SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ELK RIDGE CITY

FINAL DRAFT

APRIL 2015

AQUA ENGINEERING

ACKNOWLEDGEMENTS

We graciously thank all those who have supported this study, and especially recognize those who have provided funding. The input and knowledge from the following were invaluable in preparing this report:

- Elk Ridge City Mayor Hal Shelley
- Elk Ridge City Council: Brian Burke, Nelson Abbott, Paul Squires, Dale Bigler and Brittany Thompson
- Elk Ridge City Public Works Department
- Southern Utah Valley Municipal Water Association
- Central Utah Water Conservancy District
- Jay Franson of Franson Civil Engineers

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

SECONDARY WATER SYSTEM PRELIMINARY ENGINEERING REPORT EXECUTIVE SUMMARY

Elk Ridge City partnered with the Division of Water Resources to produce a study that evaluated the feasibility of various alternatives to provide secondary water as the City grows and water demands increase. Currently, outdoor irrigation water is provided through the same distribution system as the indoor culinary water. The Capital Facilities Plan and Impact Fee Analysis Update 2014 has addressed development plans to meet 6-year and 20-year demands for indoor and outdoor water use. The possible solutions considered in this study include meeting outdoor water demands, by 1) additional groundwater sources, with water being provided through the existing culinary water distribution system, 2) obtaining water from the Utah Lake Drainage Basin Water Delivery System (ULS) and constructing infrastructure to provide secondary water to a portion of the community, or 3) obtaining water from the ULS and conveying it through the proposed High Line Canal enclosure pipeline, and constructing infrastructure to supply a portion of the community.

DEMOGRAPHICS

In order to adequately quantify the future demands for secondary water, historic demographic data for the City is used to project future populations and per capita water usage. For the purposes of this report, demographic data for the 20-year and the build-out conditions are considered. This data has previously been compiled in the Capital Facilities Plans and Impact Fee Analysis Update 2014 (Aqua, 2014).

Based on demographic data from the Governor's Office of Management & Budget (GOMB) and the Mountainland Association of Governments (MAG), along with growth projections from Elk Ridge City, a variable growth rate is used. The projected growth rate is shown in Table E1.

Table E1: Projected Growth Rates

Year	Growth Rate
2013	7.0% for 5 years
2018	3.5% for 5 years
2023	Maintain 2.0% until build-out

Source: Table 15 in Section 2.2

Using these population projections, Elk Ridge City's Future Land Use Map, and established land use densities the projected future units and ERCs have been derived (see Table E2). Equivalent Residential Connections (ERCs) are the primary units used to evaluate water demands. One ERC represents a single family dwelling with known demand characteristics or requirements. Other types of uses such as commercial or industrial uses are typically factored based upon comparison of their demand to the residential single family unit.

Table E2: Summary of Projected Future Units and ERCs

	Year	**2014**	**2034**	**Build-Out (Year 2054)**
	Projected Pop.	**2,926**	**5,398**	**7,902**
Land Use	**Growth Rate (%)**	**ERC**	**ERC**	**ERC**
Residential	Variable	760	1,402	2,052
Commercial	Variable	0	55	115
Church	1 per 900 Pop.	9	18	27
Elementary School	1 per 4,000 Pop.	0	11	22
Totals		**769**	**1,486**	**2,216**
Increase From 2015 (Current)		0	717	1,447

Source: Table 21 in Section 2.6

EXISTING FACILITIES

The existing culinary water system facilities were inventoried to provide a point of reference for identifying where secondary water rights, sources, storage and distribution system improvements would be needed. The existing facilities are provided as follows:

Water Rights

As of March 2014, the City holds the water rights as shown in Table E3. The City also continues to acquire water rights through an ordinance that requires developers to provide the necessary rights associated with developing their land within the City limits. As the City continues to enforce this ordinance sufficient water rights will be acquired to meet future build-out demands.

