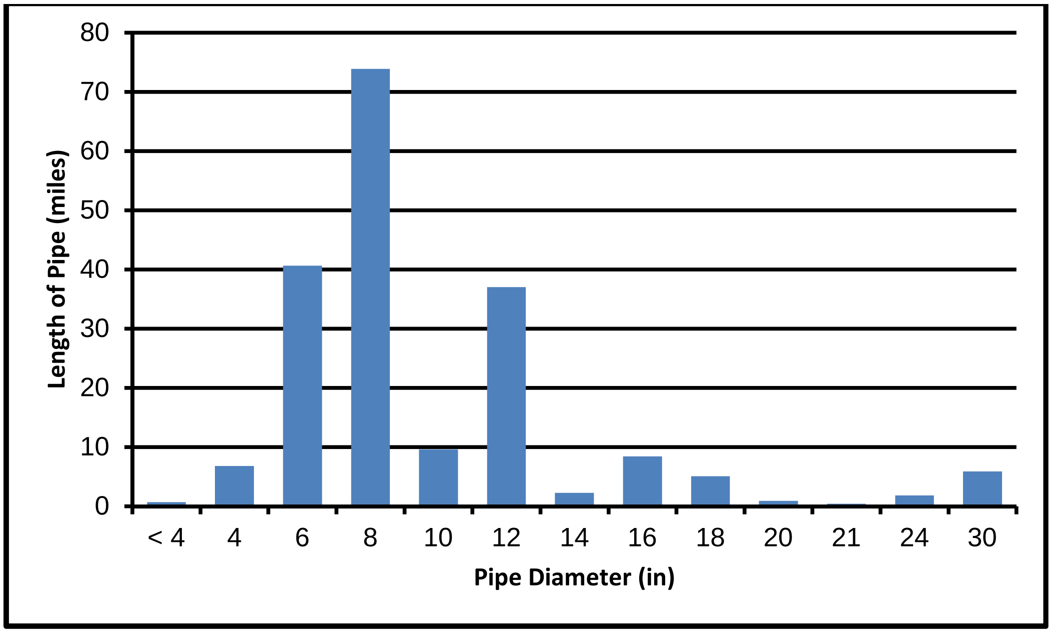


FIGURE V-1: LENGTH OF PIPE CATEGORIZED BY DIAMETER

The distribution system is comprised of 6 pressure zones and is shown in Figures I-1 and I-3.

EXISTING DISTRIBUTION SYSTEM REQUIREMENTS

Utah Administrative Code R309-105-9(1) applies to existing systems approved prior to January 1, 2007 and requires that distribution systems be able to maintain 20 psi at all points in the system during normal operating conditions and during conditions of fire flow and peak day demand. R309-105-9(2) adds the following minimum water pressure constraints: (a) 20 psi during conditions of fire flow and fire demand experienced during peak day demand; (b) 30 psi during peak instantaneous demand; and (c) 40 psi during Peak Day Demand. R309 105-9(2) applies to new systems approved after January 1, 2007 and to new areas or subdivisions of existing systems. Most of Spanish Fork is subject to R309-105-9(1); however, new developments will need to meet the criteria outlined by R309-105-9(2). The City prefers that the distribution system maintains pressures between 50 and 125 psi at all customer connections in the City under normal operating conditions including Peak Instantaneous, Peak Day, and Average Day.

Existing Peak Instantaneous Demand

Peak instantaneous demand is the highest demand on the peak day. The pipes in the distribution system must be large enough to convey the peak instantaneous demand while maintaining a pressure at connections between 50 and 125 psi. The peaking factor from the peak day average flow to peak instantaneous flow was estimated to be 1.45 based on flow data from the SCADA system (see Figure III-1). Applying this peaking factor of 1.45 to the peak day demand gives a total existing peak instantaneous demand of **10,000 gpm**.

Existing Peak Day Plus Fire Flow Demand

In accordance with DDW regulations, the distribution system must be capable of delivering fire flow to a specified location within the system while supplying the peak day demand to the entire distribution system and maintaining 20 psi minimum pressure at all delivery points within the distribution system. A minimum fire flow demand of **1,000 gpm** or more is required for all demand nodes in the system. Other than a small percentage of fire hydrants, most of the system can handle fire flows of at least 1,500 gpm. Larger fire flows are required at larger structures throughout the system based on the International Fire Code and recommendations from the Spanish Fork City Fire Marshall. The highest fire flow required in each zone is presented in Table IV-3. All fire flows were simulated under peak day demand conditions (see Chapter III for a complete explanation of peak day demand).

BUILD-OUT DISTRIBUTION SYSTEM REQUIREMENTS

The existing system requirements apply to the projected build-out system as well. As previously noted, the City prefers that the distribution system maintain pressures between 50 and 125 psi at all customer connections in the City under normal operating conditions and at least 20 psi during a fire flow.

Build-Out Peak Instantaneous Demand

Assuming the same peaking factor of 1.45 applies to the build-out peak day demand gives a build-out peak instantaneous demand of **23,200 gpm**.

Build-Out Peak Day Demand Plus Fire Flow

Peak day demand projected for build-out is discussed in Chapter III and presented by pressure zone in Table III-5. Once again, fire flow requirements for build-out conditions were unchanged from the conditions previously described for the existing conditions.

COMPUTER MODEL

A computer model of the City's water distribution system was developed to analyze the performance of the existing and future distribution system and to prepare solutions for existing facilities that cannot meet the DDW criteria for water system pressures. The software used for the model was EPANET 2.0. EPANET 2.0 is a computer program that models the hydraulic behavior of piping networks. The pipe, tank, and valve data used to develop the model were obtained from the GIS inventory water mains of the Spanish Fork City water system.

Computer models were developed for three phases of water system development. The first phase was the development of a model of the existing system (existing model). This model was used to calibrate the model and identify deficiencies in the existing system. A second model developed was used to identify those corrections necessary to improve existing system deficiencies (corrected existing model). The third phase was the development of a future model to indicate those improvements that will be necessary for the projected “build-out” condition (future model).

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 include elbows, bends, valves, pumps, and other operational elements. The default Darcy-Weisbach roughness coefficient used in the model was 1 milifeet, because of the abundance of old cast iron pipe. A coefficient of 0.1 was used on other pipes known to be PVC. 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 (a reservoir or PRV).

Pipe Network

As indicated previously, the pipe network layout was based upon the City’s GIS inventory. The computer model of the water distribution system is not an exact replica of the actual water system, although efforts were made to make the model as complete and accurate as possible. Pipeline locations used in the model are from the City’s GIS inventory. Service laterals were not included in the model and the locations of general valves are not represented in the model. Every other pipeline that was included in the GIS inventory was included, including the fire hydrant laterals and fire hydrants.

Demands

Water demands were located in the model based on billing data and billing address. The average yearly demand was determined for each billing address, and then the billing addresses were geocoded in order to link the demands to a physical location. Using GIS, the geocoded demands in gallons per minute were then assigned to the closest model demand node. Future demand was assigned to nodes in the future model which best represented the location of the anticipated demand by ERC.

The billed average day demands assigned to the demand nodes were then multiplied by a peaking factor that increased the total demand to the average day demand and peak day demand calculated from DDW requirements (3,360 gpm for average day and 6,716 gpm for peak day).

The pattern of how the demand changes over a 24 hour period is referred to as a diurnal or daily demand curve. The diurnal curve for average day was developed using data from the SCADA system and is shown in Figure V-2. The diurnal curve for peak day was developed using the SCADA system and modified to represent a more aggressive peak day with a peak instantaneous 1.45 times the peak day average. The peak day diurnal curve is presented in Figure III-1. The diurnal curves are used by the model to change the demand at each demand node for each time period to simulate how demand changes in the water system throughout the day.

In summary, the billing data was used for accurate demand distribution, production data (DDW standards) was used for demand volume, and data from the SCADA system was used to define how the demand varies throughout the day.

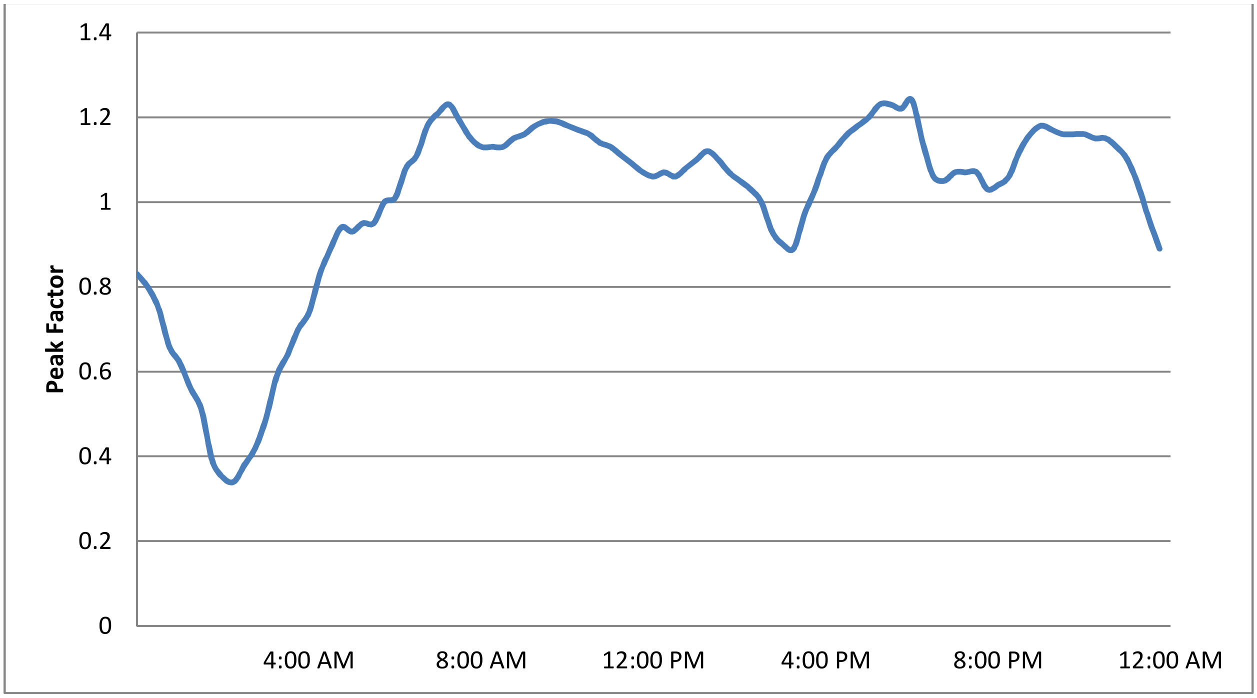


FIGURE V-2: AVERAGE DAY DIURNAL CURVE

Sources and Storage Tanks

The sources of water in the model are the wells and springs. Wells are represented with a reservoir to represent the ground water, a pump with a pump curve, and a pipe representing the pump column to the surface. Tank location, height diameter and volume are represented in the model. The extended period model predicts the levels in the tanks as they fill from sources and as they empty to meet demand in the system.

MODEL CALIBRATION

A water system computer model should be calibrated before it may be relied on to accurately simulate the performance of the distribution system. Calibration is a comparison of the computer results, field tests, and actual system performance. Field tests are accomplished by performing fire flow tests and pressure tests on the system. When the computer model does not match the field tests within an acceptable level of accuracy, the computer model is adjusted to match field conditions.

The extended period model was run for several days with the demand curve repeating every 24 hours in order for the model to be compared to how the actual system performs. Key indicators of the model performing correctly are the tanks filling and emptying in consistent and similar patterns without running empty, and pumps turning on and off at similar times.

The model was calibrated successfully with the use of fire flow, pressure tests, and system performance information from the SCADA system. Calibration data is found in Appendix D. It is recommended that City staff continue to conduct fire flow tests on an ongoing basis and review SCADA information to refine the model calibration as system conditions change.

ANALYSIS METHODOLOGY

The extended period EPANET 2.0 model was used to analyze the performance of the water system with current and projected future demands. An extended period model is actually a static model run many times, once for each time step. Like a movie is made up of individual pictures put together in a time series, the results of the extended period model can be viewed over time to watch how the system responds to changes in demand. The extended period model was used to analyze the worst case conditions in the system, analyze system controls and operation, analyze performance of the system over time, analyze system recommendations, analyze the water system for system optimization recommendations, and analyze the system for water quality. System recommendations for existing conditions and future conditions at build-out were checked with the extended period model to confirm adequacy.

Three extreme operating conditions analyzed with the model were high pressure conditions, peak instantaneous conditions, and peak day plus fire flow conditions. Each of these conditions is a worst-case situation so the performance of the distribution system may be analyzed for compliance with DDW and Spanish Fork City's requirements. Each operating condition is discussed in more detail below.

High Pressure Conditions

Low flow or 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 tend to be 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 condition that can also cause high pressures in the City's water system occurs when demand is low and pumps and wells are on to fill storage tanks. During times of low demand, the pumps increase the pressure in the system high enough to reverse the flow coming from the tanks. The highest pressures are reached when pumps are on, tanks are almost full, and demand is low. Both of these high pressure conditions were simulated with the model. The City prefers that maximum pressures be kept below 125 psi.

Peak Instantaneous Demand Conditions

Peak Instantaneous demand conditions can sometimes be the worst-case scenario for low pressures throughout a water distribution system. The water system reaches peak instantaneous demand conditions during the hottest days of the summer when water use is the highest. The high demand creates high velocities in the distribution pipes which reduces pressure. DDW requires the pipes in the distribution system to be capable of delivering peak instantaneous demand to the entire service area and maintain a minimum pressure of 30 psi at any service connection within the distribution system. Usually, minimum pressures of 30 psi at peak instantaneous demand are too low for customer satisfaction; hence, the City prefers a minimum pressure of 50 psi under this condition.

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 is often the worst-case scenario for the lowest pressures for specific locations in the system. This condition occurs when fire hydrants are being used on a day of high water demand. The distribution system must 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. In accordance with the recommendations from the Spanish Fork City Fire Marshal, the required fire flow of at least 1,000 gpm must be delivered while maintaining 20 psi minimum residual pressure at the delivery point and to all service connections within the distribution system. In addition, specific locations in the water system must have higher fire flows due to the nature of the development in those areas. The highest fire flow applied in each pressure zone is in Table IV-3.

While the computer analysis is useful for providing an indication of the fire flow capacity, it should not replace physical fire flow tests at fire hydrants as the primary method of determining fire flow capacity.

CONTINUED USE OF THE COMPUTER PROGRAM

It is recommended that the City continue updating the model as the water system changes. Below is a list of ways in which the model could help the City with water system management. The computer model can assist City staff in determining:

- Effect of new development on the system
- Efficient system operation
- Effect on the system if individual system facilities are added or taken out of service
- Selection of pipe diameters and location of proposed water mains
- Capacity of the water system to provide fire flows in specific areas
- Water age for water quality monitoring

The computer model should be maintained for future use. Necessary data required for continued use of the program are:

- The location, length, diameter, pipe material, and ground elevation at each end of each new pipeline constructed
- Changes in water supply location and characteristics
- Location and demand for new connections

RESULTS

Generally speaking, the computer model showed that the distribution system performs quite well in both existing and future scenarios. The only location with pressures less than 50 psi during peak instantaneous demand conditions is at the top of Upper Oaks Zone. This can easily be remedied by increasing the Spanish Oaks East PRV pressure setting to 110 psi. This also resolves a fire flow issue at the highest fire hydrant in the Upper Oaks Zone.

The remaining system deficiencies are related to fire flow. The Spanish Fork City distribution system contains a number of 4-inch and 6-inch pipelines which may not supply adequate fire flow. Also, a few older buildings in Spanish Fork City are not built to more recent buildings codes. With these combinations of factors, a few buildings in Spanish Fork City are deficient in terms of available fire flow. In general, the fire flow deficiencies can be resolved by installing larger pipelines. Projects are recommended to increase the fire flow at several locations in the system.

Several energy inefficiencies were identified by the extended period computer model. The existing system is set up to pump a majority of the water to the Sterling Tanks elevation and then allow the water to flow down to the lower pressure zones through PRVs. Significant energy savings could be realized by using the water already at the highest pressure at the lowest cost (Crab Creek Springs) for the highest zones. Then, instead of pumping water to a higher head when it is used at a low head anyway, use the lowest head water to meet the lowest head demands. A significant portion of the system demand is at a lower head currently and a majority of new development will also be at the lower elevations. Projects are recommended to facilitate the reduction of inefficiencies in the drinking water system.

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 evaluate the performance of the various components of the distribution system. Results from the model are available on a CD in Appendix E. Due to the large number of pipes and nodes in the model, it is impractical to prepare a figure which illustrates pipe numbers and node numbers. The reader should refer to the CD to review model output.

Recommendations for future pipelines, PRVs, and solutions to correct fire flow deficiencies are given below under Distribution System Recommendations.

DISTRIBUTION SYSTEM RECOMMENDATIONS

Distribution system recommendations provide solutions for existing deficiencies and define improvements to provide capacity for future growth. Recommendations are discussed in order of priority.

Crab Creek Transmission Line

The first priority distribution recommendation is the Crab Creek transmission line. A second transmission line down Spanish Fork Canyon connecting the spring sources and Sterling Hollow storage tanks with the water system resolves several immediate issues. First, Cold Springs needs a way to drain by gravity to ensure the springs do not backup and compromise water quality. Second, the existing transmission line is having corrosion problems and has had several failures in the recent past. The new Crab Creek transmission line will serve as a redundant transmission line greatly reducing the risk of unexpectedly losing the City’s main source of water and storage for an extended period of time. It will also allow the opportunity to repair and rehabilitate the existing line without taking the spring sources and storage offline. Dedicating the existing transmission line to Cold Springs allows the pressure to be reduced by 55 psi. Relieving the pressure in the aging pipe reduces the risk of pipe failure and reduces water leakage. Third, with the new transmission line conveying higher pressure water from the storage tanks, Cold Springs would be able to supply water to lower pressure zones in the system by gravity. Eliminating the need to pump Cold Springs has the potential to save the City over $100,000 a year in pumping costs. Fourth, the City will be able to use Cold Springs in the pressurized irrigation system when it is not needed in the drinking water system. Currently Cold Springs cannot be used in the drinking water system while the springs are being developed. It would be more efficient to use Cold Springs in the pressurized irrigation system by gravity rather than use more expensive water that has to be pumped once or twice.

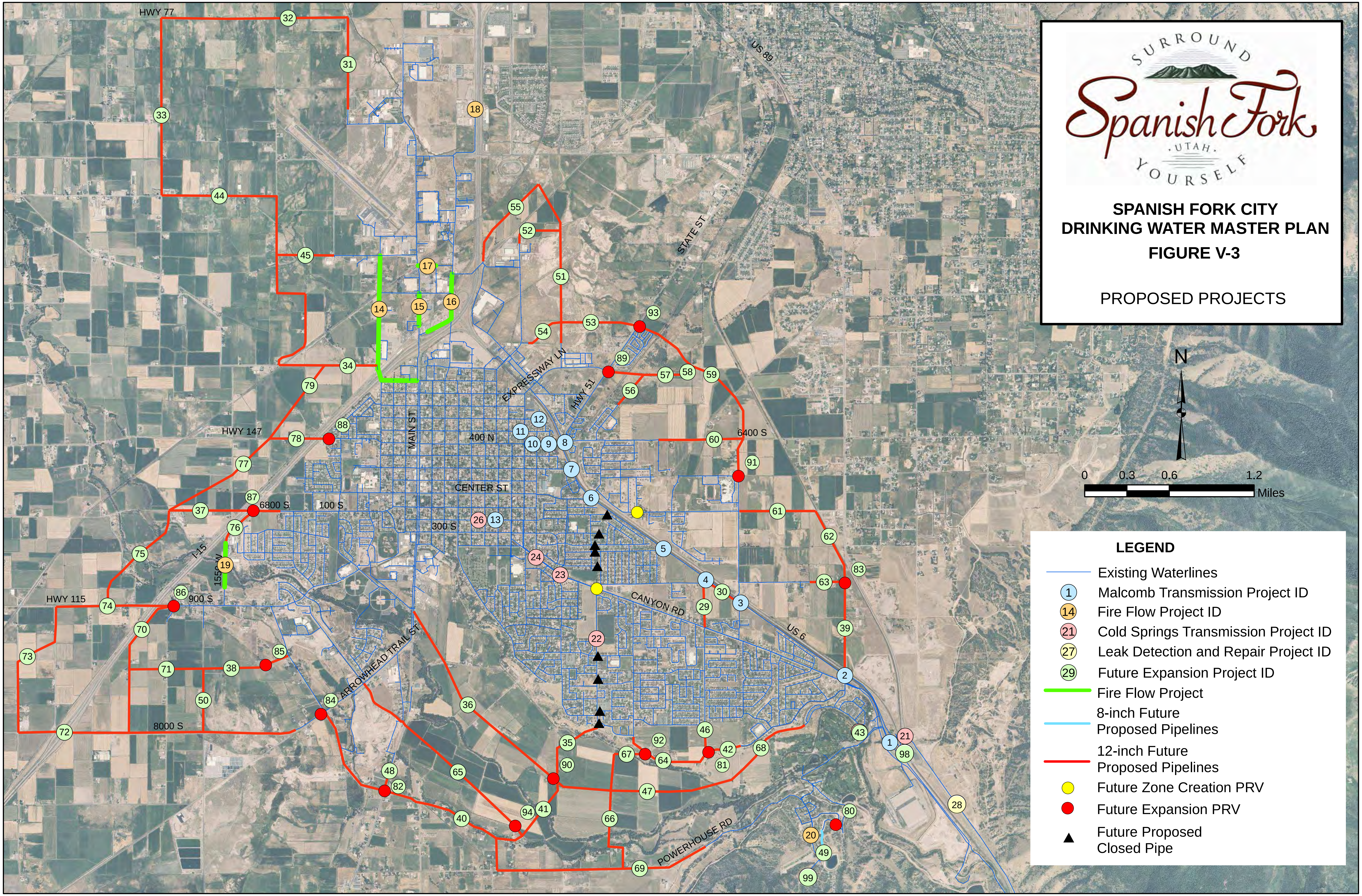
Malcomb Transmission Projects

The new Crab Creek transmission line allows for a way to get the water to the City by gravity, but there are a few additional projects that have to be completed to be able to disconnect Cold Springs from the drinking water system and allow it to be used in the pressurized irrigation system. In summary, the projects allow the Malcomb transmission line to switch from the 21 to 18-inch in Canyon Road to the 30 to 24-inch in Highway 6. This allows the 21 to 18-inch to be used to gravity feed Cold Springs water to the lower pressurized irrigation system zone and gives the Malcomb storage much needed transmission capacity to the Malcomb and Industrial

Zone. This set of projects is called the Malcomb Transmission Projects. These projects are identified in Table V-1 and are located on Figure V-3.

TABLE V-1
PROPOSED MALCOMB TRANSMISSION PROJECTS

MAP ID	LOCATION	DESCRIPTION	PROJECT
1	3750 E Highway 6 (Malcomb Tanks)	Allows Cold Springs water to be used in PI system, Connects the system to the Sterling Tanks with a new transmission line, Increases the transmission capacity of low pressure water to the lower pressure zones	Complete new 24-inch Crab Creek Transmission Line. Disconnect the Malcomb tank outflow from the 21-inch line and connect to the downstream 30-inch line, Connect the upstream 30-in transmission line to the 21-inch line
2	Intersection of 3400 E (Canyon Crest Drive) and Highway 6	Isolation of 30-inch line	Close the 24-inch pipeline in 3400 E from the 30-inch pipeline in Highway 6
3	2550 E Highway 6	Isolation of the 30-inch line while maintaining redundancy by connecting the 8-inch and 20-inch pipelines.	Close or disconnect the 8-inch and 20-inch lines in 2550 E from 30-in pipeline in Highway 6, connect the 8-in line to the 20-in line using the existing PRV station
4	750 S Highway 6	Isolation of 30-inch line	Close 8-inch pipeline in 750 S from the 30-inch pipeline in Highway 6
5	500 S Highway 6	Isolation of 30-inch line	Close the 8-inch pipeline in 500 S from the 30-inch pipeline in Highway 6
6	Intersection of Highway 6 and Center Street	Isolation of the 30-inch line while maintaining redundancy by connecting the 12-inch and 10-inch pipelines.	Disconnect the 12-inch and 10-inch pipelines from the 30-inch pipeline at the intersection of Center Street and Highway 6. Connect the 12-inch line to the 10-inch line
7	200 N Highway 6	Isolation of 30-inch line	Close the 12-in line in 200 N just west of Highway 6
8	400 N Highway 6	Provide redundancy and improve fire flows to northeastern areas of City	Install a check valve in the 8-inch line in 400 E just east of Highway 6
9	400 N 1000 E	Zone boundary realignment	Close valve in 4-inch line in 100 E just south of 400 N
10	400 N 900 E	Zone boundary realignment	Close valve on 12-inch line in 900 E just south of 400 N
11	500 N 800 E	Zone boundary realignment	Open Valve in 500 N just east of 800 E
12	600 N 900 E	Zone boundary realignment	Open 8” Valve in 600 N near 900 E
13	500 E 200 S	Improve fire flow to southwestern portion of City, Allows Cold Springs water to be used in the PI system	Install 10-inch PRV at 500 E 200 S in 12-inch line. Disconnect the 18-inch transmission line and connect to the PI system


SURROUND
Spanish Fork
UTAH
YOURSELF
SPANISH FORK CITY
DRINKING WATER MASTER PLAN
FIGURE V-3
PROPOSED PROJECTS
HWY 77
US 89
STATE ST
EXPRESSWAY LN
HWY 51
MAIN ST
400 N
CENTER ST
100 S
300 S
6800 S
6400 S
HWY 147
I-15
1550 W
900 S
HWY 115
CANYON RD
US 6
ARROWHEAD TRAIL ST
8000 S
POWERHOUSE RD
N
0 0.3 0.6 1.2
Miles
LEGEND
Existing Waterlines
1 Malcomb Transmission Project ID
14 Fire Flow Project ID
21 Cold Springs Transmission Project ID
27 Leak Detection and Repair Project ID
29 Future Expansion Project ID
Fire Flow Project
8-inch Future Proposed Pipelines
12-inch Future Proposed Pipelines
Future Zone Creation PRV
Future Expansion PRV
Future Proposed Closed Pipe

Fire Flow Projects

The Spanish Fork City distribution system contains a number of 4-inch and 6-inch pipelines which may not supply adequate fire flow. Also, a few older buildings in Spanish Fork City are not built to more recent buildings codes. With these combinations of factors, a few buildings in Spanish Fork City are deficient in terms of available fire flow. In general, the fire flow deficiencies can be resolved by installing larger pipelines. Table V-2 lists projects and Figure V-3 shows the location of projects which will resolve the identified fire flow deficiencies in the system.

TABLE V-2
PROPOSED FIRE FLOW PROJECTS

MAP ID	LOCATION	DESCRIPTION	PROJECT
14	300 W between 900 N and 1900 N and 900 N between 300 W and Main Street	Improve fire flows	Install 4,700 feet of 12-inch pipe in 300 W between 900 N and 1900 N and 1,400 feet of 12-inch pipe in 900 N between 300 W and Main Street
15	Main Street between 1380 N and 1600 N	Improve fire flows	Install 1,200 feet of 16-inch pipe in Main Street between 1380 N and 1600 N
16	Industrial Park Drive between 45 N and 200 E and 200 E between 1300 N and 1750 N	Improve fire flows to industrial buildings along Industrial Park Drive and 200 E and abandon the 4-inch pipeline in 200 E under I-15	Install 1,050 feet of 8-inch pipe in Industrial Park Drive between 45 N and 200 E and 1,600 feet of 8-inch pipe in 200 E between 1300 N and 1750 N
17	150 E to Main Street at 1800 N	Improve fire flows	Install 700 feet of 10-inch pipe in from 1800 N and 150 E directly east to 1800 N and Main Street
18	300 E and 3100 N	Provide backup fire flow and emergency capacity to and from Springville City	Install a two-way PRV and meter station
19	1550 W between 750 S and 400 S	Provide additional fire flow capacity to Wasatch Pallet and the Sugar Factory	Install 1,650 feet of 12-inch pipe in 1550 W between 750 S and 400 S
20	2650 S Spanish Oaks Drive and 2400 S Spanish Oaks Drive	Improve fire flow pressure and raise operating pressures within the Spanish Oaks subdivision	Install a 10-inch PRV at approximately 2650 S Spanish Oaks Drive and adjust the Spanish Oaks East PRV located at about 2400 S Spanish Oaks Drive to 110 psi

Cold Springs Transmission Projects

The Cold Springs Transmission Projects are projects that allow the Cold Springs water to gravity feed into the drinking water system and at the same time allow additional available Cold Springs water to overflow into the pressurized irrigation system. These projects are not needed until the projects include splitting the Lower Crab Creek Zone into two pressure zones. The lower pressure zone will be supplied from Cold Springs by gravity. The proposed pressure zone boundaries are shown on Figure V-4. The recommended pipes to be closed to create the new Cold Springs Zone as well as the locations of the other Cold Springs Transmission projects are shown on Figure V-3. Table V-3 shows the projects required to complete the connection of Cold Springs to the drinking water system.

TABLE V-3
PROPOSED COLD SPRINGS TRANSMISSION PROJECTS

MAP ID	LOCATION	DESCRIPTION	PROJECT
21	3750 E Highway 6 (Malcomb Tanks)	Connect Cold Springs transmission line to deliver water to Malcomb Tanks	Connect the 30-inch pipe to the 21-inch transmission line to Malcomb Tanks with a control valve
22	Cold Springs Zone	Create the Cold Springs Zone	Close pipes at 1620 S and 1410 E, 1700 S and 1410 E, 1470 S and 1410 E, 1240 S and 1410 E, 600 S and 1430 E, 500 S and 1420 E, 410 S and 1420 E, 300 S and 1435 E, Mountain View Drive and 1480 E, and add 10-inch PRVs at Canyon Road and 1400 E, and 120 S and 1750 E to create the Cold Springs Zone
23	Intersection of 900 E and Canyon Road	Connect Cold Springs transmission line to the Cold Springs Zone	Connect the 12-inch pipe in 900 E to the 18-inch transmission line in Canyon Road
24	Intersection of 1100 E and Canyon Road	Connect Cold Springs transmission line to the Cold Springs Zone	Connect the 6-inch pipe to the North and the 8-inch pipe to the South to the 18-inch transmission line in Canyon Road
25	River Bottoms Road between Powerhouse Road and 1800 S	Increase transmission from the Cold Springs transmission line to the Cold Springs Zone	Install 600 feet of 8-inch pipe in River Bottoms Road between Powerhouse Road and 1800 S
26	500 E 200 S	Connect Cold Springs transmission line to the Malcomb Springs Zone	Connect 18-inch transmission line to Malcomb Springs Zone through 12-inch PRV

Pipeline Replacement Projects

It is recommended that the City continue developing and funding a pipeline replacement program in order to systematically replace old pipelines that are smaller than 8-inches in diameter during road resurfacing projects and other situations of convenience. Meter data indicates that the City has a large amount of unaccounted water. It is recommended that in addition to a program that replaces old pipelines, the City also fund a program for locating leaks. It is likely the old pipes are also the leaky pipes. It is estimated that the drinking water system has at least $13,000,000 of pipeline that is due for replacement and a total replacement cost of $100,000,000. It is recommended that the City budget at least $500,000 to $1,000,000 a year for pipeline replacement. It is known that the existing 30-inch transmission line has corrosion problems. It is recommended that the pipeline be rehabilitated or replaced if necessary. Table V-4 shows projects related to a pipe replacement and leak detection program in the City.

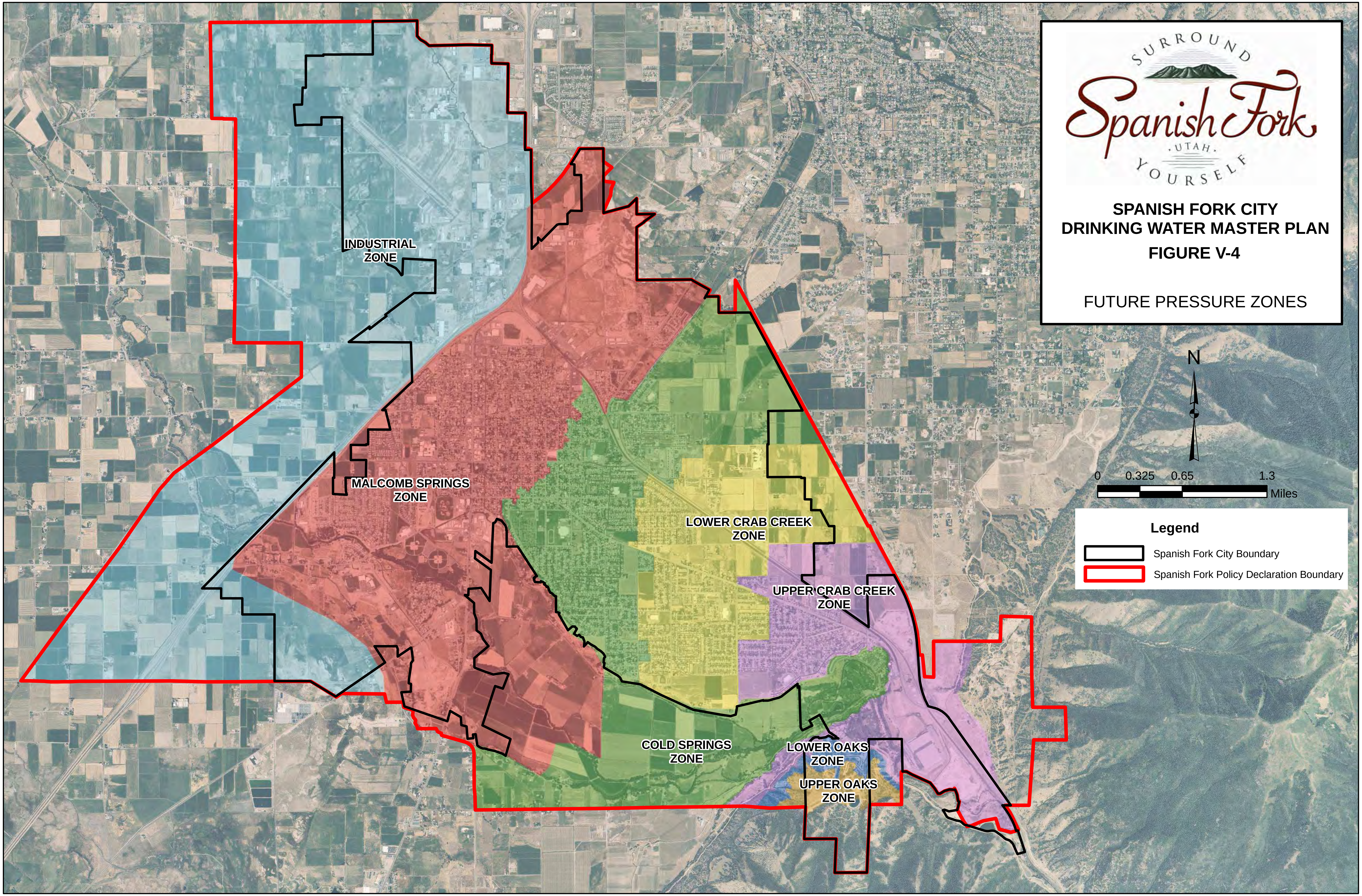

SURROUND
Spanish Fork
UTAH
YOURSELF
SPANISH FORK CITY
DRINKING WATER MASTER PLAN
FIGURE V-4
FUTURE PRESSURE ZONES
N
0
0.325
0.65
1.3
Miles
Legend
Spanish Fork City Boundary
Spanish Fork Policy Declaration Boundary
INDUSTRIAL ZONE
MALCOMB SPRINGS ZONE
LOWER CRAB CREEK ZONE
UPPER CRAB CREEK ZONE
COLD SPRINGS ZONE
LOWER OAKS ZONE
UPPER OAKS ZONE

TABLE V-4
PIPELINE REPLACEMENT PROJECTS

MAP ID	LOCATION	DESCRIPTION	PROJECT
27	System wide	Pipe replacement and leak detection program	Identify leaking pipes in the system
28	Highway 6 from Cold Springs to 750 S	Leak repair in 30-inch Cold Springs Transmission Line	Line the 30-inch diameter Cold Springs transmission line to reduce leakage

Future Expansion Projects

Table V-5 lists the projects required to accommodate future population growth in the City, and anticipated expansion of the City boundaries. In general the locations for the proposed future projects follow future roads projects identified in the transportation master plan. The locations descriptions are approximations based off of Spanish Fork's road numbering system. Proposed pipe sizes, locations and configurations should be checked with the hydraulic model before approval. The projects are more for estimating cost of future expansion rather than dictating future pipe size and alignment.

TABLE V-5
PROPOSED FUTURE EXPANSION PROJECTS

MAP ID	LOCATION	PROJECT
29	2300 E between Canyon Road and 750 S	Install 1,650 feet of 12-in pipe in 2300 E between Canyon Road and 750 S
30	Highway 6 between 750 S and 2550 E	Install 1,190 feet of 12-in pipe in Highway 6 between 750 S and 2550 E
31	600 W between 3100 N and State Road 77	Install 3,440 feet of 12-in pipe in 600 W between 3100 N and State Road 77
32	Highway 77 between 550 W and 2050 W	Install 6,990 feet of 12-in pipe in Highway 77 between 550 W and 2050 W
33	2050 W between 3800 N and 2400 N	Install 6,620 feet of 12-in pipe in 1150 W between 3050 N and 2400
34	1000 N between 300 W and 1120 W	Install 3,670 feet of 12-in pipe in 1000 N between 300 W and 1120 W
35	From 2300 S and 1100 E to 1400 E and 1870 S	Install 2,960 feet of 12-in pipe from 2300 S and 1100 E to 1400 E and 1870 S
36	From 2350 S and 1100 E to Volunteer Drive and Main Street	Install 10,540 feet of 12-in pipe from 2350 S and 1100 E to Volunteer Drive and Main Street
37	100 S between 1060 W and 1850 W	Install 4,170 feet of 12-in pipe in 100 S between 1060 W and 1850 W

TABLE V-5
PROPOSED FUTURE EXPANSION PROJECTS
(CONTINUED)

MAP ID	LOCATION	PROJECT
38	1300 S between Mill Road and 1200 W	Install 3,260 feet of 12-in pipe in 1300 S between Mill Road and 1200 W
39	3400 E from Highway 6 to 750 S	Install 3,480 feet of 12-in pipe in 3400 E between Highway 6 to 750 S
40	Woodland Hills Drive between State Road 164 and South Field Road to 620 E and 620 E to 3000 S	Install 4,010 feet of 12-in pipe in Woodland Hills Drive between State Roads 164 and 198, and install 4,620 feet of 12-in pipe in South Field Road between State Road 198 and 620 E and install 1,200 feet of 12-in pipe in 620 E to 3000 S
41	From 620 E and South Field Road to 2300 S and 1100 E	Install 3,500 feet of 12-in pipe from 620 E and South Field Road to 2300 S and 1100 E
42	Canyon Crest Road between 2300 E and 2600 E	Install 1,350 feet of 12-in pipe in Canyon Crest Road between 2300 E and 2600 E
43	River Bottoms Road from Powerhouse Road to 1800 S	Install 600 feet of 8-in pipe in River Bottoms Road from Powerhouse Road to 1800 S
44	1600 N between 300 W and 1100 W, 1100 W and 900 W between 1600 N and 1000 N	Install 4,330 feet of 12-in pipe in 1600 N between 300 W and 1100 W, install 7,900 feet of 12-in pipe in 1100 W and 900 W between 1600 N and 1000 N
45	1700 N between 500 W and 1100 W	Install 2,150 feet of 12-in pipe in 1700 N between 500 W and 1100 W
46	2300 E between 1850 S and 2000 S	Install 1,020 feet of 12-in pipe in 2300 E from 1850 S to 2000 S
47	From 2350 S and 1100 E to 2300 S and 2300 E	Install 3,590 feet of 12-in pipe from 2350 S and 1100 E to 2300 S and 2300 E
48	State Road 198 between South Field Road and 2225 S	Install 740 feet of 12-in pipe in State Road 198 between South Field Road and 2225 S
49	End of Eagle Drive and nearby reservoir parking lot	Install 970 feet of 8-in pipe between the end of Eagle Drive and the reservoir parking lot
50	1700 W between State Road 164 and 1400 S	Install 2,360 feet of 12-in pipe in 1700 W between State Road 164 and 1400 S
51	1100 E from 1200 N to 950 E and 2500 N	Install 6,140 feet of 12-in pipe in 1100 E from 1200 N to 950 E and 2500 N
52	2150 N between 1100 E and Chappel Drive	Install 1,920 feet of 12-in pipe in 2150 N between 1100 E and Chappel Drive
53	1300 N between Chappel Drive to 1100 E	Install 2,900 feet of 12-in pipe in 1300 N between Chappel Drive to 1100 E
54	1200 N from Chappel Drive to 1100 E and 1300 N	Install 1,560 feet of 12-in pipe in 1200 N from Chappel Drive to 1100 E and 1300 N
55	From 1950 N on Williams Lane to 950 E and 2500 N	Install 3,700 feet of 12-in pipe connecting 1950 N on Williams Lane to 950 E and 2500 N

TABLE V-5
PROPOSED FUTURE EXPANSION PROJECTS
(CONTINUED)