Table E3: Existing Municipal Use Certificated, Pending, and Permitted Water Rights

Classification	**Duty Cap (acre-feet)**
Certificated	544.33
Pending (Proof submitted to State)	493.98
Permitted (Estimated)	429.01
Total	**1,467.32**

Water Sources

The City has two wells to meet source demands. The City also maintains a third small well as an emergency supply source. These wells, and information regarding them, are given in Table E4. In addition to these existing wells, the City has identified, in the Capital Facilities Plan and Impact Fee analysis, the need for an additional well within the 6-year planning period. This well has been designated as the Lakota well and it is expected that this well will have a capacity of approximately 1,300 gpm.

Table E4: Existing Potable Water Sources

Source	Location	Casing, (inches)/ Depth (feet)	Pump Intake Depth (feet below ground surface)	Static Water Level (feet below ground surface)	Drawdown (feet below ground surface)	Rated Capacity (gpm)
Highline Well [1]	South 24 feet, East 39 feet from the North Quarter Corner of Section 23, T9S, R2E, S.L.B.&M.	16 / 928, Total Depth=928 ft	500 feet	280 feet on October 28, 2002	354.66 feet at 1,850 gpm (74.66 feet of drawdown)	1,233 gpm
Upper Loafer Canyon Well [2]	South 2841 feet, East 1589 feet from the North Quarter Corner of Section 36, T9S, R 2E, S.L.B.&M.	12 / 305, Total Depth=305 ft	285 feet	120 feet on October 1, 1993	245 feet at 1,000 gpm (125 feet of drawdown)	667 gpm
					Total	**1,900 gpm**

Water Storage

The City maintains three (3) storage tanks, with sizes and capacities as given in Table E5.

Table E5: Existing Potable Water Storage Tanks

Tank	Diameter / Dimensions (feet)	Depth (feet)	Primary Supply Source(s) [1]	Equipped Capacity (Gallons)
Upper Tank	65	21	Upper Loafer Canyon and Highline Well	500,000
Hillside Tank	78	15	Upper Loafer Canyon and Highline Well	500,000
Fairway Tank	83	30	Upper Loafer Canyon and Highline Well	1,000,000
Total	**N/A**	**N/A**	**N/A**	**2,000,000**

Water Distribution

The City maintains a distribution system to provide culinary water to all City connections. In addition to this distribution system, the City maintains two booster pump stations, with capacity as given in Table E6. It is noted that the City has required developers to install 8" secondary irrigation pipelines in certain portions of the City. These pipelines have not yet been put into service, but would be used in a secondary distribution system.

Table E6: Existing Potable Water Pump Stations

Pump Station	Single Pump Capacity	Duplex Pump Capacity
Fairway Booster Pump	600 gpm @ 250 feet TDH	940 gpm (470 gpm/pump) @ 270 feet TDH
Hillside Booster Pump	350 gpm @ 406 feet TDH	N/A

Note: Fairway Booster Pump Station is equipped with 3 pumps (1 is a standby pump). Hillside Booster Pump Station consists of 1 pump.

SECONDARY WATER ALTERNATIVES

Using demographic and existing water infrastructure data as reviewed from the Capital Facilities Plan and Impact Fee Analysis, the report evaluated three alternatives to meeting future indoor and outdoor demands in Elk Ridge City. These alternatives were 1) development of groundwater for culinary and secondary water demands, 2) obtaining and delivering water through the ULS project, and 3) obtaining water through the ULS project and conveying it to Elk Ridge through the Highline canal pipeline enclosure project.

Alternative 1: Developing Groundwater Sources

This alternative consists of drilling an additional well to meet build-out demands for the City. This alternative would provide culinary water to all connections for indoor and outdoor water demands. In addition to the new well, additional storage would be required, as well as some minor distribution system upgrades. The total capital cost is given in Table E7 and the annual O&M costs are given in Table E8.

Table E7: Alternative 1 Capital Costs

Description	Cost
New Loafer Canyon Well	$2,311,200
750,000 Gallon Storage Tank	$1,792,125
Dry Line Commissioning	$533,250
TOTAL CAPITAL COST	**$4,636,575**

Table E8: Alternative 1 O&M Costs

Description	Annual Cost
Pump Operation	$105,192
Storage Tank Maintenance	$4,000
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$111,892**

Alternative 2: Delivering Water Through ULS Project

This alternative would provide raw water from the Central Utah Project through the ULS pipeline, which once constructed, would pass near Elk Ridge. This water could be used to provide a certain number of ERCs with secondary water for outdoor water usage. By utilizing this ULS water, the culinary water demands of the City at build-out would be reduced and the well described in Alternative 1 would not need to be drilled. To provide this secondary water, a distribution pipeline from the ULS pipeline to deliver water to Elk Ridge, a surface storage reservoir, and a secondary distribution system would each need to be constructed. The total capital cost is given in Table E9 and the annual O&M costs are given in Table E10.

Table E9: Alternative 2 Capital Costs

Description	Cost
Surface Storage Reservoir	$759,150
Secondary Distribution Upgrades	$2,736,788
TOTAL CAPITAL COST	**$3,459,938**

Table E10: Alternative 2 O&M Costs

Description	Annual Cost
Storage Reservoir Maintenance	$20,000
ULS Water Repayment	$175,189
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$197,889**

Alternative 3: Delivering ULS Water Through the Enclose Highline Canal

This alternative would require the City to acquire the same water as described in Alternative 2, but instead of the water being conveyed through the ULS pipeline, it would be conveyed through the Strawberry Highline Canal Enclosure Project. As the ULS pipeline associated with Alternative 2 may not be completed for several years, this alternative provides another option to convey CUP water if the demands in the City need to be met sooner that the ULS pipeline is completed. The total capital cost is given in Table E11 and the annual O&M costs are given in Table E12.

Table E11: Alternative 3 Captial Costs

Description	Cost
SHLCC Enclosure Project Buy-In Cost	$1,054,300
Surface Storage Reservoir	$759,150
Reservoir Pump Station	$1,407,524
Secondary Distribution Upgrades	$1,431,000
Environmental Impact Study Update	$100,000
TOTAL CAPITAL COST	**$4,751,974**

Table E12: Alternative 3 O&M Costs

Description	Annual Cost
Pump Operation	$72,874
Storage Reservoir Maintenance	$20,000
ULS Water Repayment	$175,134
SHLCC Pipeline O&M	$78,055
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$348,762**

AQUIFER STORAGE AND RECOVERY

Development of groundwater sources, as suggested in Alternative 1, will likely result in public protests from other users who divert groundwater from the same aquifer. The negative impacts to downstream users may be mitigated by recharging the aquifer via aquifer storage and recovery (ASR). SUVMWA produced a groundwater recharge study that described the feasibility of the technology of ASR by infiltrating surface waters into the groundwater aquifer for later use or by other users. This report identifies possible locations within the City that may be suitable for ASR, and suggests that using ULS water (conveyed either through the ULS project or the Highline canal pipeline) may be economically feasible to achieve the necessary recharge. Table E13 identifies the total capital and O&M cost of the ASR system.

Table E13: Capital and Annual O&M Cost of ASR Options

Description	Capital Cost	Annual O&M Costs
Highline Canal Pipeline	$1,525,300	$102,200
Spanish Fork-Santaquin Pipeline	$1,248,300	$70,700

The cost of maintaining the recharge pond is shown in Table E14.

Table E14: ASR Pond O&M Costs

Description	Annual Cost
Scarify Basin Surface (Annually)	$28,000
Rehabilitate Basin (Every 10 Years)	$8,400
Total Annual Cost	**$36,400**

CONSERVATION AND DEMAND REDUCTION

Water conservation efforts will not only protect precious water resources in the Utah Valley basin, but will also reduce the amount of infrastructure improvements needed in Elk Ridge City, which will reduce the overall cost associated with providing secondary water to residents. Current water usage in Elk Ridge City is significantly higher than average state water usage, see Figure E1.