MAP ID	LOCATION	PROJECT
56	1420 E Extension to Expressway Lane	Install 1,480 feet of 12-in pipe in future extension of 1420 E to Expressway Lane
57	Expressway Lane between State Road 51 and 2250 E	Install 2,890 feet of 12-in pipe in Expressway Lane between State Road 51 and 2250 E
58	2250 E between Legacy Farms Parkway and Expressway Lane	Install 390 feet of 12-in pipe in 2250 E from Legacy Farms Parkway to Expressway Lane
59	Legacy Farms Parkway between 250 N and State Road 51	Install 7,650 feet of 12-in pipe in Legacy Farms Parkway between 250 N and State Road 51
60	400 N between Stahell Lane and Legacy Farms Parkway	Install 3,170 feet of 12-in pipe in 400 N between Stahell Lane and Legacy Farms Parkway
61	150 S between 2550 E and Railroad	Install 2,850 feet of 12-in pipe in 150 S between 2550 E and Railroad
62	3400 E along Railroad between 750 S and 150 S	Install 2,910 feet of 12-in pipe in 3400 E and along the Railroad between 750 S and 150 S
63	750 S between 3400 E and 3100 E	Install 1,320 feet of 12-in pipe in 750 S between 3400 E and 3100 E
64	2300 S (relatively) between 2300 E and 1700 E	Install 3,310 feet of 12-in pipe in 2300 S between 2300 E and 1700 E
65	From 2750 S and 820 E to Arrowhead Trail Street and Del Monte Road	Install 8,310 feet of 12-in pipe from 2750 S and 820 E to Arrowhead Trail Street and Del Monte Road
66	1100 E and 1200 E between 3000 S and 2080 S	Install 4,790 feet of 12-in pipe in 1100 E and 1200 E between 3000 S and 2080 E
67	From 1550 E and 2050 S to 1830 E and 2080 S	Install 1,280 feet of 12-in pipe from 1550 E and 2050 S to 1830 E and 2080 S
68	From River Bottoms Road and 3100 E to 2300 E and 2030 S	Install 4,570 feet of 12-in pipe from River Bottoms Road and 3100 E to 2300 E and 2030 S
69	3000 S between 2300 E and 620 E	Install 8,010 feet of 12-in pipe in 3000 S between 2300 E and 620 E
70	1800 W along I-15 between 3000 S and 900 S	Install 5,570 feet of 12-in pipe in 1800 W and along I-15 between 3000 S and 900 S
71	1300 S between 1200 W and 1800 W	Install 2,770 feet of 12-in pipe in 1300 S between 1200 W and 1800 W
72	3000 S between 1000 W and 2200 W	Install 10,400 feet of 12-in pipe in 3000 S between 1000 W and 2200 W
73	From 2200 W and 3000 S to 1950 W and 900 S	Install 5,530 feet of 12-in pipe in From 2200 W and 3000 S to 1950 W and 900 S
74	900 S between 2000 W and 1400 W	Install 4,380 feet of 12-in pipe in 900 S between 2000 W and 1400 W

TABLE V-5
PROPOSED FUTURE EXPANSION PROJECTS
(CONTINUED)

MAP ID	LOCATION	PROJECT
75	From 900 S and 2500 W to 100 S and 2000 W	Install 4,510 feet of 12-in pipe in From 900 S and 2500 W to 100 S and 2000 W
76	1550 W between 300 S and 100 S	Install 1,660 feet of 12-in pipe in 1550 W between 300 S and 100 S
77	From 100 S and 1850 W to 400 N and 1230 W	Install 4,670 feet of 12-in pipe from 100 S and 1850 W to 400 N and 1230 W
78	400 N between 1230 W and 700 W	Install 2,170 feet of 12-in pipe in 400 N between 1230 W and 700 W
79	From 1230 W and 400 N to 1000 N and 700 W	Install 3,410 feet of 12-in pipe from 1230 W and 400 N to 1000 N and 700 W
80	Eagle Drive and Hawk Drive intersection	Install 8-in PRV on west side of Eagle Drive and Hawk Drive intersection
81	Canyon Crest Drive and 2300 E intersection	Install 10-in PRV on east side of Canyon Crest Drive and 2300 E intersection (See project 42)
82	South Field Road and State Road 198 intersection	Install 10-in PRV on east side of South Field Road and State Road 198 intersection (See project 40)
83	750 S and 3400 E intersection	Install 10-in PRV on south side of 750 S and 3400 E intersection (See project 39)
84	Mill Road and State Road 164 intersection	Install 10-in PRV on southwest side of Mill Road and State Road 164 intersection
85	1300 S and 900 W	Install 10-in PRV at 1300 S and 900 W (See project 38)
86	900 S and 1400 W intersection	Install 10-in PRV on east side of 900 S and 1400 W intersection
87	100 S and 1320 W intersection	Install 10-in PRV on west side of 100 S and 1320 W intersection (See project 37)
88	400 N and 700 W	Install 6-in PRV in 400 N and 700 W
89	Expressway Lane and State Road 51 intersection	Install 10-in PRV on east side of Expressway Lane and State Road 51 intersection
90	2300 S and 1100 E	Install 10-in PRV at 2300 S and 1100 E (See project 36)
91	2550 E and 150 N intersection	Install 10-in PRV at 2550 E and 150 N intersection
92	1830 E and 2080 S	Install 10-in PRV at 1830 E and 2080 S (See project 67)
93	Legacy Farms Parkway and State Road 51	Install 10-in PRV at Legacy Farms Parkway and State Road 51 (See project 59)
94	750 E and 2650 S	Install 10-in PRV at 750 E and 2650 S (See project 65)

CHAPTER VI

CAPITAL IMPROVEMENTS PLAN

Throughout the master planning process, the three main components of the City's water system (source, storage, and distribution) were analyzed to determine the system's ability to meet existing demands and also the anticipated future demands at build-out. Each of the system deficiencies identified in the master planning process and described previously in this report were presented in an alternatives workshop with City staff. Possible solutions were discussed for each of the identified system deficiencies as well as possible solutions for maintenance and other system needs not identified in the system analysis. After the workshop, HAL studied the feasibility of the solution alternatives and developed conceptual costs.

One important method of paying for system improvements is through impact fees. Impact fees are collected from new development and should only be used to pay for system improvements related to new development. For this reason it is important to identify which projects are related to resolving existing deficiencies, and which projects are related to providing anticipated future capacity for new development.

PRECISION OF COST ESTIMATES

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

Type of Estimate	Precision
Master Planning	±50%
Preliminary Design	±30%
Final Design or Bid	±10%

For example, at the master planning level (or conceptual or feasibility design level), if a project is estimated to cost $1,000,000, then the precision or reliability of the cost estimate would typically be expected to range between approximately $500,000 and $1,500,000. While this may seem very imprecise, the purpose of master planning is to develop general sizing, location, cost, and scheduling information on a number of individual projects that may be designed and constructed over a period of many years. Master planning also typically includes the selection of common design criteria to help ensure uniformity and compatibility among future individual projects. Details such as the exact capacity of individual projects, the level of redundancy, the location of facilities, the alignment and depth of pipelines, the extent of utility conflicts, the cost of land and easements, the construction methodology, the types of equipment and material to be used, the time of construction, interest and inflation rates, permitting requirements, etc., are typically developed during the more detailed levels of design.

At the preliminary or 10% design level, some of the aforementioned information will have been developed. Major design decisions such as the size of facilities, selection of facility sites, pipeline alignments and depths, and the selection of the types of equipment and material to be used during construction will typically have been made. At this level of design the precision of the cost estimate for a $1,000,000 project would typically be expected to range between approximately $700,000 and $1,300,000.

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

SYSTEM IMPROVEMENT PROJECTS

As discussed in previous chapters, several source, storage and distribution system deficiencies were identified during the system analysis. Project costs for water system improvements are presented in Table VI-1 with the associated project number shown in Figure V-3. The projects are summarized by type in Table VI-2. Each recommendation includes a conceptual cost estimate for construction.

Unit costs for the construction cost estimates are based on conceptual level engineering. Sources used to estimate construction costs include:

1. “Means Heavy Construction Cost Data, 2011"
2. Price quotes from equipment suppliers
3. Recent construction bids for similar work

All costs are presented in 2011 dollars. Recent price and economic trends indicate that future costs are difficult to predict with certainty. Engineering cost estimates provided in this study should be regarded as conceptual level for use as a planning guide. Only during final design can a definitive and more accurate estimate be provided for each project. A cost estimate calculation for each project is provided in Appendix C. All Malcomb Transmission Projects, Fire Flow Projects, and Cold Springs Transmission Projects are recommended to be completed in 0 to 5 years.

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS

TYPE	ID	RECOMMENDED PROJECT	COST
Crab Creek Transmission	1	Complete new 24-inch Crab Creek Transmission Line	$3,000,000
Malcomb Transmission Projects		Disconnect the Malcomb tank outflow from the 21-inch line and connect to the downstream 30-inch line, Connect the upstream 30-in transmission line to the 21-inch line	$18,000
Malcomb Transmission Projects	2	Close the 24-inch pipeline in 3400 E from the 30-inch pipeline in Highway 6	No Cost
Malcomb Transmission Projects	3	Close or disconnect the 8-inch and 20-inch lines in 2550 E from 30-in pipeline in Highway 6, connect the 8-in line to the 20-in line using the existing PRV station	$65,000
Malcomb Transmission Projects	4	Close 8-inch pipeline in 750 S from the 30-inch pipeline in Highway 6	No Cost
Malcomb Transmission Projects	5	Close the 8-inch pipeline in 500 S from the 30-inch pipeline in Highway 6	No Cost

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Malcomb Transmission Projects	6	Disconnect the 12-inch and 10-inch pipelines from the 30-inch pipeline at the intersection of Center Street and Highway 6. Connect the 12-inch line to the 10-inch line	$6,000
Malcomb Transmission Projects	7	Close the 12-in line in 200 N just west of Highway 6	No Cost
Malcomb Transmission Projects	8	Install a check valve in the 8-inch line in 400 E just east of Highway 6	$2,000
Malcomb Transmission Projects	9	Close valve in 4-inch line in 100 E just south of 400 N	No Cost
Malcomb Transmission Projects	10	Close valve on 12-inch line in 900 E just south of 400 N	No Cost
Malcomb Transmission Projects	11	Open Valve in 500 N just east of 800 E	No Cost
Malcomb Transmission Projects	12	Open 8" Valve in 600 N near 900 E	No Cost
Malcomb Transmission Projects	13	Install PRV at 500 E 200 S in 12-inch line. Disconnect the 18-inch transmission line and connect to the PI system	$45,000
Fire Flow Projects	14	Install 4,700 feet of 12-inch pipe in 300 W between 900 N and 1900 N and 1,400 feet of 12-inch pipe in 900 N between 300 W and Main Street **(73% attributed to future growth)***	$939,000
Fire Flow Projects	15	Install 1,200 feet of 16-inch pipe in Main Street between 1380 N and 1600 N **(88% attributed to future growth)***	$211,000
Fire Flow Projects	16	Install 1,050 feet of 8-inch pipe in Industrial Park Drive between 45 N and 200 E and 1,600 feet of 8-inch pipe in 200 E between 1300 N and 1750 N **(80% attributed to future growth)***	$326,000
Fire Flow Projects	17	Install 700 feet of 10-inch pipe in from 1800 N and 150 E directly east to 1800 N and Main Street **(16% attributed to future growth)***	$96,000
Fire Flow Projects	18	Install a two-way PRV and meter station	$41,000
Fire Flow Projects	19	Install 1,650 feet of 12-inch pipe in 1550 W between 750 S and 400 S **(90% attributed to future growth)***	$254,000
Fire Flow Projects	20	Install a PRV at approximately 2650 S Spanish Oaks Drive and adjust the Spanish Oaks East PRV located at about 2400 S Spanish Oaks Drive to 100 psi **(100% attributed to future growth)***	$43,000

* Percentage of the project attributed to future growth was determined by comparing peak flows in the existing and future models

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Cold Springs Transmission Projects	21	Connect the 30-inch pipe to the 21-inch transmission line to Malcomb Tanks with a control valve	$63,000
Cold Springs Transmission Projects	22	Close pipes at 1620 S and 1410 E, 1700 S and 1410 E, 1470 S and 1410 E, 1240 S and 1410 E, 600 S and 1430 E, 500 S and 1420 E, 410 S and 1420 E, 300 S and 1435 E, Mountain View Drive and 1480 E, and add PRVs at Canyon Road and 1400 E, and 120 S and 1750 E to create the Cold Springs Zone	$86,000
Cold Springs Transmission Projects	23	Connect the 12-inch pipe in 900 E to the 18-inch transmission line in Canyon Road	$2,000
Cold Springs Transmission Projects	24	Connect the 6-inch pipe to the North and the 8-inch pipe to the South to the 18-inch transmission line in Canyon Road	$1,000
Cold Springs Transmission Projects	25	Install 600 feet of 8-inch pipe in River Bottoms Road between Powerhouse Road and 1800 S	$74,000
Cold Springs Transmission Projects	26	Connect 18-inch transmission line to Malcomb Springs Zone through 12-inch PRV	$58,000
Leak detection and repair	27	Identify and repair leaking pipes in the system	$200,000
Line 30-inch Cold Springs Transmission Line	28	Line the 30-inch diameter Cold Springs transmission line to reduce leakage	$1,350,000
Future Expansion Projects	29	Install 1,650 feet of 12-in pipe in 2300 E between Canyon Road and 750 S	$254,000
Future Expansion Projects	30	Install 1,190 feet of 12-in pipe in Highway 6 between 750 S and 2550 E	$183,000
Future Expansion Projects	31	Install 3,440 feet of 12-in pipe in 600 W between 3100 N and State Road 77	$529,000
Future Expansion Projects	32	Install 6,990 feet of 12-in pipe in Highway 77 between 550 W and 2050 W	$1,076,000
Future Expansion Projects	33	Install 6,620 feet of 12-in pipe in 1150 W between 3050 N and 2400	$1,019,000
Future Expansion Projects	34	Install 3,670 feet of 12-in pipe in 1000 N between 300 W and 1120 W	$565,000
Future Expansion Projects	35	Install 2,960 feet of 12-in pipe from 2300 S and 1100 E to 1400 E and 1870 S	$456,000

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Future Expansion Projects	36	Install 10,540 feet of 12-in pipe from 2350 S and 1100 E to Volunteer Drive and Main Street	$1,622,000
Future Expansion Projects	37	Install 4,170 feet of 12-in pipe in 100 S between 1060 W and 1850 W	$642,000
Future Expansion Projects	38	Install 3,260 feet of 12-in pipe in 1300 S between Mill Road and 1200 W	$502,000
Future Expansion Projects	39	Install 3,480 feet of 12-in pipe in 3400 E between Highway 6 to 750 S	$536,000
Future Expansion Projects	40	Install 4,010 feet of 12-in pipe in Woodland Hills Drive between State Roads 164 and 198, and install 4,620 feet of 12-in pipe in South Field Road between State Road 198 and 620 E and install 1,200 feet of 12-in pipe in 620 E to 3000 S	$1,513,000
Future Expansion Projects	41	Install 3,500 feet of 12-in pipe from 620 E and South Field Road to 2300 S and 1100 E	$539,000
Future Expansion Projects	42	Install 1,350 feet of 12-in pipe in Canyon Crest Road between 2300 E and 2600 E	$208,000
Future Expansion Projects	43	Install 600 feet of 8-in pipe in River Bottoms Road from Powerhouse Road to 1800 S	$74,000
Future Expansion Projects	44	Install 3,820 feet of 12-in pipe in 1600 N between 300 W and 1100 W, install 3,610 feet of 12-in pipe in 1100 W between 1600 N to 2400 N, and install 4,300 feet of 12-in pipe in 2400 N between 1100 W and 2050 W	$1,805,000
Future Expansion Projects	45	Install 2,150 feet of 12-in pipe in 1700 N between 500 W and 1100 W	$331,000
Future Expansion Projects	46	Install 1,020 feet of 12-in pipe in 2300 E from 1850 S to 2000 S	$157,000
Future Expansion Projects	47	Install 3,590 feet of 12-in pipe from 2350 S and 1100 E to 2300 S and 2300 E	$553,000
Future Expansion Projects	48	Install 740 feet of 12-in pipe in State Road 198 between South Field Road and 2225 S	$114,000
Future Expansion Projects	49	Install 970 feet of 8-in pipe between the end of Eagle Drive and the reservoir parking lot	$119,000
Future Expansion Projects	50	Install 2,360 feet of 12-in pipe in 1700 W between State Road 164 and 1400 S	$363,000
Future Expansion Projects	51	Install 6,140 feet of 12-in pipe in 1100 E from 1200 N to 950 E and 2500 N	$945,000
Future Expansion Projects	52	Install 1,920 feet of 12-in pipe in 2150 N between 1100 E and Chappel Drive	$295,000
Future Expansion Projects	53	Install 2,900 feet of 12-in pipe in 1300 N between Chappel Drive to 1100 E	$446,000

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Future Expansion Projects	54	Install 1,560 feet of 12-in pipe in 1200 N from Chappel Drive to 1100 E and 1300 N	$240,000
Future Expansion Projects	55	Install 3,700 feet of 12-in pipe connecting 1950 N on Williams Lane to 950 E and 2500 N	$569,000
Future Expansion Projects	56	Install 1,480 feet of 12-in pipe in future extension of 1420 E to Expressway Lane	$228,000
Future Expansion Projects	57	Install 2,890 feet of 12-in pipe in Expressway Lane between State Road 51 and 2250 E	$445,000
Future Expansion Projects	58	Install 390 feet of 12-in pipe in 2250 E from Legacy Farms Parkway to Expressway Lane	$60,000
Future Expansion Projects	59	Install 7,650 feet of 12-in pipe in Legacy Farms Parkway between 250 N and State Road 51	$1,177,000
Future Expansion Projects	60	Install 3,170 feet of 12-in pipe in 400 N between Stahell Lane and Legacy Farms Parkway	$950,000
Future Expansion Projects	61	Install 2,850 feet of 12-in pipe in 150 S between 2550 E and Railroad	$439,000
Future Expansion Projects	62	Install 2,910 feet of 12-in pipe in 3400 E and along the Railroad between 750 S and 150 S	$448,000
Future Expansion Projects	63	Install 1,320 feet of 12-in pipe in 750 S between 3400 E and 3100 E	$203,000
Future Expansion Projects	64	Install 3,310 feet of 12-in pipe in 2300 S between 2300 E and 1700 E	$509,000
Future Expansion Projects	65	Install 8,310 feet of 12-in pipe from 2750 S and 820 E to Arrowhead Trail Street and Del Monte Road	$1,279,000
Future Expansion Projects	66	Install 4,790 feet of 12-in pipe in 1100 E and 1200 E between 3000 S and 2080 E	$737,000
Future Expansion Projects	67	Install 1,280 feet of 12-in pipe from 1550 E and 2050 S to 1830 E and 2080 S	$197,000
Future Expansion Projects	68	Install 4,570 feet of 12-in pipe from River Bottoms Road and 3100 E to 2300 E and 2030 S	$703,000
Future Expansion Projects	69	Install 8,010 feet of 12-in pipe in 3000 S between 2300 E and 620 E	$1,233,000
Future Expansion Projects	70	Install 5,570 feet of 12-in pipe in 1800 W and along I-15 between 3000 S and 900 S	$857,000
Future Expansion Projects	71	Install 2,770 feet of 12-in pipe in 1300 S between 1200 W and 1800 W	$426,000
Future Expansion Projects	72	Install 10,400 feet of 12-in pipe in 3000 S between 1000 W and 2200 W	$1,601,000
Future Expansion Projects	73	Install 5,530 feet of 12-in pipe in From 2200 W and 3000 S to 1950 W and 900 S	$851,000

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Future Expansion Projects	74	Install 4,380 feet of 12-in pipe in 900 S between 2000 W and 1400 W	$674,000
Future Expansion Projects	75	Install 4,510 feet of 12-in pipe in From 900 S and 2500 W to 100 S and 2000 W	$694,000
Future Expansion Projects	76	Install 1,660 feet of 12-in pipe in 1550 W between 300 S and 100 S	$255,000
Future Expansion Projects	77	Install 4,670 feet of 12-in pipe from 100 S and 1850 W to 400 N and 1230 W	$719,000
Future Expansion Projects	78	Install 2,170 feet of 12-in pipe in 400 N between 1230 W and 700 W	$334,000
Future Expansion Projects	79	Install 3,410 feet of 12-in pipe from 1230 W and 400 N to 1000 N and 700 W	$525,000
Future Expansion Projects	80	Install 8-in PRV on west side of Eagle Drive and Hawk Drive intersection	$31,000
Future Expansion Projects	81	Install 10-in PRV on east side of Canyon Crest Drive and 2300 E intersection (See project 42)	$43,000
Future Expansion Projects	82	Install 10-in PRV on east side of South Field Road and State Road 198 intersection (See project 40)	$43,000
Future Expansion Projects	83	Install 10-in PRV on south side of 750 S and 3400 E intersection (See project 39)	$43,000
Future Expansion Projects	84	Install 10-in PRV on southwest side of Mill Road and State Road 164 intersection	$43,000
Future Expansion Projects	85	Install 10-in PRV at 1300 S and 900 W (See project 38)	$43,000
Future Expansion Projects	86	Install 10-in PRV on east side of 900 S and 1400 W intersection	$43,000
Future Expansion Projects	87	Install 10-in PRV on west side of 100 S and 1320 W intersection (See project 37)	$43,000
Future Expansion Projects	88	Install 6-in PRV in 400 N and 700 W	$28,000
Future Expansion Projects	89	Install 10-in PRV on east side of Expressway Lane and State Road 51 intersection	$43,000
Future Expansion Projects	90	Install 10-in PRV at 2300 S and 1100 E (See project 36)	$43,000
Future Expansion Projects	91	Install 10-in PRV at 2550 E and 150 N intersection	$43,000
Future Expansion Projects	92	Install 10-in PRV at 1830 E and 2080 S (See project 67)	$43,000
Future Expansion Projects	93	Install 10-in PRV at Legacy Farms Parkway and State Road 51 (See project 59)	$43,000

TABLE VI-1
CAPITAL IMPROVEMENT PROJECTS
(CONTINUED)

TYPE	ID	RECOMMENDED PROJECT	COST
Future Expansion Projects	94	Install 10-in PRV at 750 E and 2650 S (See project 65)	$43,000
Cold Springs Development	95	Fill in the Cold Springs Pond and develop the entire spring for use in the drinking water system	$2,500,000
Make Water Right Changes	96	Clean up drinking water system water rights and make sure all source capacities match available water rights	$100,000
Develop New wells	97	Develop new well sources for backup and redundancy for future growth	$3,780,000
5.0 MG Malcomb Tanks Replacement	98	Replace the Malcomb Tanks with a 5.0 MG Tank	$4,050,000
0.6 MG Oaks Tanks Replacement	99	Replace the Oaks Tanks with a 0.6 MG Tank	$810,000
System Planning Updates	100	Update the Model and Master Plan as needed, and update the Impact Fees annually	$248,013

TABLE VI-2
CAPITAL IMPROVEMENT PROJECT SUMMARY

TYPE	DESCRIPTION	TOTAL COST
Crab Creek Transmission Line Project	New transmission line from Cold Springs to the Upper Crab Creek Zone to allow Cold Springs to gravity flow	$3,000,000
Malcomb Transmission Projects	Projects to increase transmission capacity from the Malcomb Tanks and allow Cold Springs to supply the lower pressurized irrigation zone by gravity.	$136,000
Fire Flow Projects	Projects to resolve fire flow deficiencies	$1,910,000
Cold Springs Transmission Projects	Projects to allow Cold Springs to supply both the drinking water and pressurized irrigation system by gravity which includes the creation of the Cold Springs Zone	$284,000
Leak Detection & Repair	Leak detection program and specific projects to eliminate lost water due to leaks in the system	$1,550,000
Future Expansion Projects	Projects to increase the system capacity to meet future expansion demands	$43,032,013
	TOTAL	**$49,912,012**

FUNDING OPTIONS

Funding options for the recommended projects, in addition to water use fees, could include general obligation bonds, revenue bonds, State/Federal grants and loans, and impact fees. In reality, the City may need to consider a combination of these funding options. Currently, the City is making the final payment this fiscal year on an older water revenue bond. The City has a new 20-year water revenue bond for the new Crab Creek Transmission Line (Map ID 1). Details of the bond are found in Appendix C. The following discussion describes funding options.

General Obligation Bonds

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

Revenue Bonds

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

State/Federal Grants and Loans

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

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

Impact Fees

Impact fees can be applied to water related facilities under the Utah Impact Fees Act. The Utah Impacts Fees Act is designed to provide a logical and clear framework for establishing new development assessments. It is also designed to establish the basis for the fee calculation which the City must follow in order to comply with the statute. However, the fundamental objective for the fee structure is the imposition on new development of only those costs associated with providing or expanding water infrastructure to meet the capacity needs created by that specific new development. The following information on reimbursement for pipelines over 8-inch and existing remaining capacity is provided to the City to aid in the calculation of impact fees. It is recommended that the impact fee calculation be updated annually.

Reimbursement for Pipelines over 8-inch

The City requires that a developer be responsible to install the minimum size pipe in a new development. If the pipe size recommended by the model and Master Plan is a larger diameter pipe to accommodate future growth then it is recommended that the City require the developer to install the larger pipeline. It is also recommended that the developer be reimbursed the difference between the larger pipe cost and the cost of minimum sized pipe (8 inch) as shown in Table VI-3. An estimated reimbursement cost over the next 10 years for growth related pipeline capacity above 8-inch is listed in Table VI-4 with an ID of A.

TABLE VI-3
PERCENTAGE OF PIPELINE COST RELATED TO GROWTH

PIPE SIZE	COST PER LINEAL FOOT	% GROWTH RELATED
8 inch	$91/ft	0%
10 inch	$102/ft	11%
12 inch	$114/ft	20%
16 inch	$130/ft	30%
18 inch	$148/ft	39%
20 inch	$157/ft	42%
24 inch	$186/ft	51%
30 inch	$248/ft	63%
36 inch	$328/ft	72%

Existing Remaining Capacity

The Utah Impact Fees Act allows for the calculation of Impact Fees based on an estimated cost of existing system capacity that will be recouped by future development. The following is an estimate of remaining capacity in the existing drinking water source, storage and distribution system.

Source. The remaining capacity of source for the Drinking Water System was calculated based on the level of service Design Criteria presented in Table I-1 and I-2. The level of service for source is 0.56 gpm per ERC with a total existing system source requirement of 6,716 gpm. Table III-2 shows the total of existing sources as 10,400 gpm. Because the 1700 East Well is needed as a pressurized irrigation source, this reduces the existing capacity to 8,700 gpm. Subtracting the existing source requirement of 6,716 gpm from the existing capacity leaves 1,984 gpm capacity or 3,543 ERCs.

Storage. The remaining capacity of storage for the drinking water system was calculated based on the level of service Design Criteria presented in Table I-1 and IV-2. Currently, the City has no remaining capacity in any of the existing storage tanks except for the new 5 MG Sterling Hollow Tank which currently has 3.15 MG of storage capacity remaining or 7,875 ERCs. At the time the Sterling Hollow Tank was constructed, the City did not have a storage deficiency, so it was 100% built for future growth. The 5 MG Sterling Hollow Tank is listed in Table VI-4 with an ID of B.

Distribution System. The capacity for the distribution system was calculated based on the level of service Design Criteria presented in Table I-1. Using the existing extended period hydraulic model for the drinking water system, the demand was increased until the existing system reached unacceptable performance during peak instantaneous demand. Unacceptable performance was defined as a minimum normal operating pressure of 50 psi. The highest elevations in each zone reaching 50 psi corresponded to a maximum system-wide pressure reduction during peak instantaneous demand of 20 psi caused by high velocities. The maximum capacity of the existing drinking water system was determined to be 22,300 ERCs. Given the existing demand on the system of 12,031 ERCs, the remaining capacity of the distribution system is 10,269 ERCs or 46%.

Summary of Impact Fee Related Projects

Table VI-4 shows impact fee eligible projects that Spanish Fork City has recently completed or anticipates completing in the next ten years. The percent impact fee eligible column is the current remaining capacity available to new development for the existing projects and the anticipated percentage of the proposed projects attributed to new development. Projects already constructed have letter IDs. Master Plan recommended projects have Map ID numbers from Table VI-1.

TABLE VI-4
IMPACT FEE RELATED PROJECTS

ID	DESCRIPTION	% IMPACT FEE ELIGIBLE	TOTAL COST
A	Maple Mtn. High School 2550 E Trunkline	58%	$174,347
B	5 MG Water Tank – Sterling Hollow	100%	$3,215,705

TABLE VI-4
IMPACT FEE RELATED PROJECTS
(CONTINUED)

ID	DESCRIPTION	% IMPACT FEE ELIGIBLE	TOTAL COST
1	Crab Creek Transmission Line	48%	$1,955,139
15	Main St 1400 N to 1600 N Trunk line	88%	$215,000
95	Cold Springs Pond Fill & Collection Line	100%	$2,500,000
100	Model, Master Plan & Impact Fee Updates	100%	$248,013

SUMMARY OF RECOMMENDATIONS

Several recommendations were made throughout the master plan report. The following is a summary of the recommendations.

1. It is recommended that the City continue to update the model as the water system changes and use the model as a tool for determining: the effect of changes to the system, verification of pipe diameters and location of proposed water mains, operational efficiency, and capacity of the system to provide fire flows.

2. It is recommended that City staff continue to conduct fire flow tests and SCADA data on an ongoing basis to refine the model calibration as system conditions change.

3. It is recommended that the Existing and Future Recommended Projects be completed.

4. It is recommended that the City move additional Strawberry Project water (similar to water right 51-6497) or move additional canal company irrigation stock (similar to water right 51-5523) to Cold Springs. The amount moved should be enough to cover the full capacity of the springs including the full developed capacity of Cold Springs. It is anticipated that this should be an additional 1,000 to 4,000 gpm and 1,600 to 6,450 ac-ft/year.

5. It is recommended that the City continue to monitor and perfect water rights and shares as land in Spanish Fork City is developed. It is also recommended that redundancy be incorporated into the drinking water system so that the drinking water system is able to meet all of the demand objectives at build-out with a major source unavailable.

6. It is recommended that the City continue funding and developing a pipe replacement program, and establish a program to locate leaks and other sources of unaccounted water loss in the drinking water system and repair them. It is recommended that the City budget at least $500,000 to $1,000,000 a year for pipeline replacement.

7. It is recommended that the City use lower cost water first whenever possible.

8. It is recommended that the City continue to develop well sources with the City's existing ground water rights as additional source as needed.

9. It is recommended that the pond at Cold Springs be removed, and the springs be fully developed and put back into the drinking water system as soon as possible.

10. Currently, Spanish Fork City has 11.25 MG of storage and a calculated storage requirement of 8.10 MG. Even though there is a surplus of 3.15 MG, the Malcomb Tanks have a shortage and the Sterling Tanks have a surplus. It is recommended that 2.5 MG of storage in the Sterling Tanks be reserved for the Malcolm Springs and Industrial Zones.

11. Under build-out conditions, storage deficiencies are projected for both the Oaks Tanks and the Malcolm Tanks. The state requirements for indoor equalization storage are quite conservative, according to the model. It is therefore recommended that the City consider asking the DDW executive secretary for an exception from the equalization storage requirements. It is recommended that the storage situation be monitored as development occurs.

12. It is recommended that a 5.0 MG storage tank replacing the Malcomb tanks when replacement is necessary. At least a 0.6 MG storage tank should replace the Oaks Tanks when they need replacement not only for increased equalization storage but also for more efficient pump operation.

13. It is recommended that the impact fee calculation be updated annually.

14. The City requires that a developer be responsible to install the minimum size pipe in a new development. If the pipe size recommended by the model and Master Plan is a larger diameter pipe to accommodate future growth then it is recommended that the City require the developer to install the larger pipeline.

REFERENCES

Horrocks Engineers. (2011). *Spanish Fork City Transportation Master Plan*. Pleasant Grove, UT: Horrocks Engineers.

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Utah Division of Administrative Rules. 2010. *Utah Administrative Code, R309-105-9, R309-110-4, R309-510, R309-511*.The Department of Administrative Services.

U.S. Census Bureau. 2010. *Profile of General Population and Housing Characteristics: 2010, Spanish Fork City, Utah*. http://factfinder2.census.gov

APPENDIX A
DDW Report Certification

HYDRAULIC MODEL DESIGN ELEMENTS & SYSTEM CAPACITY EXPANSION REPORT

REPORT CERTIFICATION

It is hereby certified that the Hydraulic Model Design Elements & System Capacity Expansion Report for:

Spanish Fork City Drinking Water Master Plan
(Project Name)

25003
(Water System Number)

Spanish Fork City Municipal Water
(Water System Name)

(DDW File Number, If Available)

October 3, 2011
(Date)

Meets all requirements as set forth in *R309-511 Hydraulic Modeling Rule* and *R309-110-4 Definitions* and complies with the provisions thereof, as well as the sizing requirements of *R309-510*, and the minimum water pressures of *R309-105-9*. Where applicable the proposed additions to the distribution system will not cause the pressures at any new or existing connections to be less than those specified in R309-105-9. The calibration methodology is described in the report and the model is sufficiently calibrated and accurate to represent the conditions within this water system. The hydraulic modeling method is computer software, and the computer software used EPANET 2.0.

Steven C. Jones, P.E.

State of Utah No. 362076-2202

CHECKLIST FOR HYDRAULIC MODEL DESIGN ELEMENTS REPORT

This hydraulic model checklist identifies the components included in the Hydraulic Model Design Elements Report for

Spanish Fork City Drinking Water Master Plan
(Project Name)

25003
(Water System Number)

Spanish Fork City Municipal Water
(Water System Name)

October 3, 2011
(Date)

The checkmarks or P.E. initials after each item indicate the conditions supporting P.E. Certification of this Report.

1. The Report contains:

   (a) A listing of sources including: the source name, the source type (i.e., well, spring, reservoir, stream etc.) for both existing sources and additional sources identified as needed for system expansion, the minimum reliable flow of the source in gallons per minute, the status of the water right and the flow capacity of the water right. *[R309-110-4 "Master Plan" definition]* ☑ SA

   (b) A listing of storage facilities including: the storage tank name, the type of material (i.e., steel, concrete etc.), the diameter, the total volume in gallons, and the elevation of the overflow, the lowest level (elevation) of the equalization volume, the fire suppression volume, and the emergency volume or the outlet. *[R309-110-4 "Master Plan" definition]* ☑ SA

   (b) A listing of pump stations including: the pump station name and the pumping capacity in gallons per minute. Under this requirement one does not need to list well pump stations as they are provided in requirement (a) above. *[R309-110-4 "Master Plan" definition]* ☑ SA

   (d) A listing by customer type (i.e., single family residence, 40 unit condominium complex, elementary school, junior high school, high school, hospital, post office, industry, commercial etc.) along with an assessment of their associated number of ERC'S. *[R309-110-4 "Master Plan" definition]* ☑ SA

   (e) The number of connections along with their associated ERC value that the public drinking water system is committed to serve, but has not yet physically connected to the infrastructure. *[R309-110-4 "Master Plan" definition]* ☑ SA

(f) A description of the nature and extent of the area currently served by the water system and a plan of action to control addition of new service connections or expansion of the public drinking water system to serve new development(s). The plan shall include current number of service connections and water usage as well as land use projections and forecasts of future water usage.
[R309-110-4 "Master Plan" definition] ☑ SA

(h) A hydraulic analysis of the existing distribution system along with any proposed distribution system expansion identified in (g) above.
[R309-110-4 "Master Plan" definition] ☑ SA

(i) A description of potential alternatives to manage system growth, including interconnections with other existing public drinking water systems, developer responsibilities and requirements, water rights issues, source and storage capacity issues and distribution issues.
[R309-110-4 "Master Plan" definition] ☑ SA

2. At least 80 percent of the total pipe lengths in the distribution system affected by the proposed project are included in the model.
[R309-511-5(1)] ☑ SA

3. 100 percent of the flow in the distribution system affected by the proposed project is included in the model. If customer usage in the system is metered, water demand allocations in the model account for at least 80 percent of the flow delivered by the distribution system affected by the proposed project.
[R309-511-5(2)] ☑ SA

4. All 8-inch diameter and larger pipes are included in the model. Pipes smaller than 8-inch diameter are also included if they connect pressure zones, storage facilities, major demand areas, pumps, and control valves, or if they are known or expected to be significant conveyers of water such as fire suppression demand.
[R309-511-5(3)] ☑ SA

5. All pipes serving areas at higher elevations, dead ends, remote areas of a distribution system, and areas with known under-sized pipelines are included in the model.
[R309-511-5(4)] ☑ SA

6. All storage facilities and accompanying controls or settings applied to govern the open/closed status of the facility for standard operations are included in the model.
[R309-511-5(5)] ☑ SA

7. Any applicable pump stations, drivers (constant or variable speed), and accompanying controls and settings applied to govern their on/off/speed status for various operating conditions and drivers are included in the model.
[R309-511-5(6)] ☑ SA

8. Any control valves or other system features that could significantly affect the flow of water through the distribution system (i.e. interconnections with other systems, pressure

reducing valves between pressure zones) for various operating conditions are included in the model.
[R309-511-5(7)] ☑ SA

9. Imposed peak day and peak instantaneous demands to the water system's facilities are included in the model. The Hydraulic Model Design Elements Report explains which of the Rule-recognized standards for peak day and peak instantaneous demands are implemented in the model (i.e., (i) peak day and peak instantaneous demand values per *R309-510, Minimum Sizing Requirements*, (ii) reduced peak day and peak instantaneous demand values approved by the Executive Secretary per *R309-510-5, Reduction of Requirements*, or (iii) peak day and peak instantaneous demand values expected by the water system in excess of the values in *R309-510, Minimum Sizing Requirements*). The Hydraulic Model Design Elements Report explains the multiple model simulations to account for the varying water demand conditions, or it clearly explains why such simulations are not included in the model. The Hydraulic Model Design Elements Report explains the extended period simulations in the model needed to evaluate changes in operating conditions over time, or it clearly explains (e.g., in the context of the water system, the extent of anticipated fire event, or the nature of the new expansion) why such simulations are not included in the model.
[R309-511-5(8) & R309-511-6(1)(b)] ☑ SA

10. The hydraulic model incorporates the appropriate demand requirements as specified in *R309-510, Minimum Sizing Requirements*, and *R309-511, Hydraulic Modeling Rule*, in the evaluation of various operating conditions of the public drinking water system. The Report includes:
    - the methodology used for calculating demand and allocating it to the model;
    - a summary of pipe length by diameter;
    - a hydraulic schematic of the distribution piping showing pressure zones, general pipe connectivity between facilities and pressure zones, storage, elevation, and sources; and
    - a list or ranges of values of friction coefficient used in the hydraulic model according to pipe material and condition in the system. In accordance with Rule stipulation, all coefficients of friction used in the hydraulic analysis are consistent with standard practices.

    [R309-511-7(4)] ☑ SA

11. The Hydraulic Model Design Elements Report documents the calibration methodology used for the hydraulic model and quantitative summary of the calibration results (i.e., comparison tables or graphs). The hydraulic model is sufficiently accurate to represent conditions likely to be experienced in the water delivery system. The model is calibrated to adequately represent the actual field conditions using field measurements and observations.
[R309-511-4(2)(b), R309-511-5(9), R309-511-6(1)(e) & R309-511-7(7)] ☑ SA

12. The Hydraulic Model Design Elements Report includes a statement regarding whether fire hydrants exists within the system. Where fire hydrants are connected to the distribution system, the model incorporates required fire suppression flow standards. The statement that appears in the Report also identifies the local fire authority's name, address, and contact information, as well as the standards for fire flow and duration

explicitly adopted from *R309-510-9(4), Fireflows*, or alternatively established by the local fire suppression agency, pursuant to *R309-510-9(4), Fireflows*. The Hydraulic Model Design Elements Report explains if a steady-state model was deemed sufficient for residential fire suppression demand, or acknowledges that significant fire suppression demand warrants extended model simulations and explains the run time used in the simulations for the period of the anticipated fire event.
[R309-511-5(10) & R309-511-7(5)] ☑ SA

13. If the public drinking water system provides water for outdoor use, the Report describes the criteria used to estimate this demand. If the irrigation demand map in *R309-510-7(3), Estimated Outdoor Use*, is not used, the report provides justification for the alternative demands used in the model. If the irrigation demands are based on the map in *R309-510-7(3), Estimated Outdoor Use*, the Report identifies the irrigation zone number, a statement and/or map of how the irrigated acreage is spatially distributed, and the total estimated irrigated acreage. The indicated irrigation demands are used in the model simulations in accordance with Rule stipulation. The model accounts for outdoor water use, such as irrigation, if the drinking water system supplies water for outdoor use.
[R309-511-5(11) & R309-511-7(1)] ☑ SA

14. The Report states the total number of connections served by the water system including existing connections and anticipated new connections served by the water system after completion of the construction of the project.
[R309-511-7(2)] ☑ SA

15. The Report states the total number of equivalent residential connections (ERC) including both existing connections as well as anticipated new connections associated with the project. In accordance with Rule stipulation, the number of ERC's includes high as well as low volume water users. In accordance with Rule stipulation, the determination of the equivalent residential connections is based on flow requirements using the anticipated demand as outlined in *R309-510, Minimum Sizing Requirements*, or is based on alternative sources of information that are deemed acceptable by the Executive Secretary. *[R309-511-7(3)]* ☑ SA

16. The Report identifies the locations of the lowest pressures within the distribution system, and areas identified by the hydraulic model as not meeting each scenario of the minimum pressure requirements in *R309-105-9, Minimum Pressure Requirements*.
[R309-511-7(6)] ☑ SA

17. The Hydraulic Model Design Elements Report identifies the hydraulic modeling method, and if computer software was used, the Report identifies the software name and version used.

[R309-511-6(1)(f)] ☑ SA

18. For community water system models, the community water system management has been provided with a copy of input and output data for the hydraulic model with the simulation that shows the worst case results in terms of water system pressure and flow.
[R309-511-6(2)(c)] ☑ SA

19. The hydraulic model predicts that new construction will not result in any service connection within the new expansion area not meeting the minimum distribution system pressures as specified in *R309-105-9, Minimum Pressure Requirements.* *[R309-511-6(1)(c)]* ☑ SA

20. The hydraulic model predicts that new construction will not decrease the pressures within the existing water system to such that the minimum pressures as specified in *R309-105-9, Minimum Pressure Requirements* are not met. *[R309-511-6(1)(d)]* ☑ SA

APPENDIX B
Cold Springs Water Quality Results

MEMORANDUM

DATE: June 14, 2011

TO: Chris Thompson, P.E.
Spanish Fork City
2160 North 175 East
Spanish Fork, UT 84660

FROM: Steven C. Jones, P.E.
Hansen, Allen & Luce, Inc. (HAL)
6771 South 900 East
Midvale, Utah 84047

SUBJECT: Cold Springs Water Quality Assessment

PROJECT NO: 348.11.100

BACKGROUND

Spanish Fork City requested that Hansen, Allen & Luce, Inc. (HAL) conduct a water sampling study at Cold Springs. The purpose of the study is to gain an understanding of the source of the water entering the Cold Springs area and assess the possibility that the water is influenced by surface water.

SAMPLING

City personnel were able to pump the pond down at Cold Springs. To do this, the pump station was used to pump 3,600 gpm to the drain that discharges from the pond into the Spanish Fork River. The pond outlet on the north end of the pond was plugged so water being pumped to the drain could not recirculate back into the pond. At the south end of the pond, a City owned 6-inch diameter pump was used to pump an estimated 600 to 800 gpm to another drain that also discharges to the river. In addition to the 6-inch diameter pump, City personnel also rented a 12-inch diameter pump that was placed next to the 6-inch diameter pump to add an estimated 3,000 to 4,000 gpm pumping capacity. After a couple of days, City personnel were able to pump the pond down 2.5 feet—about a foot below the invert of the pond outlet pipe (see attached photos).