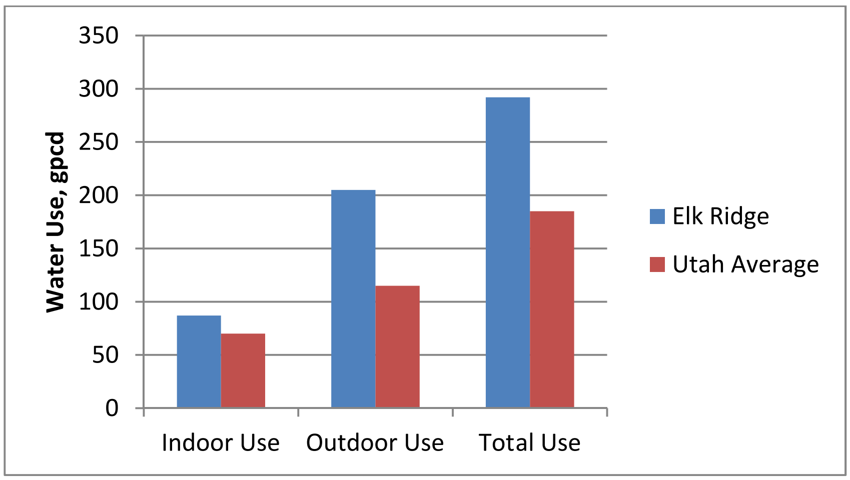


Figure E1: Water Consumption

The difference between actual use and state average use suggests that there may be some relatively simple solutions to conserving water, and reducing or eliminating infrastructure that would otherwise be necessary to meet future demands. Four possible solutions include 1) education of the public of existing rebate programs for water conserving technology, 2) upgrading metering software to better identify leaks, excessive water users or otherwise monitor water usage, 3) provide incentives for water reduction efforts, such as xeriscaping, and 4) adjusting block fees to encourage reduction in consumption.

CONCLUSION AND RECOMMENDATIONS

This study evaluated three (3) alternatives to providing a secondary water system to meet future demands in Elk Ridge. The study also evaluated the feasibility of Aquifer Storage and Recovery, as well as the impact that water conversation would have for the City.

The results of this study were that the City should first consider water conservation methods to reduce water demands and potentially eliminate the need for further secondary water system improvements. It is noted that whether conservations are implemented or not, the dry irrigation lines that are currently installed will still need to be energized. If, after evaluation, it is determined that conservation efforts are not sufficient to reduce demands to avoid further secondary water improvements, Figure E2 details the process that should be taken in evaluating which alternative to use.

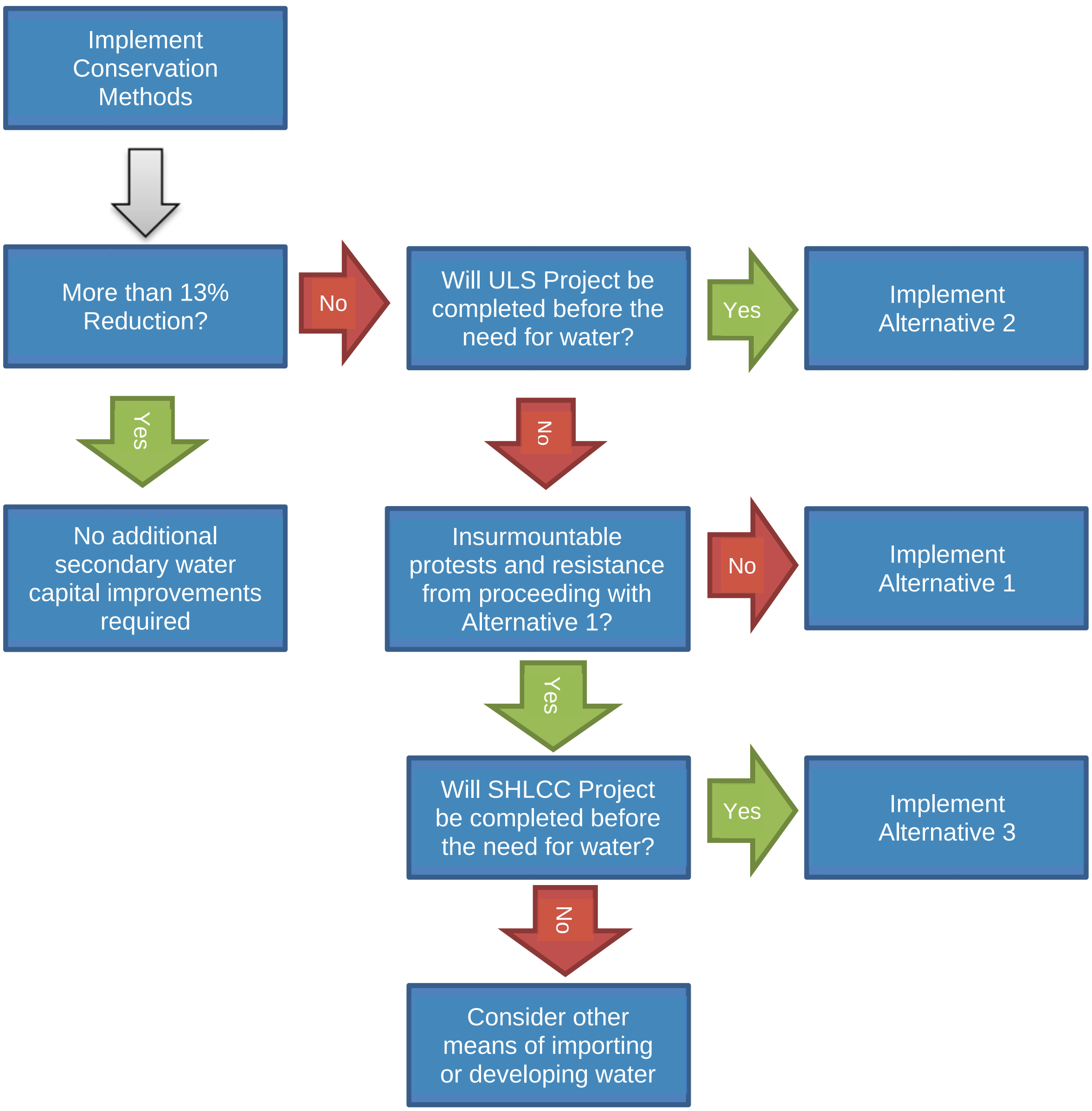


Figure E2: Decision Flow Chart

SECTION 1 - INTRODUCTION

1.1 PURPOSE AND SCOPE

Elk Ridge City partnered with the Division of Water Resources to produce a study that considers the feasibility of a secondary water system to meet water demands of the City as it continues to develop. The purpose of this study is to identify and quantify the feasibility of various alternatives to meet these future water demands.

The study first provides demographic information, and then describes the existing water facilities of the City. This information was obtained from the Capital Facilities Plan and Impact Fee Analysis Update 2014 (Aqua, 2014), updated to reflect current estimated populations and expected water facility improvements to be made within the 6-year planning period. For the purposes of this report, it is assumed that all proposed improvements in the 6-year planning period will be completed. This information is then used to establish a baseline for evaluating the alternatives considered. Three different alternatives have been identified to meet future secondary water demands:

1. Developing additional groundwater sources.
2. Purchasing water from the Central Utah Project (CUP) and delivering it to the City via the Utah Lake Drainage Basin Water Delivery System (ULS) pipeline.
3. Purchasing water from the CUP and delivering it to the City via the Strawberry Highline Canal Enclosure Project.