After pumping down the pond at cold springs, it was evident that there were four main areas where water was flowing into the pond from the bank of the pond. It was also observed that water was coming up from locations on the bottom of the pond. It was decided to collect samples of water at the four areas where water was flowing into the pond from the bank. In order to identify possible sources for these four flowing areas, samples were taken from the Spanish Fork River, the Upper Cold Springs collection box and the middle collection box at Lower Cold Springs. These seven total samples were taken by Paul Taylor of Spanish Fork City with help from Steven Jones of HAL using bottles prepared by Chemtech-Ford Laboratories of Murray, Utah. See the attached map with the location of the sample sites. Because no filters were used while collecting the samples some sand and solids were present in the samples taken from the bank of the pond. The samples were taken in the afternoon of June 6, 2011 and were delivered to Chemtech-Ford within 2 hours. The samples were tested for complete inorganics. The results are attached with this memorandum.

RESULTS

Steven Jones reviewed the results with Bill Bigelow and Greg Poole, HAL Principals with experience in water sampling. It was concluded that the water entering the pond is from ground water, and is most likely not influenced by water from the Spanish Fork River (see attached data). On the date of the sampling, the flow of the Spanish Fork River was above the 10% historical exceedance probability. This provides a worst case scenario for possible surface water influence into the spring. Key indicators that the water on the east side of the Highway 6 is not influenced by water in the Spanish Fork River include Chloride, Conductivity, Fluoride, Sulfate, Total Dissolved Solids, Potassium, Selenium, and Sodium—all of which had lower levels in the river water. Key indicators that were higher in the river water than all the other samples include pH, Phosphate, Total Suspended Solids, Turbidity, Arsenic, Barium, Chromium, Copper, Iron, Lead, and Zinc. It is also interesting to note that Hardness, Conductivity, Calcium, Magnesium and Sodium matched well between Sites 2 and 4 and Sites 3 and 7. Site 4 is the inflow to the pond closest to Upper Cold Springs (Site 2) and Site 7 is the inflow to the pond closest to Lower Cold Springs (Site 3).

Spanish Fork City Cold Springs Water Quality Sampling

Data From Chemtech-Ford Laboratories 10-Jun-11
Work Order 1104159

	Sample Results							EPA Max Contaminant Level (MCL)	Minimum Reporting Limit	Units
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7			
Calculations										
Hardness, Total as CaCO3	387	427	254	438	384	340	258		**1**	mg/L
Inorganic										
Alkalinity - Bicarbonate (CaCO3)	278	297	254	284	286	267	242		**1.0**	mg/L
Alkalinity - Carbonate (CaCO3)	ND	ND	ND	ND	ND	ND	ND		**1.0**	mg/L
Alkalinity - CO2 (CaCO3)	201	227	192	219	217	200	180		**1.0**	mg/L
Alkalinity - Hydroxide (CaCO3)	ND	ND	ND	ND	ND	ND	ND		**1.0**	mg/L
Alkalinity - Total (as CaCO3)	228	244	209	233	234	219	198		**1.0**	mg/L
Chloride	23	88	95	66	121	82	77	**250**	**1**	mg/L
Conductivity	600	1160	990	1100	1230	1000	860		**1**	umhos/cm
Cyanide, Total	ND	ND	ND	ND	ND	ND	ND	**0.2**	**0.002**	mg/L
Fluoride	0.3	0.4	0.5	0.5	0.5	0.4	0.4	**4**	**0.1**	mg/L
Nitrate as N	0.3	0.2	0.5	0.2	0.3	0.4	0.5	**10**	**0.1**	mg/L
Nitrite as N	ND	ND	ND	ND	ND	ND	ND	**1**	**0.1**	mg/L
pH	8.4	7.4	7.6	7.6	7.5	7.6	7.6		**0.1**	pH Units
Phosphate, ortho	0.01	ND	ND	ND	ND	ND	ND		**0.1**	mg/L
Sulfate	49	226	129	240	197	159	106	**250**	**1**	mg/L
Total Dissolved Solids (TDS)	310	684	510	680	696	558	440	**1000**	**10**	mg/L
Total Suspended Solids (TSS)	350	ND	ND	24	4	93	21		**4**	mg/L
Turbidity	**370.0**	1.4	0.8	**13**	4.3	**26.0**	**7.0**	**5**	**0.02**	NTU
Metals										
Antimony, Total	ND	ND	ND	ND	ND	ND	ND	**0.006**	**0.0005**	mg/L
Arsenic, Total	0.0019	0.0005	0.0005	ND	ND	ND	ND	**0.01**	**0.0005**	mg/L
Barium, Total	0.154	0.027	0.023	0.034	0.033	0.067	0.028	**2**	**0.005**	mg/L
Beryllium, Total	ND	ND	ND	ND	ND	ND	ND	**0.004**	**0.001**	mg/L
Calcium, Total	112.0	131.0	74.2	134.0	115.0	101.0	74.5		**0.2**	mg/L
Cadmium, Total	ND	ND	ND	ND	ND	ND	ND	**0.005**	**0.0005**	mg/L
Chromium, Total	0.005	ND	ND	ND	ND	ND	ND	**0.1**	**0.005**	mg/L
Copper, Total	0.007	ND	ND	ND	ND	ND	ND	**1.3**	**0.005**	mg/L
Iron, Total	**4.84**	0.06	ND	0.41	0.10	**1.05**	0.22	**0.3**	**0.02**	mg/L
Lead, Total	0.0065	ND	ND	ND	ND	0.0027	ND	**0.015**	**0.0005**	mg/L
Mercury, Total	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.0002**	mg/L
Magnesium, Total	26.0	24.2	16.7	25.1	23.4	21.4	17.6		**0.2**	mg/L
Manganese, Total	**0.22**	0.006	ND	0.014	ND	**0.078**	0.011	**0.05**	**0.005**	mg/L
Nickel, Total	ND	ND	ND	ND	ND	ND	ND	**0.1**	**0.005**	mg/L
Potassium, Total	2.8	3.1	5.1	**4.3**	6.2	5.6	5.4		**0.5**	mg/L
Selenium, Total	0.0014	0.0026	0.0028	ND	0.0027	0.0020	0.0020	**0.05**	**0.0005**	mg/L
Silver, Total	ND	ND	ND	ND	ND	ND	ND	**0.1**	**0.0005**	mg/L
Sodium, Total	20.2	57.8	64.9	50.5	85.1	63.9	60.5		**0.5**	mg/L
Thallium, Total	ND	ND	ND	ND	ND	ND	ND	**0.002**	**0.0005**	mg/L
Zinc, Total	0.02	ND	ND	ND	ND	ND	ND	**5**	**0.01**	mg/L

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APPENDIX C
Cost Estimates and Calculations

Spanish Fork Fire Flow 50 Largest Buildings

Size Rank	Use	Type	Building Name	Square Footage	Acres	Address	Fire Code	Sprinkler	Fire Flow	Reduction %	Adj. Fire Flow
1	Industrial	Single Business	Western Distribution	1050844.99	24.12	4000 E Hwy 6	Mixed Occupancy-B-S1 Type II-B	Yes	8000	75	2000
2	Industrial	Multi Business	Longview Fiber	508157.47	11.67	2406 N Main St	Occupancy F-1 Type V-A	Yes	8000	75	2000
3	Industrial	Single Business	SAPA	309205.04	7.10	1550 Kirby Ln	Occupancy F-1 Type V-A	Yes	8000	75	2000
4	Civic	High School	SF High School	222473.09	5.11	99 N 300 West	Occupancy E Type II-B	Yes/No	8000	25	6000
5	Civic	High School	Maple Mt. High School	204989.94	4.71	51 N 2550 East	Occupancy E Type II-B	Yes	8000	75	2000
6	Industrial	Multi Business	Fritizi Building	193520.03	4.44	1350 Calpac Ave	Occupancy F-1 Type IV-	Yes	8000	75	2000
7	Industrial	Single Business	Provo Craft	187038.07	4.29	151 E 3450 North	Mixed Occupancy-B-S1 Type II-B	Yes	8000	75	2000
8	Industrial	Single Business	Natures Sunshine Pro.	180678.13	4.15	1655 N Main St	Mixed Occupancy-B-S1/ F-1 Type II-B	Yes	8000	75	2000
9	Civic	Junior High Schoo	SF Junior High	140610.22	3.23	820 E 600 South	Occupancy E Type II-B	No	8000	75	2000
10	Government	Utah County	Utah County Jail	134706.75	3.09	3075 N Main St	Occupancy I-3 Condition 4 Type 1-A	Yes	4000	50	2000
11	Industrial	Single Business	Klune Industry	133992.17	3.08	1800 N 300 West	Mixed Occupancy B-F-1 Type II-B + 1/5 V-B	No	8000	0	8000
12	Industrial	Single Business	Mt. Country Foods	131975.22	2.47	185 E 1600 North	Mixed Occpancy B-F1/S-1 TypeIV	No	6500	0	6500
13	Civic	Junior High Schoo	Diamond Fork Jr. High	129981.96	2.98	50 N 900 East	Occupancy E Type II-B	Yes	7500	75	1875
14	Industrial	Single Business	PDM Steel	123420.75	0.97	1100 N 300 West	Occupancy F-1 Type IV-B	No	6500	75	1625
15	Commercial	Single Business	Young Living	107067.84	2.46	142 E 3450 North	Mixed Occupancy B-S-1/ F-1 Type II-B	Yes	7000	75	1750
16	Commercial	Multi Business	K-Mart	106849.12	2.45	900 E Hwy 6	Occupancy M Type II-B	Yes	7000	75	1750
17	Commercial	Single Business	Empty Bldg. For Sale	95623.07	2.20	2600 N Main St	Occupancy ? Type IV-B	Yes	8000	75	2000
18	Civic	Elementary School	Sierra Bonita Elementary School	84302.97	1.87	53 S 100 South	Occupancy E Type II-B	Yes	6250	75	1563
19	Civic	Elementary School	Rees Elementary	82454.26	1.89	574 N Rees Ave	Occupancy E Type II-B	Yes	6000	75	1500
20	Civic	Elementary School	East Meadows Elementary	81568.35	1.87	1287 S 2130 East	Occupancy E Type II-B	Yes	6000	75	1500
21	Civic	Elementary School	West Fields Elementary	80885.45	1.86	628 S West Park Dr	Occupancy E Type II-B	Yes	6000	75	1500
22	Civic	Elementary School	Canyon Elementary	76945.28	1.77	1492 E 1240 South	Occupancy E Type II-B	Yes	5750	75	1500
23	Commercial	Single Business	Macy's	76025.28	1.75	187 E 1000 North	Occupancy M Type II-B	Yes	5750	75	1500
24	Civic	Elementary School	Spanish Oaks Elementary	75776.93	1.74	2701 E Canyon Crest D	Occupancy E Type II-B	Yes	5750	75	1500
25	Commercial	Multi Business	Fresh Market	73519.04	1.69	652 N 920 East	Occupancy M Type II-B	Yes(main store)	6000	50	3000
26	Commercial	Single Business	Shopko	71555.90	1.64	955 N Main St	Occupancy M Type II-B	Yes	5750	75	1500
27	Civic	Elementary School	Brock Bank Elementary	66728.63	1.53	340 W 500 North	Occupancy E Type II-B	No	5500	0	5500
28	Civic	Elementary School	Park Elementary	65954.00	1.01	90 N 600 East	Occupancy E Type II-B	No	5500	0	5500
29	Commercial	Single Business	Rocky Mt. Composite	64493.93	1.48	303 W 3000 North	Mixed Occupancy B-S-1/ F-1 Type V-A	Yes	6750	75	1688
30	Industrial	Single Business	Iron Town Homes	62883.81	1.44	1947 N Chappel Dr	Occupancy F-1 Type II-B	Yes	5500	75	1500
31	Civic	Elementary School	Larsen Elementary	61948.62	1.42	1175 E 300 South	Occupancy E Type II-B	?	5750	75	1500
32	Government	Military	Nation Guard Armory	61879.36	1.42	2751 N Main St	Mixed Occupancy B-S-1-A Type II-B	Yes	5250	7500	1500
33	Commercial	Single Business	Mt. Country Foods	58382.28	1.34	2102 N Main St	Mixed Occupancy B-S-1/ F-1 Type IV-A	No	4500	0	4500
34	Commercial	Single Business	Old Bldg (Food for Less)	55354.40	1.27	784 E Expressway Ln	Occupancy M Type II-B	Yes	5000	75	1500
35	Commercial	Single Business	CAL Ranch	52828.47	1.21	950 N Main St	Occupancy M Type V-A	Yes	6250	75	1600
36	Civic		ALA High School	51291.19	1.18	942 W 1100 South	Occupancy E Type II-B	Yes	4750	75	1500
37	Commercial	Single Business	Rocky Mt. Composite	49591.76	1.14	301 W 3000 North	Occupancy F-1-B	Yes	6000	75	1500
38	Civic	Police/Courts	Justice Building	42870.64	0.98	789 W Center St.	Occupancy B Type II-B	Yes	4500	75	1500
39	Civic	Park	Willie Neilson Arena	41644.34	0.96	550 S Center St.	Occupancy Type V-A	No	3750	0	3750
40	Commercial	Single Business	Klune Industry	39949.63	0.92	609 W 1900 North	Occupancy F-1 Type II-B	No	4250	0	4250
41	Commercial	Accessory	SF Foundry	39239.10	0.90	250 E 1600 North	Occupancy F-1 Type V-B	No	5250	0	5250
42	Civic		ALA Elementary	36405.97	0.84	864 W 1100 South	Occupancy E Type II-B	Yes	4000	75	1500
43	Commercial	Single Business	Wasatch Pallet	36067.21	0.83	521 S 1550 West	Occupancy F-1 Type V-B	No	5000	0	5000
44	Commercial	Accessory	Sugar Factory	35821.88	0.82	433 S 1550 West	OccupancyS-1 Type V-B	No	5000	0	5000
45	Commercial	Multi Business	Zion/Main St/Businesses	35190.41	0.81	190 N Main St	Mixed Occupancy B-M Type V-B	No	5000	0	5000
46	Civic	High School	Landmark Highschool	33449.00	0.02	606 S Main St.	Occupancy E Type II-B	Yes	4000	75	1500
47	Civic	School District	Nebo School Distric Offices	32618.23	0.75	350 S Main Street	Mixed occupancy B-S-1/ F-1 Type II-b/V-B	Yes/No	4500	40	1850
48	Commercial	Multi Business	Big 5/Dollar Tree	29823.43	0.68	1066 N Main St	Occupancy B Type V-B	y	4500	75	1500
49	Residential	Accessory	Residential House/Barn	28968.56	0.67	990 S 2400 E	Mixed Occupancy R-4 Type V-B	No	4000	0	4000
50	Commercial	Multi Business	Golds Gym	28729.13	0.66	795 E 800 N	Mixed Occupancy B Type V-B	No	4500	0	4500

ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	PROJECT COST
		New Pipe	**24**	**22085**	**foot**	$101	$2,221,972	$777,690	**$3,000,000**	**$3,000,000**
1	3750 E & Hwy 6 (Malcomb Tanks)	Close Pipe	21	1	each	$-00	$-00	$-00	**$-00**	**$18,000**
		New Pipe	21	40	foot	$157	$6,280	$2,198	**$8,000**	
		New Pipe	30	30	foot	$248	$7,440	$2,604	**$10,000**	
2	3400 E & Hwy 6 (30" line isolation)	Close Pipe	24	1	each	$-00	$-00	$-00	**$-00**	**$-00**
3	2550 E & Hwy 6 (30" line isolation and redundancy)	New Pipe	30	92	foot	$248	$22,816	$7,986	**$31,000**	**$65,000**
	Connect 8" and 20" lines in 2550 E	New Pipe	12	218	foot	$114	$24,863	$8,702	**$34,000**	
4	750 S & Hwy 6 (30" line isolation)	Close Pipe	8	1	each	$-00	$-00	$-00	**$-00**	**$-00**
5	500 S & Hwy (30" line isolation)	Close Pipe	8	1	each	$-00	$-00	$-00	**$-00**	**$-00**
6	Center Street & Hwy 6 (30" line isolation and redundancy)	New Pipe	12	40	foot	$114	$4,560	$1,596	**$6,000**	**$6,000**
		Close Pipe	12	1	each	$-00	$-00	$-00	**$-00**	
7	200 N & Hwy 6 (Improve ff)	Close Pipe	12	1	each	$-00	$-00	$-00	**$-00**	**$-00**
8	400 N & Hwy 6 (Improve ff)	Check Valve	8	1	each	$1,550	$1,550	$543	**$2,000**	**$2,000**
9	400 N & 1000 E (Zone Boundary Realignment)	Close Valve	4	1	each	$-00	$-00	$-00	**$-00**	**$-00**
10	400 N & 900 E (Zone Boundary Realignment)	Close Valve	12	1	each	$-00	$-00	$-00	**$-00**	**$-00**
11	500 N & 800 E (Zone Boundary Realignment)	Open Valve	6	1	each	$-00	$-00	$-00	**$-00**	**$-00**
12	600 N & 900 E (Zone Boundary Realignment)	Open Valve	8	1	each	$-00	$-00	$-00	**$-00**	**$-00**
13	500 E & 200 S (Improve ff)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$45,000**
		New Pipe	18	10	foot	$148	$1,480	$518	**$2,000**	
14	300 W from 900 N to 1900 N, 900 N from 300 W to Main St (Improve ff)	New Pipe	12	6,100	foot	$114	$695,400	$243,390	**$939,000**	**$939,000**
15	Main St from 1380 N to 1600 N (Improve ff)	New Pipe	16	1,200	foot	$130	$156,000	$54,600	**$211,000**	**$211,000**
16	Industrial Park Dr from 45 N to 200 E, 200 E from 1300 N to 1750 N (Improve ff abandon 4")	New Pipe	8	2,650	foot	$91	$241,150	$84,403	**$326,000**	**$326,000**
17	150 E to Main St at 1800 N (Improve ff)	New Pipe	10	700	foot	$102	$71,400	$24,990	**$96,000**	**$96,000**
18	300 E and 3100 N (Improve ff for Springville)	Two Way PR\	8	1	each	$30,000	$30,000	$10,500	**$41,000**	**$41,000**
19	1500 W from 750 S to 400 S(Improve ff to WP	New Pipe	12	1,650	foot	$114	$188,100	$65,835	**$254,000**	**$254,000**
20	2650 S Spanish Oaks Dr and 2400 S Spanish Oaks Dr (Improve ff and pressures)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
		Adjust PRV		100	psi	$-00	$-00	$-00	**$-00**	
21	3750 E Hwy 6 (Connect Cold Springs)	Control Valve	16	1	each	$37,000	$37,000	$12,950	**$50,000**	**$63,000**
		New Pipe	21	60	foot	$157	$9,420	$3,297	**$13,000**	
22	Cold Springs Zone (Create Zone)	Close Valves		9	each	$-00	$-00	$-00	**$-00**	**$86,000**
		PRV Install	10	2	each	$32,000	$64,000	$22,400	**$86,000**	
23	900 E and Canyon Rd	New Pipe	12	10	foot	$114	$1,140	$399	**$2,000**	**$2,000**
24	1100 E and Canyon Rd	New Pipe	6	10	each	$84	$840	$294	**$1,000**	**$1,000**
25	River Bottoms Rd from Powerhouse Rd to 1800 S	New Pipe	8	600	foot	$91	$54,600	$19,110	**$74,000**	**$74,000**
26	500 E and 200 S	PRV Install	12	1	each	$37,000	$37,000	$12,950	**$50,000**	**$58,000**
		New Pipe	18	40	foot	$148	$5,920	$2,072	**$8,000**	

ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	PROJECT COST
27	Create leak detection program	Leak Detection		1	each	$148,148	$148,148	$51,852	**$200,000**	**$200,000**
28	Line 30" pipeline from cold springs	Line Pipe		1	each	$1,000,000	$1,000,000	$350,000	**$1,350,000**	**$1,350,000**
29	2300 East between Canyon Road and 750 South	New Pipe	12	1,650	foot	$114	$188,100	$65,835	**$254,000**	**$254,000**
30	Highway 6 between 750 South and 2550 East	New Pipe	12	1,190	foot	$114	$135,660	$47,481	**$183,000**	**$183,000**
31	600 West between 3100 North and State Road 77	New Pipe	12	3,440	foot	$114	$392,160	$137,256	**$529,000**	**$529,000**
32	Install 6,990 feet of 12-in pipe in Highway 77 between 550 W and 2050 W	New Pipe	12	6,990	foot	$114	$796,860	$278,901	**$1,076,000**	**$1,076,000**
33	Install 6,620 feet of 12-in pipe in 1150 W between 3050 N and 2400	New Pipe	12	6,620	foot	$114	$754,680	$264,138	**$1,019,000**	**$1,019,000**
34	Install 3,670 feet of 12-in pipe in 1000 N between 300 W and 1120 W	New Pipe	12	3,670	foot	$114	$418,380	$146,433	**$565,000**	**$565,000**
35	Install 2,960 feet of 12-in pipe from 2300 S and 1100 E to 1400 E and 1870 S	New Pipe	12	2,960	foot	$114	$337,440	$118,104	**$456,000**	**$456,000**
36	Install 10,540 feet of 12-in pipe from 2350 S and 1100 E to Volunteer Drive and Main Street	New Pipe	12	10,540	foot	$114	$1,201,560	$420,546	**$1,622,000**	**$1,622,000**
37	100 South between 1060 West and 1550 West	New Pipe	12	4,170	foot	$114	$475,380	$166,383	**$642,000**	**$642,000**
38	1300 South between Mill Road and 1200 West	New Pipe	12	3,260	foot	$114	$371,640	$130,074	**$502,000**	**$502,000**
39	3400 East from Highway 6 to 750 South	New Pipe	12	3,480	foot	$114	$396,720	$138,852	**$536,000**	**$536,000**
40	Install 4,010 feet of 12-in pipe in Woodland Hills Drive between State Roads 164 and 198, and install 4,620 feet of 12-in pipe in South Field Road between State Road 198 and 620 E and install 1,200 feet of 12-in pipe in 620 E to 3000 S	New Pipe	12	9,832	foot	$114	$1,120,848	$392,297	**$1,513,000**	**$1,513,000**
41	Install 3,500 feet of 12-in pipe from 620 E and South Field Road to 2300 S and 1100 E	New Pipe	12	3,500	foot	$114	$399,000	$139,650	**$539,000**	**$539,000**
42	Install 1,350 feet of 12-in pipe in Canyon Crest Road between 2300 E and 2600 E	New Pipe	12	1,350	foot	$114	$153,900	$53,865	**$208,000**	**$208,000**
43	Rivers Bottom Road from Powerhouse Road to 1800 South	New Pipe	8	600	foot	$91	$54,600	$19,110	**$74,000**	**$74,000**
44	1600 North between 300 W and 1100 West, 1100 West between 1600 North and 2400 North, and 2400 North between 1100 West and 2050 West	New Pipe	12	11730	foot	$114	$1,337,220	$468,027	**$1,805,000**	**$1,805,000**
45	1700 North between 500 West and 1100 West	New Pipe	12	2,150	foot	$114	$245,100	$85,785	**$331,000**	**$331,000**
46	2300 East between 1850 South and 2000 South	New Pipe	12	1,020	foot	$114	$116,280	$40,698	**$157,000**	**$157,000**

ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	PROJECT COST
47	Install 3,590 feet of 12-in pipe from 2350 S and 1100 E to 2300 S and 2300 E	New Pipe	12	3,590	foot	$114	$409,260	$143,241	**$553,000**	**$553,000**
48	State Road 198 between South Field Road and 2225 South	New Pipe	12	740	foot	$114	$84,360	$29,526	**$114,000**	**$114,000**
49	End of Eagle Drive and nearby reservoir parking lot	New Pipe	8	970	foot	$91	$88,270	$30,895	**$119,000**	**$119,000**
50	1700 West between State Road 164 and 1400 South	New Pipe	12	2360	foot	$114	$269,040	$94,164	**$363,000**	**$363,000**
51	Install 6,140 feet of 12-in pipe in 1100 E from 1200 N to 950 E and 2500 N	New Pipe	12	6,140	foot	$114	$699,960	$244,986	**$945,000**	**$945,000**
52	2150 North between 1100 East and Chappel Drive	New Pipe	12	1,920	foot	$114	$218,880	$76,608	**$295,000**	**$295,000**
53	1300 North between Chappel Drive to 1100 East	New Pipe	12	2,900	foot	$114	$330,600	$115,710	**$446,000**	**$446,000**
54	Install 1,560 feet of 12-in pipe in 1200 N from Chappel Drive to 1100 E and 1300 N	New Pipe	12	1,560	foot	$114	$177,840	$62,244	**$240,000**	**$240,000**
55	Install 3,700 feet of 12-in pipe in future road connecting 1950 N on Williams Lane to 950 E and 2500 N	New Pipe	12	3,700	foot	$114	$421,800	$147,630	**$569,000**	**$569,000**
56	1420 East Extension to Expressway Lane	New Pipe	12	1,480	foot	$114	$168,720	$59,052	**$228,000**	**$228,000**
57	Expressway Lane between State Road 51 and 2500 East	New Pipe	12	2,890	foot	$114	$329,460	$115,311	**$445,000**	**$445,000**
58	2200 East between 400 North and Expressway Lane	New Pipe	12	390	foot	$114	$44,460	$15,561	**$60,000**	**$60,000**
59	2550 East between 150 North and Expressway Lane	New Pipe	12	7,650	foot	$114	$872,100	$305,235	**$1,177,000**	**$1,177,000**
60	400 North between Stahell Lane and 2550 East	New Pipe	12	6,170	foot	$114	$703,380	$246,183	**$950,000**	**$950,000**
61	150 South between 2550 East and Railroad	New Pipe	12	2,850	foot	$114	$324,900	$113,715	**$439,000**	**$439,000**
62	3400 East along Railroad between 750 South and 150 South	New Pipe	12	2,910	foot	$114	$331,740	$116,109	**$448,000**	**$448,000**
63	750 South between 3400 East and 3100 East	New Pipe	12	1,320	foot	$114	$150,480	$52,668	**$203,000**	**$203,000**
64	2300 South (relatively) between 2300 East and 1700 East	New Pipe	12	3,310	foot	$114	$377,340	$132,069	**$509,000**	**$509,000**
65	Install 8,310 feet of 12-in pipe from 2750 S and 820 E to Arrowhead Trail Street and Del Monte Road	New Pipe	12	8,310	foot	$114	$947,340	$331,569	**$1,279,000**	**$1,279,000**
66	Install 4,790 feet of 12-in pipe in 1100 E and 1200 E between 3000 S and 2080 E	New Pipe	12	4,790	foot	$114	$546,060	$191,121	**$737,000**	**$737,000**

ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	PROJECT COST
67	Install 1,280 feet of 12-in pipe from 1550 E and 2050 S to 1830 E and 2080 S	New Pipe	12	1,280	foot	$114	$145,920	$51,072	**$197,000**	**$197,000**
68	Install 4,570 feet of 12-in pipe from River Bottoms Road and 3100 E to 2300 E and 2030 S	New Pipe	12	4,570	foot	$114	$520,980	$182,343	**$703,000**	**$703,000**
69	Install 8,010 feet of 12-in pipe in 3000 S between 2300 E and 620 E	New Pipe	12	8,010	foot	$114	$913,140	$319,599	**$1,233,000**	**$1,233,000**
70	1800 West along I-15 between 3000 South and 900 South	New Pipe	12	5,570	foot	$114	$634,980	$222,243	**$857,000**	**$857,000**
71	1300 South between 1200 West and 1800 West	New Pipe	12	2,770	foot	$114	$315,780	$110,523	**$426,000**	**$426,000**
72	3000 South between Arrowhead Trail Road and 2000 West	New Pipe	12	10,400	foot	$114	$1,185,600	$414,960	**$1,601,000**	**$1,601,000**
73	2200 West between 900 South and 3000 South and then along 3000 South to 2000 West	New Pipe	12	5,530	foot	$114	$630,420	$220,647	**$851,000**	**$851,000**
74	900 South between 2200 West and 1400 West	New Pipe	12	4,380	foot	$114	$499,320	$174,762	**$674,000**	**$674,000**
75	Install 4,510 feet of 12-in pipe in From 900 S and 2500 W to 100 S and 2000 W	New Pipe	12	4,510	foot	$114	$514,140	$179,949	**$694,000**	**$694,000**
76	1550 West between 300 South and 100 South	New Pipe	12	1,660	foot	$114	$189,240	$66,234	**$255,000**	**$255,000**
77	1550 West between 100 South and 400 North	New Pipe	12	4,670	foot	$114	$532,380	$186,333	**$719,000**	**$719,000**
78	400 North between 1550 West and 700 West	New Pipe	12	2,170	foot	$114	$247,380	$86,583	**$334,000**	**$334,000**
79	950 West between 400 North and 1000 North	New Pipe	12	3,410	foot	$114	$388,740	$136,059	**$525,000**	**$525,000**
80	Install 8-in PRV on west side of Eagle Drive and Hawk Drive intersection	PRV Install	8	1	each	$23,000	$23,000	$8,050	**$31,000**	**$31,000**
81	Install 10-in PRV on east side of Canyon Crest Drive and 2300 E intersection (See project 42)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
82	Install 10-in PRV on east side of South Field Road and State Road 198 intersection (See project 40)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
83	Install 10-in PRV on south side of 750 S and 3400 E intersection (See project 39)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
84	Install 10-in PRV on southwest side of Mill Road and State Road 164 intersection	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
85	Install 10-in PRV at 1300 S and 900 W (See project 38)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
86	Install 10-in PRV on east side of 900 S 1400 W intersection	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
87	Install 10-in PRV on west side of 100 S and 1320 W intersection (See project 37)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
88	Install 6-in PRV in 400 N and 700 W	PRV Install	6	1	each	$21,000	$21,000	$7,350	**$28,000**	**$28,000**

ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	PROJECT COST
89	Install 10-in PRV on east side of Expressway Lane and State Road 51 intersection	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
90	Install 10-in PRV at 2300 S and 1100 E (See project 36)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
91	Install 10-in PRV at 2550 E and 150 N intersection	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
92	Install 10-in PRV at 1830 E and 2080 S (See project 67)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
93	Install 10-in PRV at Legacy Farms Parkway and State Road 51 (See project 59)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
94	Install 10-in PRV at 750 E and 2650 S (See project 65)	PRV Install	10	1	each	$32,000	$32,000	$11,200	**$43,000**	**$43,000**
95	Fill in the Cold Springs Pond and develop the entire spring for use in the drinking water system	Future Sources		1	each	$2,500,000	$2,500,000	$-00	**$2,500,000**	**$2,500,000**
96	Clean up drinking water system water rights and make sure all source capacities match available water rights	Future Sources		1	each	$100,000	$100,000	$-00	**$100,000**	**$100,000**
97	Develop new well sources for backup and reundancy for future growth	Future Sources		1	each	$2,800,000	$2,800,000	$980,000	**$3,780,000**	**$3,780,000**
98	Replace the Malcomb Tanks with a 5.0 MG Tank	Future Storage		1	each	$3,000,000	$3,000,000	$1,050,000	**$4,050,000**	**$4,050,000**
99	Replace the Oaks Tanks with a 0.6 MG Tank	Future Storage		1	each	$600,000	$600,000	$210,000	**$810,000**	**$810,000**
100	Model, Master Plan, & Impact Fee Updates	Design & Planning							**$248,013**	**$248,013**
									Total	**$50,185,013**

IMPACT FEE RELATED PROJECT COST ESTIMATES

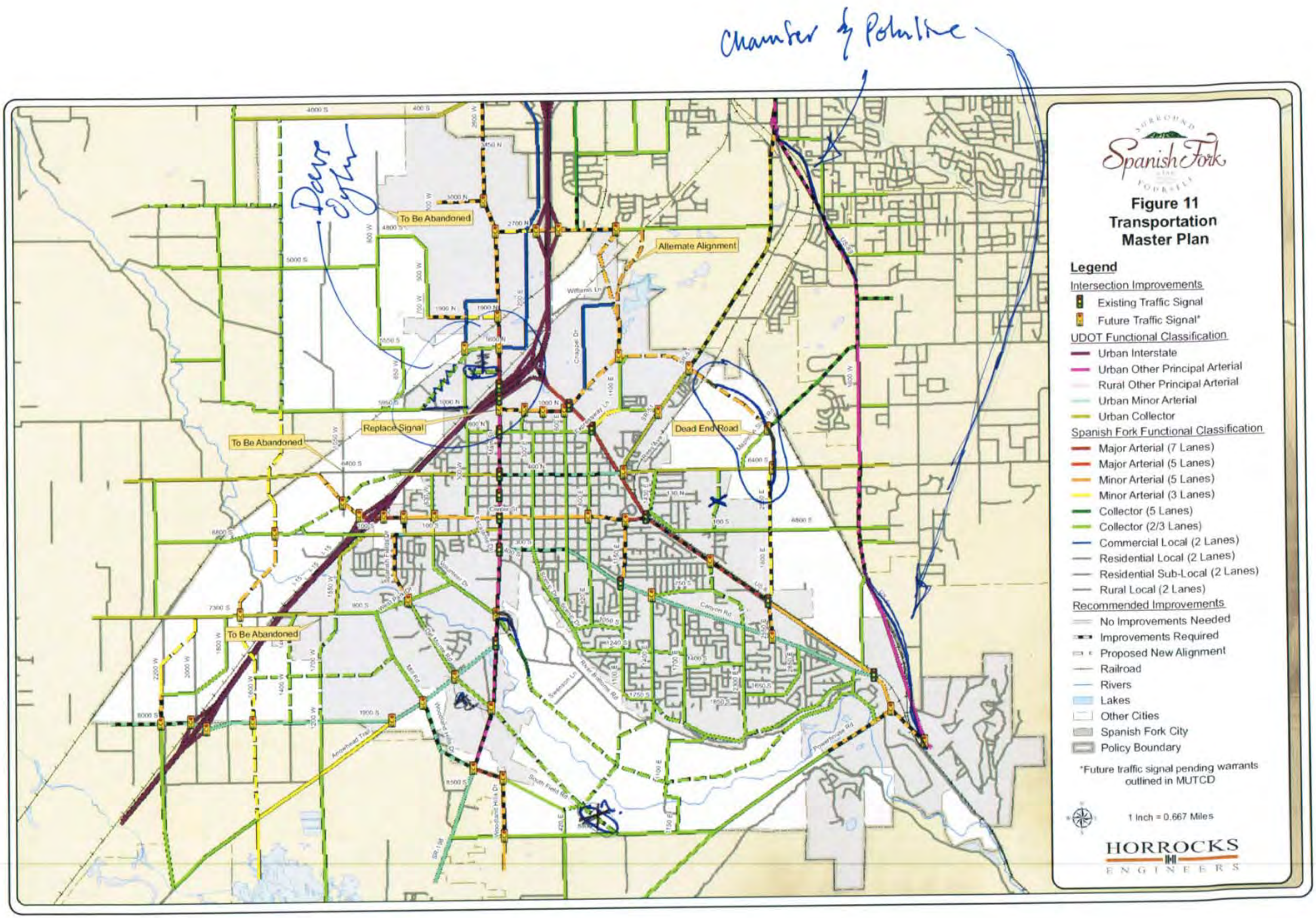
ID	Project Description	Work	Size	UNIT	UNIT TYPE	UNIT COST	COST	Contingency (20%) and Engineering (15%)	TOTAL COST	% Impact Fee Eligible	PROJECT COST	Project Cost % IF
A	Maple Mtn. High School 2550 E Trunkline	**ACTUAL COST**								**58%**	**$175,997**	**$102,078**
B	5 MG Water Tank - Sterling Hollow	**ACTUAL COST**								**100%**	**$3,215,705**	**$3,215,705**
1	Crab Creek Transmission	New Pipe	24	22085	foot				**$2,740,223**	**48%**	**$2,740,223**	**$1,315,307**
15	Main St 1400 N to 1600 N Trunk line	New Pipe	16	1,225	foot					**88%**	**$215,000**	**$189,200**
95	Cold Springs Pond Fill & Collection Line	Future Sources		1	each	$2,500,000	$2,500,000	$-00	**$2,500,000**	**100%**	**$2,500,000**	**$2,500,000**
100	Model, Master Plan & Impact Fee Updates									**100%**	**$248,013**	**$248,013**

UNIT COSTS FOR COST ESTIMATE CALCULATIONS

PVC Pipe In Road Cost/lf		PVC Pipe Out of Road Cost/lf		Check Valve		PRV Valve Station	
Diameter (in)	Cost/lf	Diameter (in)	Cost/lf	Size (in)	Cost	Size (in)	Cost
4	$76	4	$59	4	$875	4	$19,000
6	$84	6	$67	6	$1,175	6	$21,000
8	$91	8	$76	8	$1,550	8	$23,000
10	$102	10	$88	10	$2,725	10	$32,000
12	$114	12	$101	12	$3,900	12	$37,000
14	$114	14	$101	14	$4,013	14	$43,000
16	$130	16	$112	16	$4,125	16	$50,000
18	$148	18	$131	18	$6,475	18	$55,000
20	$157	20	$140	20	$12,288	20	$58,000
24	$186	24	$172	24	$18,100	24	$73,000
30	$248	30	$238	30		30	$84,000
36	$328	36	$325	36		36	$100,000
					Estimation		Estimation

Assumptions

Pipe Costs	2011 RS Ways & Means, 4' cover, 10 laterals/1,000', 2 hydrants/1,000'
Check Valve	2011 RS Ways & Means
PRV Valve Sta.	Granger Hunter Drinking Water Master Plan 2005, no inflation compensation due to similar pricing structure



Spanish Fork
Figure 11
Transportation Master Plan
Legend
Intersection Improvements
Existing Traffic Signal
Future Traffic Signal*
UDOT Functional Classification
Urban Interstate
Urban Other Principal Arterial
Rural Other Principal Arterial
Urban Minor Arterial
Urban Collector
Spanish Fork Functional Classification
Major Arterial (7 Lanes)
Major Arterial (5 Lanes)
Minor Arterial (5 Lanes)
Minor Arterial (3 Lanes)
Collector (5 Lanes)
Collector (2/3 Lanes)
Commercial Local (2 Lanes)
Residential Local (2 Lanes)
Residential Sub-Local (2 Lanes)
Rural Local (2 Lanes)
Recommended Improvements
No Improvements Needed
Improvements Required
Proposed New Alignment
Railroad
Rivers
Lakes
Other Cities
Spanish Fork City
Policy Boundary
*Future traffic signal pending warrants outlined in MUTCD
1 Inch = 0.667 Miles
HORROCKS ENGINEERS
To Be Abandoned
Alternate Alignment
Replace Signal
Dead End Road
To Be Abandoned
To Be Abandoned
Chamber of Pole line
Deer Lght

Spanish Fork City, Utah

$2,040,000 Water Revenue Bonds, Series 2011
(State Division of Drinking Water Board)
(Final Numbers)

Pricing Summary

Maturity	Type of Bond	Coupon	Yield	Maturity Value	Price		Dollar Price
06/01/2032	Term 1 Coupon	1.870%	1.869%	2,040,000.00	100.000%	c	2,040,000.00
Total	-	-	-	**$2,040,000.00**	-	-	**$2,040,000.00**

Bid Information

Par Amount of Bonds	$2,040,000.00
Gross Production	$2,040,000.00
Bid (100.000%)	2,040,000.00
Total Purchase Price	$2,040,000.00
Bond Year Dollars	$23,894.33
Average Life	11.713 Years
Average Coupon	1.8700000%
Net Interest Cost (NIC)	1.8700000%
True Interest Cost (TIC)	1.8704049%

Spanish Fork City, Utah

$2,040,000 Water Revenue Bonds, Series 2011
(State Division of Drinking Water Board)
(Final Numbers)

Sources & Uses

Dated 10/26/2011 | Delivered 10/26/2011

Sources Of Funds	
Par Amount of Bonds	$2,040,000.00
Total Sources	**$2,040,000.00**
Uses Of Funds	
Deposit to Project Construction Fund	1,985,600.00
Costs of Issuance	54,400.00
Total Uses	**$2,040,000.00**

Spanish Fork City, Utah

$2,040,000 Water Revenue Bonds, Series 2011
(State Division of Drinking Water Board)
(Final Numbers)

Debt Service Schedule

Date	Principal	Coupon	Interest	Total P+I	Fiscal Total
10/26/2011	-	-	-	-	-
06/01/2012	-	-	22,782.83	22,782.83	22,782.83
06/01/2013	85,000.00	1.870%	38,148.00	123,148.00	123,148.00
06/01/2014	87,000.00	1.870%	36,558.50	123,558.50	123,558.50
06/01/2015	88,000.00	1.870%	34,931.60	122,931.60	122,931.60
06/01/2016	90,000.00	1.870%	33,286.00	123,286.00	123,286.00
06/01/2017	92,000.00	1.870%	31,603.00	123,603.00	123,603.00
06/01/2018	93,000.00	1.870%	29,882.60	122,882.60	122,882.60
06/01/2019	95,000.00	1.870%	28,143.50	123,143.50	123,143.50
06/01/2020	97,000.00	1.870%	26,367.00	123,367.00	123,367.00
06/01/2021	99,000.00	1.870%	24,553.10	123,553.10	123,553.10
06/01/2022	100,000.00	1.870%	22,701.80	122,701.80	122,701.80
06/01/2023	102,000.00	1.870%	20,831.80	122,831.80	122,831.80
06/01/2024	104,000.00	1.870%	18,924.40	122,924.40	122,924.40
06/01/2025	106,000.00	1.870%	16,979.60	122,979.60	122,979.60
06/01/2026	108,000.00	1.870%	14,997.40	122,997.40	122,997.40
06/01/2027	110,000.00	1.870%	12,977.80	122,977.80	122,977.80
06/01/2028	113,000.00	1.870%	10,920.80	123,920.80	123,920.80
06/01/2029	114,000.00	1.870%	8,807.70	122,807.70	122,807.70
06/01/2030	117,000.00	1.870%	6,675.90	123,675.90	123,675.90
06/01/2031	119,000.00	1.870%	4,488.00	123,488.00	123,488.00
06/01/2032	121,000.00	1.870%	2,262.70	123,262.70	123,262.70
Total	**$2,040,000.00**	-	**$446,824.03**	**$2,486,824.03**	-

Yield Statistics

Bond Year Dollars	$23,894.33
Average Life	11.713 Years
Average Coupon	1.8700000%
Net Interest Cost (NIC)	1.8700000%
True Interest Cost (TIC)	1.8704049%
Bond Yield for Arbitrage Purposes	1.8704049%
All Inclusive Cost (AIC)	2.1373053%