1.2 BACKGROUND

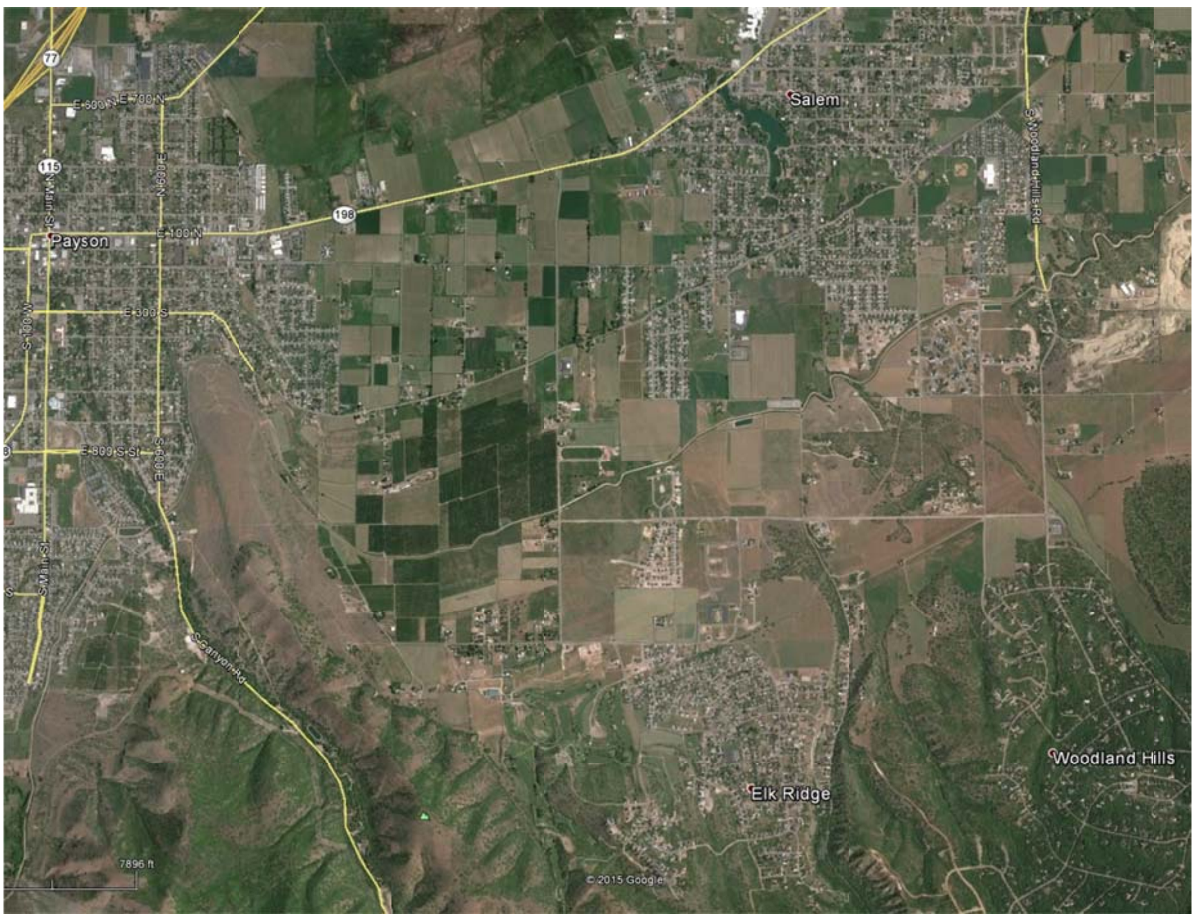
Elk Ridge City is situated at the southern end of Utah County and is located south of Salem and east of Payson as shown in Figure 3. Woodland Hills is located directly east of Elk Ridge. The City is located at an average elevation of 5,300 feet in the foothills of the Wasatch Mountain Range at the base of Mount Loafer. Terrain slopes northwesterly or just northerly toward the southeastern side of Utah Lake, which is eleven (11) miles northwest of Elk Ridge.