IRS Form 8038

Net Interest Cost	1.8700000%
Weighted Average Maturity	11.713 Years

APPENDIX D
Calibration Data

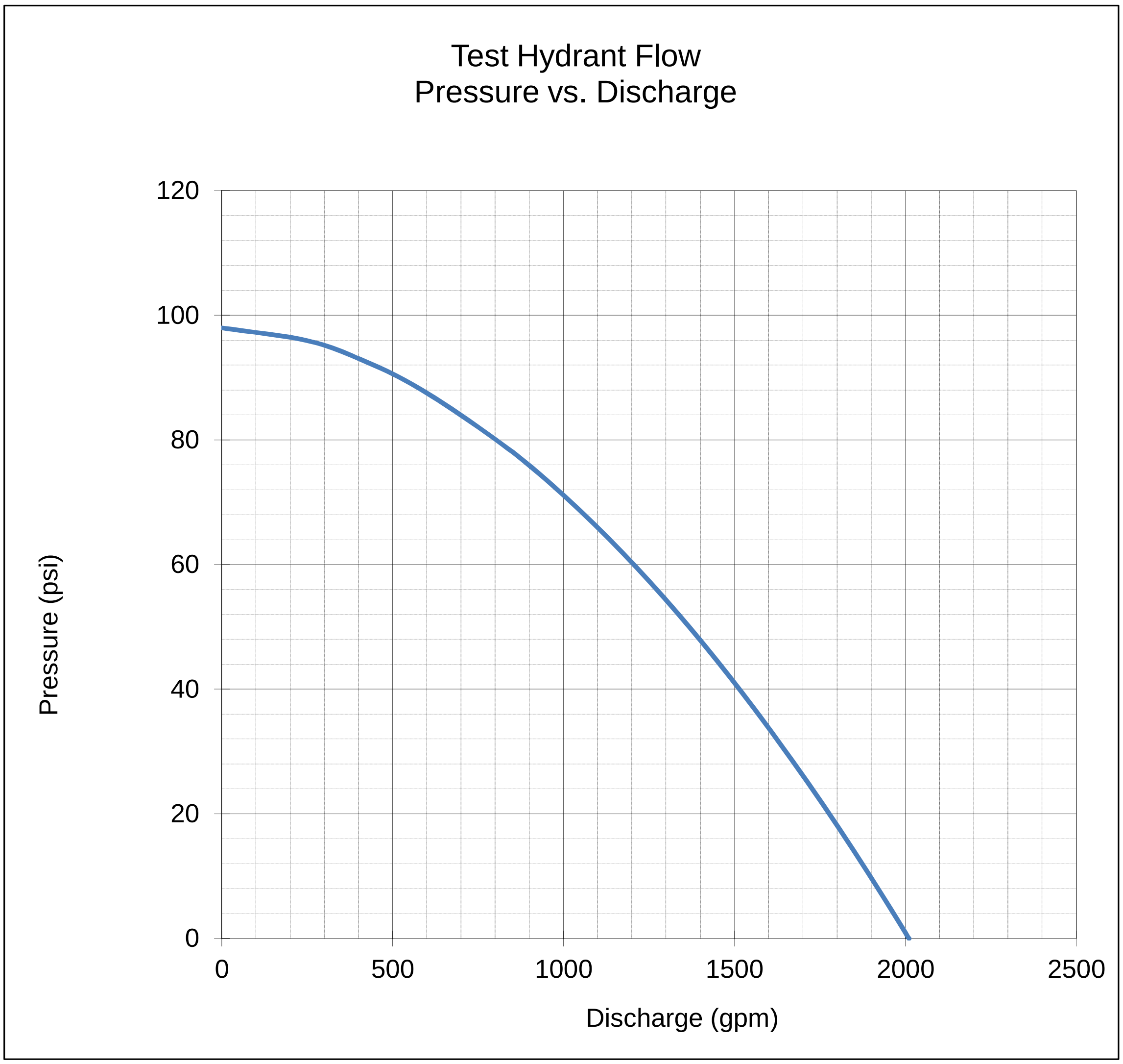
SPANISH FORK FIRE FLOW CALIBRATION SEPTEMBER 21, 2010

TEST ID	Hydrant Location	System Static (psi)	Model Static (psi)	% Difference	System Residual (psi)	Model Residual (psi)	% Difference
1	3450 N Main St	98	92	6	65	65	0
2	550 N Mitchell Dr	98	98	0	74	74	0
3	950 South 2000 West	98	98	0	62	62	0
4	632 Aarowhead Trail Rd	102	102	0	75	75	0
5	980 East Scenic Dr	65	67	-3	58	59	-2
6	241 East 1700 South	105	105	0	100	90	10
7	Powerhouse Rd	118	115	3	96	96	0
8	Oak Ridge and Spanish Oaks Dr	73	73	0	55	55	0
9	1035 South 2400 East	110	110	0	100	94	6
10	1490 East 120 North	68	68	0	56	56	0

Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 12:01 PM

DIFFUSER TEST

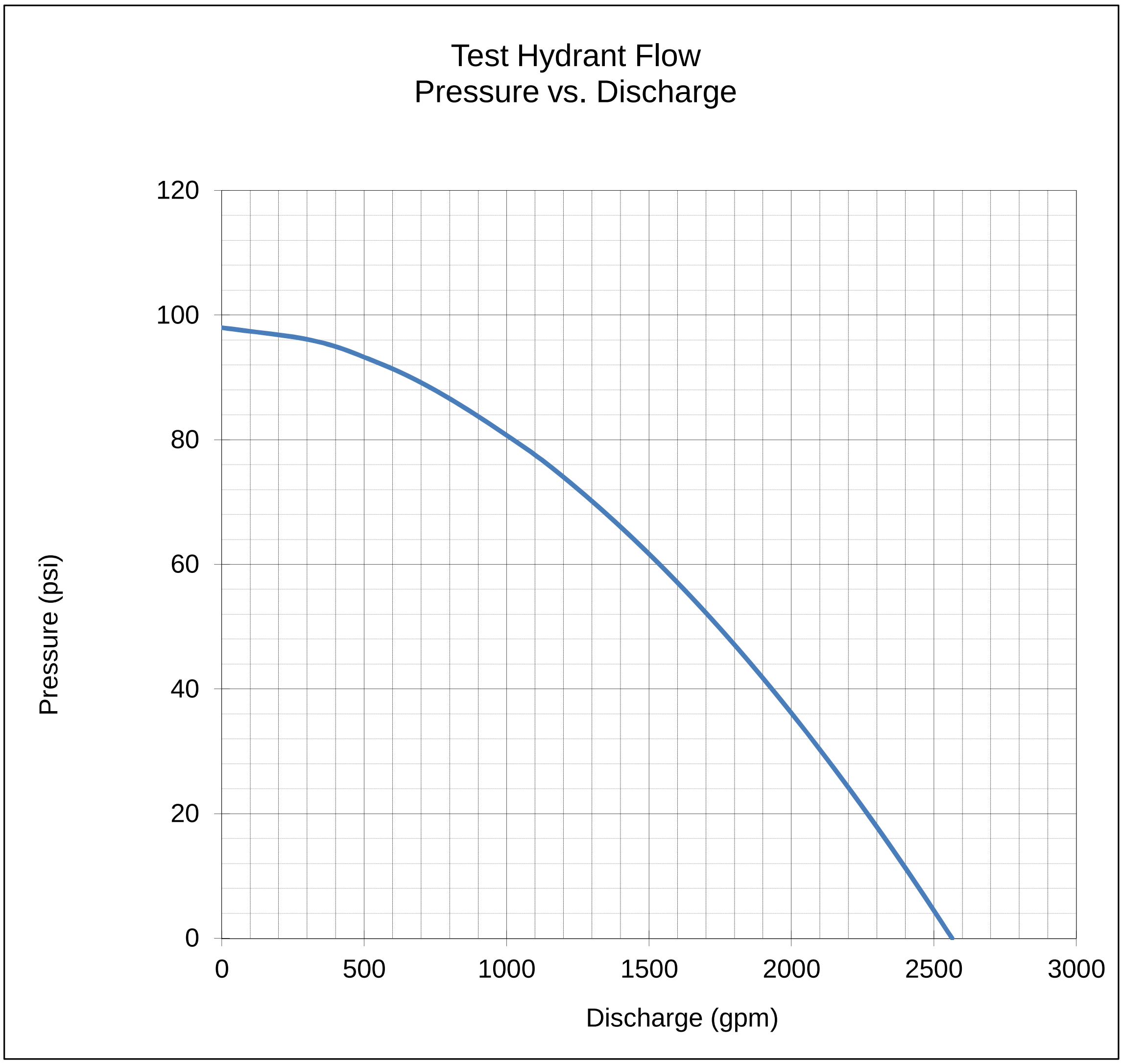
FLOW HYDRANT	4000 N Main St		TEST HYDRANT	3450 N Main St	
Pitot Pressure	65.0	psi (velocity head)	Static Pressure	98	psi.
Discharge Coef., C	0.9		Residual Pressure	62	psi
Discharge ID	2.500	inches			
Flowrate, Q	1171	gpm	Residual Flow at 20 p	1777	gpm



Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2011 Time: 12:20 PM

DIFFUSER TEST

FLOW HYDRANT	520 N Mitchell Dr		TEST HYDRANT	550 N Mitchell Dr	
Pitot Pressure	70.0	psi (velocity head)	Static Pressure	98	psi.
Discharge Coef., C	0.9		Residual Pressure	74	psi
Discharge ID	2.500	inches			
Flowrate, Q	1199	gpm	Residual Flow at 20 p	2267	gpm

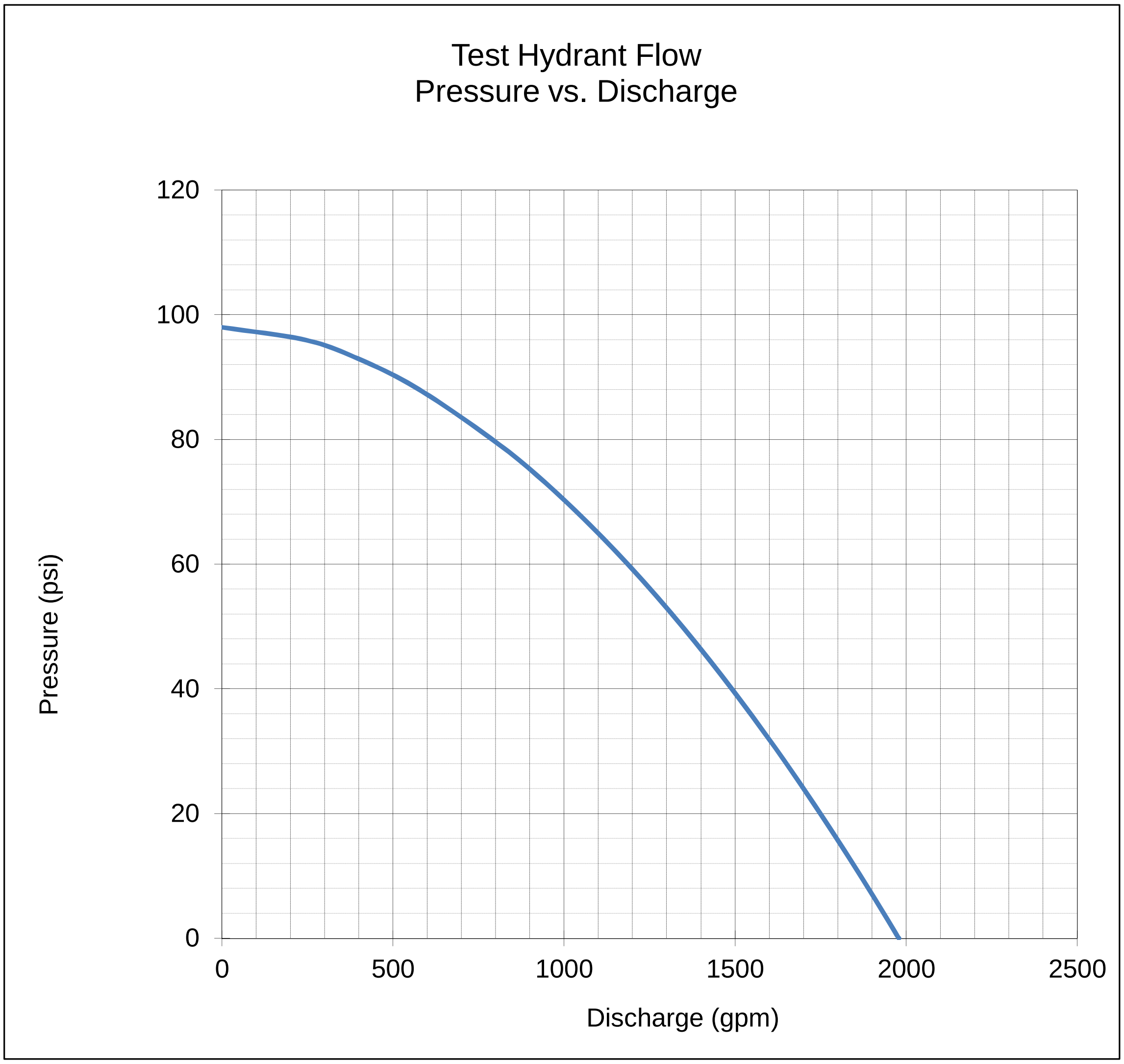


Client:	Spanish Fork		
Project:	348.08.100		
Feature:	Fire Flow Test		
Date:	9/21/2010	Time:	12:50 PM

DIFFUSER TEST

FLOW HYDRANT	900 South 2000 West		TEST HYDRANT	950 South 2000 West	
Pitot Pressure	62.0	psi (velocity head)	Static Pressure	98	psi.
Discharge Coef., C	0.9		Residual Pressure	62	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1152	gpm	Residual Flow at 20 p	1749	gpm

1254

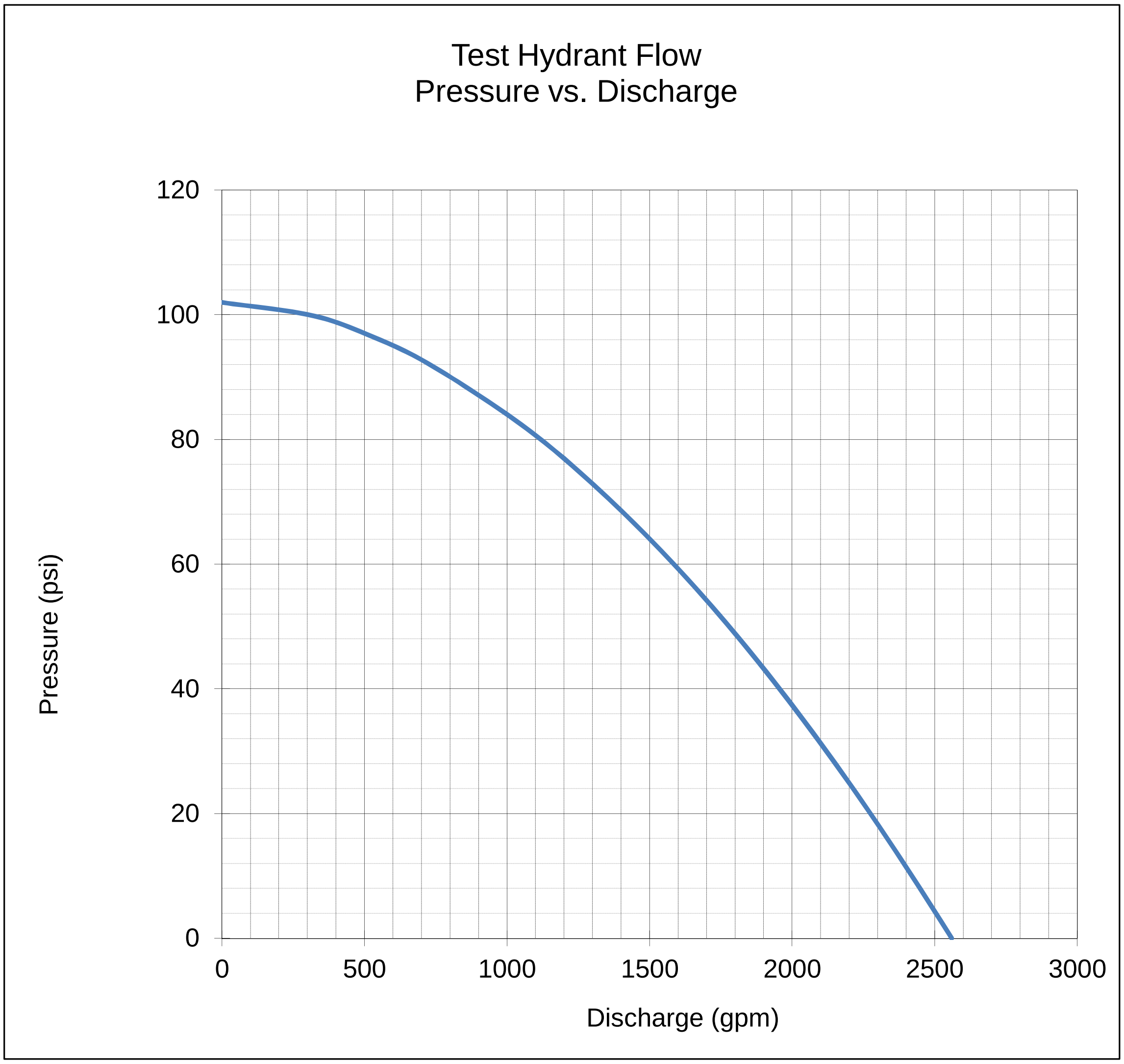


Client:	Spanish Fork
Project:	348.08.100
Feature:	Fire Flow Test
Date:	9/21/2010 Time: 12:53 PM

DIFFUSER TEST

FLOW HYDRANT	650 Aarowhead Trail Rd		TEST HYDRANT	632 Aarowhead Trail Rd	
Pitot Pressure	80.0	psi (velocity head)	Static Pressure	102	psi.
Discharge Coef., C	0.9		Residual Pressure	75	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1248	gpm	Residual Flow at 20 p	2274	gpm

1378

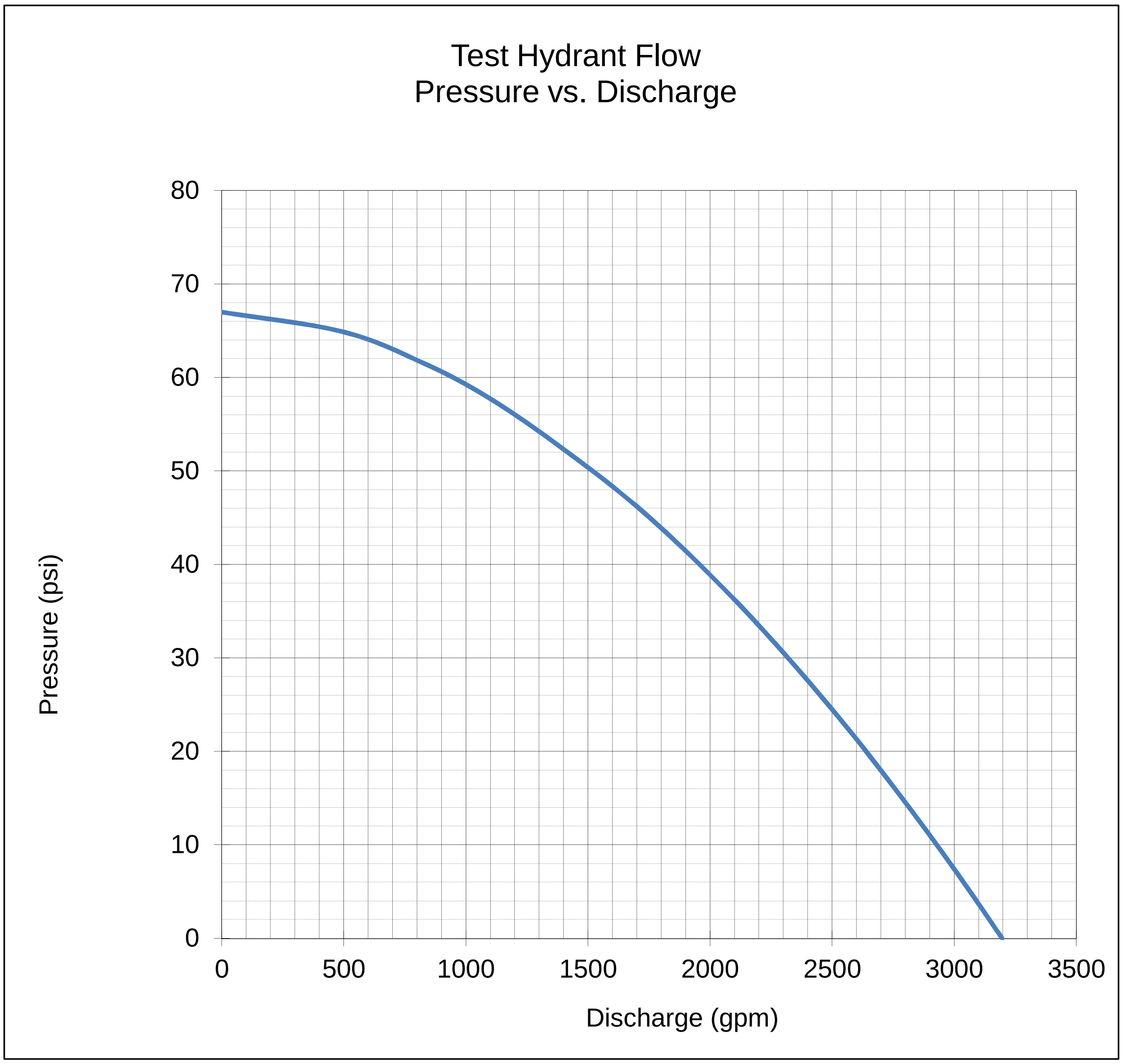


Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 1:15 PM

DIFFUSER TEST

FLOW HYDRANT	1000 East Scenic Dr		TEST HYDRANT	980 East Scenic Dr	
Pitot Pressure	52.0	psi (velocity head)	Static Pressure	67	psi.
Discharge Coef., C	0.9		Residual Pressure	58	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1081	gpm	Residual Flow at 20 p	2639	gpm

1290

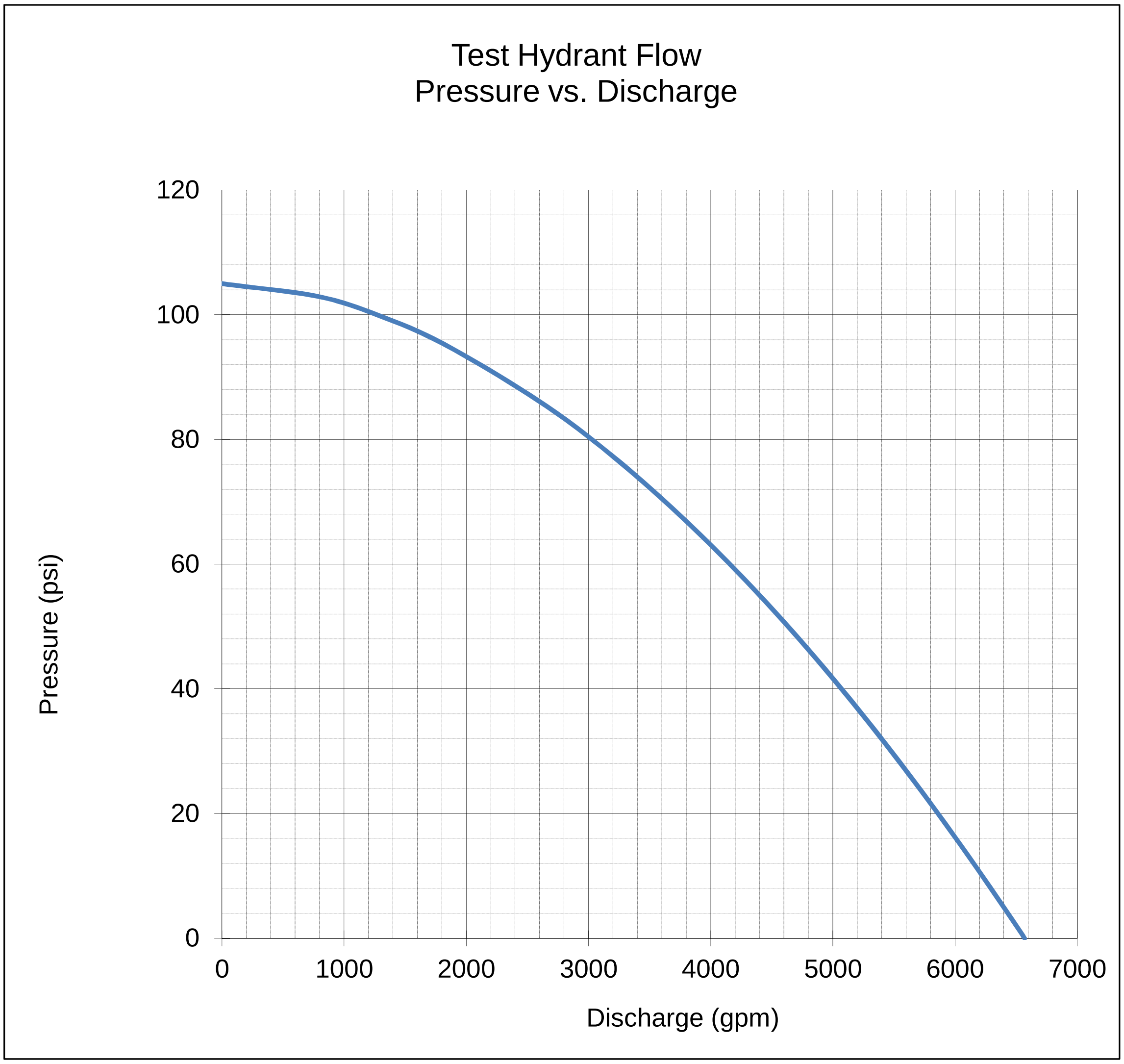


Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 1:35 PM

DIFFUSER TEST

FLOW HYDRANT	2330 East 1700 South		TEST HYDRANT	241 East 1700 South	
Pitot Pressure	85.0	psi (velocity head)	Static Pressure	105	psi.
Discharge Coef., C	0.9		Residual Pressure	100	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1269	gpm	Residual Flow at 20 p	5860	gpm

800-969

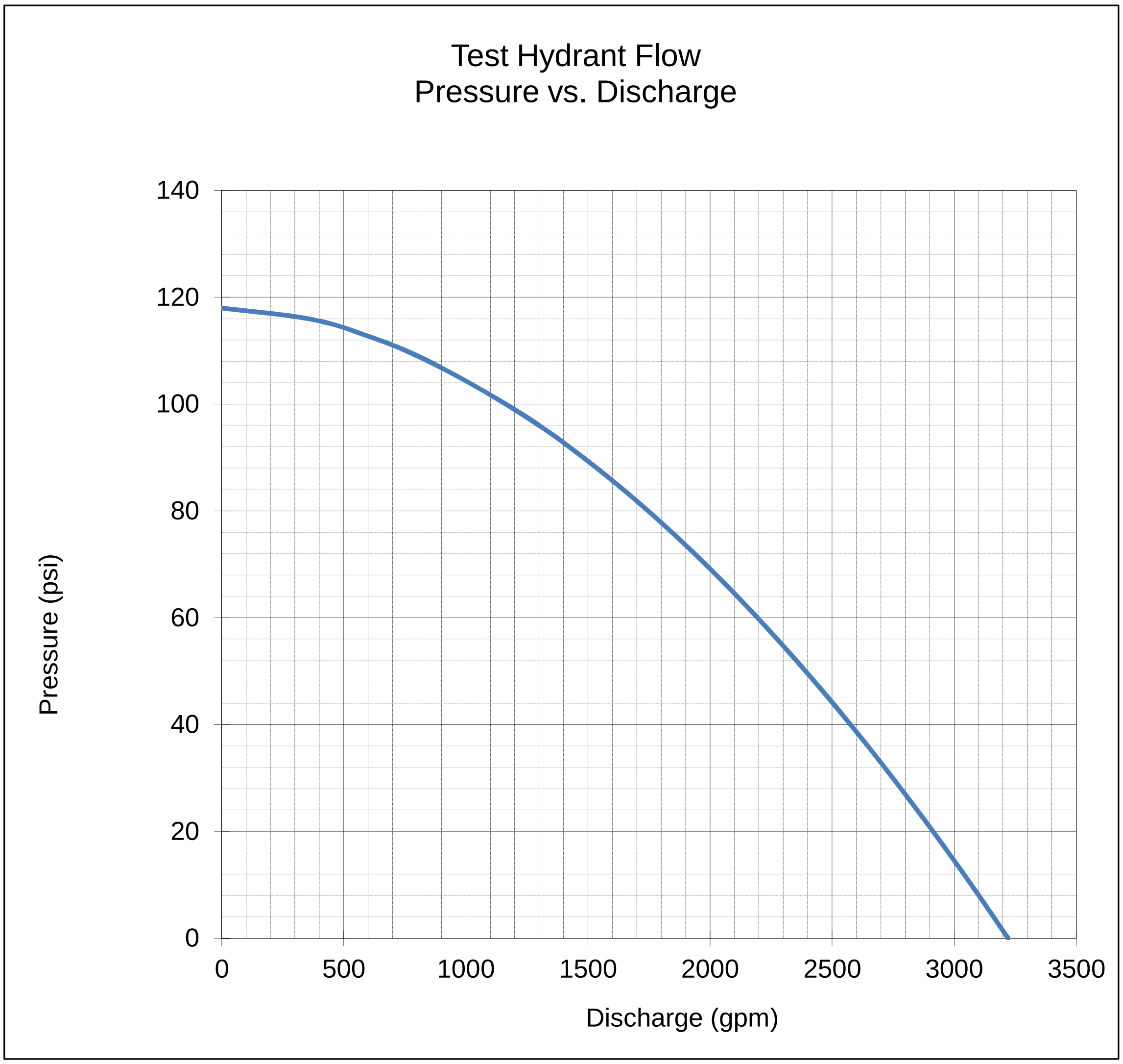


Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 2:00 PM

DIFFUSER TEST

FLOW HYDRANT	Last Hydrant Powerhouse Rd		TEST HYDRANT	Next Hydrant Powerhouse Rd	
Pitot Pressure	94.0	psi (velocity head)	Static Pressure	118	psi.
Discharge Coef., C	0.9		Residual Pressure	96	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1300	gpm	Residual Flow at 20 p	2913	gpm

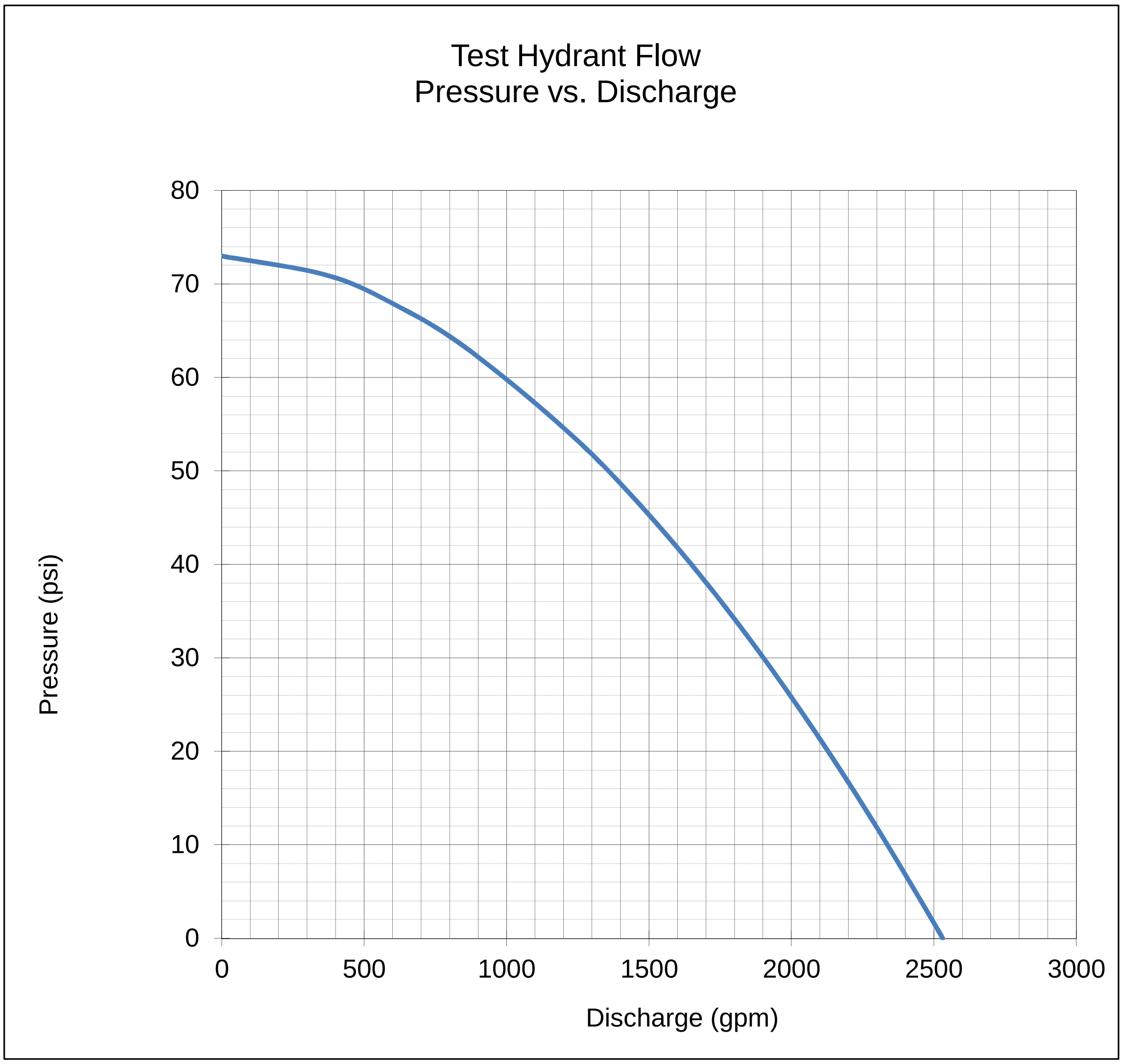
5 psi



Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 2:07 PM

DIFFUSER TEST

FLOW HYDRANT	Oak Crest and Spanish Oaks Dr		TEST HYDRANT	Oak Ridge and Spanish Oaks Dr	
Pitot Pressure	68.0	psi (velocity head)	Static Pressure	73	psi.
Discharge Coef., C	0.9		Residual Pressure	55	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1188	gpm	Residual Flow at 20 p	2129	gpm

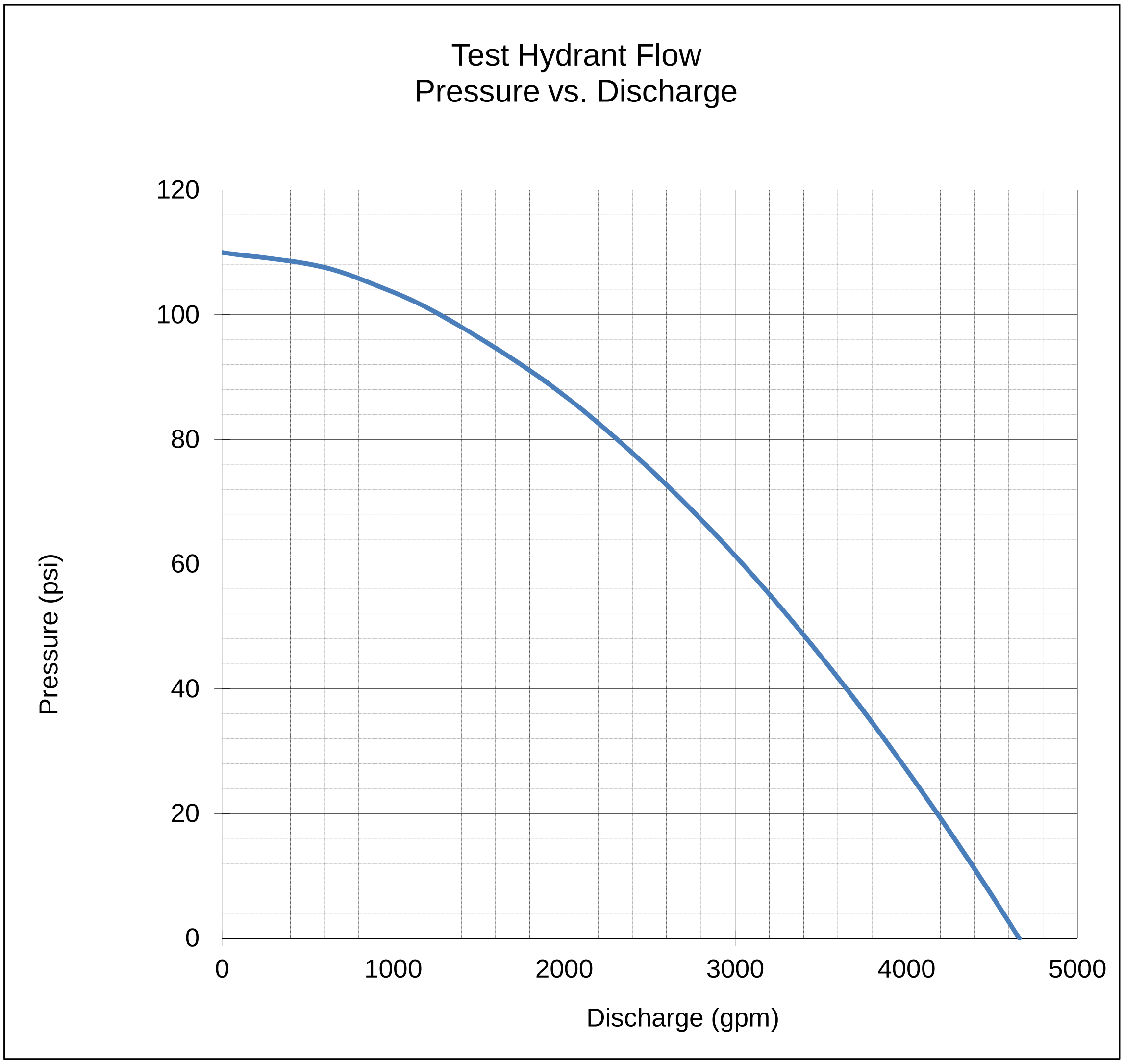


Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 9/21/2010 Time: 2:30 PM

DIFFUSER TEST

FLOW HYDRANT	2350 East 1035 South		TEST HYDRANT	1035 South 2400 East	
Pitot Pressure	87.0	psi (velocity head)	Static Pressure	110	psi.
Discharge Coef., C	0.9		Residual Pressure	100	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1277	gpm	Residual Flow at 20 p	4182	gpm

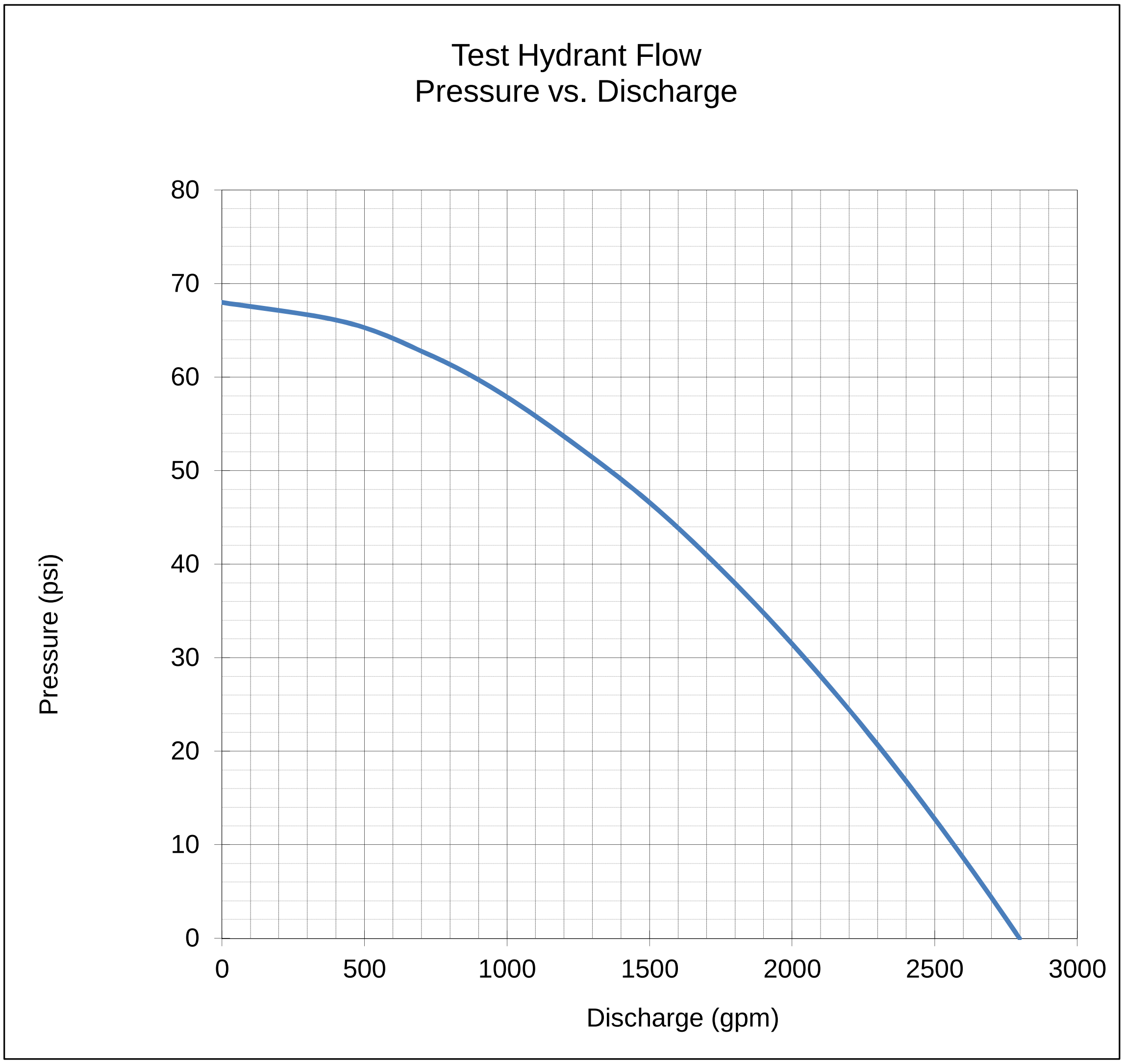
12 psi



Client: Spanish Fork
Project: 348.08.100
Feature: Fire Flow Test
Date: 4/14/2010 Time: 2:45 PM

DIFFUSER TEST

FLOW HYDRANT	1480 East 120 North		TEST HYDRANT	1490 East 120 North	
Pitot Pressure	54.0	psi (velocity head)	Static Pressure	68	psi.
Discharge Coef., C	0.9		Residual Pressure	56	psi
Discharge ID	2.500	inches	Test Hydrant Elev.	#N/A	ft
Flowrate, Q	1096	gpm	Residual Flow at 20 p	2318	gpm



APPENDIX E
Computer Model Output

SEE DISK