The City is primarily a residential community. Some commercial/industrial development is expected to occur as the population increases. This minor commercial growth is not expected to significantly change the character of the City, which is expected to continue to be a residential community exporting its workforce to larger neighboring communities.

Since its inception in November 2000, the City has acquired water rights and developed sources, storage, and distribution facilities to provide service for water demands. The City has also for the past several years, required developers to install 8" secondary irrigation pipelines in the northern portions of the City, primarily below Goosenest Drive. These pipelines have not yet been put into service, but were required to be installed in anticipation of a future secondary water system.

The City's primary source of water for both indoor and outdoor uses comes from groundwater sources (discussed in greater detail in Section 3). The City also participates as a member of the South Utah Valley Municipal Water Association (SUVMWA), an organization composed of ten cities with the intent to coordinate water issues. SUVMWA has participated in an agreement with Central Utah Water Conservancy District to obtain water for its members through the Central Utah Project (CUP), discussed in greater detail in Section 4.

Figure 3: City Aerial Overview



Based on information from the "Evaluation of the Groundwater Flow Model for Southern Utah and Goshen Valleys," produced by USGS, there are two aquifers that Elk Ridge City draws groundwater from. One is considered to be a perched aquifer, located in the fractured rock of the mountainous areas above the City. The other aquifer is the basin fill aquifer, located below the perched aquifer in the valley. This lower aquifer may be recharged, in part, by the perched aquifer above through leakage. Besides Elk Ridge City, several other water users claim to divert water or otherwise benefit from one or both of these aquifers.

SECTION 2 - DEMOGRAPHICS

2.1 INTRODUCTION

A demographic analysis of Elk Ridge City's current population, land-use, development patterns and development potential has been completed as part of the Capital Facilities Plan and Impact Fee Analysis Update 2014 (2014 CFP/IFA). The results of the analysis were used as a basis for projection of future growth and its distribution throughout the study area. These projections will be used in this report to establish outdoor water demands that could be met by constructing a secondary water system. The following demographic analysis (the remainder of Section 2) is taken directly from the aforementioned 2014 CFP/IFA, updated to reflect 2015 population projections.

2.2 POPULATION

Like much of Utah, Elk Ridge experienced significant growth up until 2008 when the National economy and real estate markets plummeted. Growth and development went from over 5% to nearly 0% during the economic downturn. From 2010 to 2012, growth averaged approximately 3% to 4% per year. Since 2013, growth in Elk Ridge City has been averaging 6.5% to 7.0% per year.

As of 2014, Elk Ridge City estimated its population to be approximately 2,700. The 2010 Census reported a population of 2,436. Using the 2000 Census population of 1,838 and Census population estimates from 2001 to 2009, a trend line was developed. This trend line was used to estimate the 2013 population to be 2,734. Thus a population of 2,734 for that year will be used herein.

The City estimates the near term growth rate to be 7.0% until 2018. This is based on the quantity of building permits issued by the City in the 2014 (approximately fifty) and an inventory of 300 approved residential lots. The City anticipates the growth rate to decrease by half for the next 5 years beginning in 2018 and then maintain a constant growth rate of 2.0% after that. These projected growth rates are shown in Table 15. Figure 4 plots the projected population over the 20 year planning period.

Table 15: Projected Growth Rates

Year	Growth Rate
2015 – 2017	7.0%
2018 – 2022	3.5%
2023 – Build-Out	2.0%

This population projection was compared to the 2012 Utah State population projections from the Governor's Office of Management & Budget (GOMB) and the Mountainland Association of Governments (MAG). Both of these agencies adopted the same population projection. The 20 year population projections from GOMB and MAG match closely with the estimated population projections in Figure 4. Table 16 summarizes the population projections from GOMB and MAG.

Figure 4: Projected Population Projection

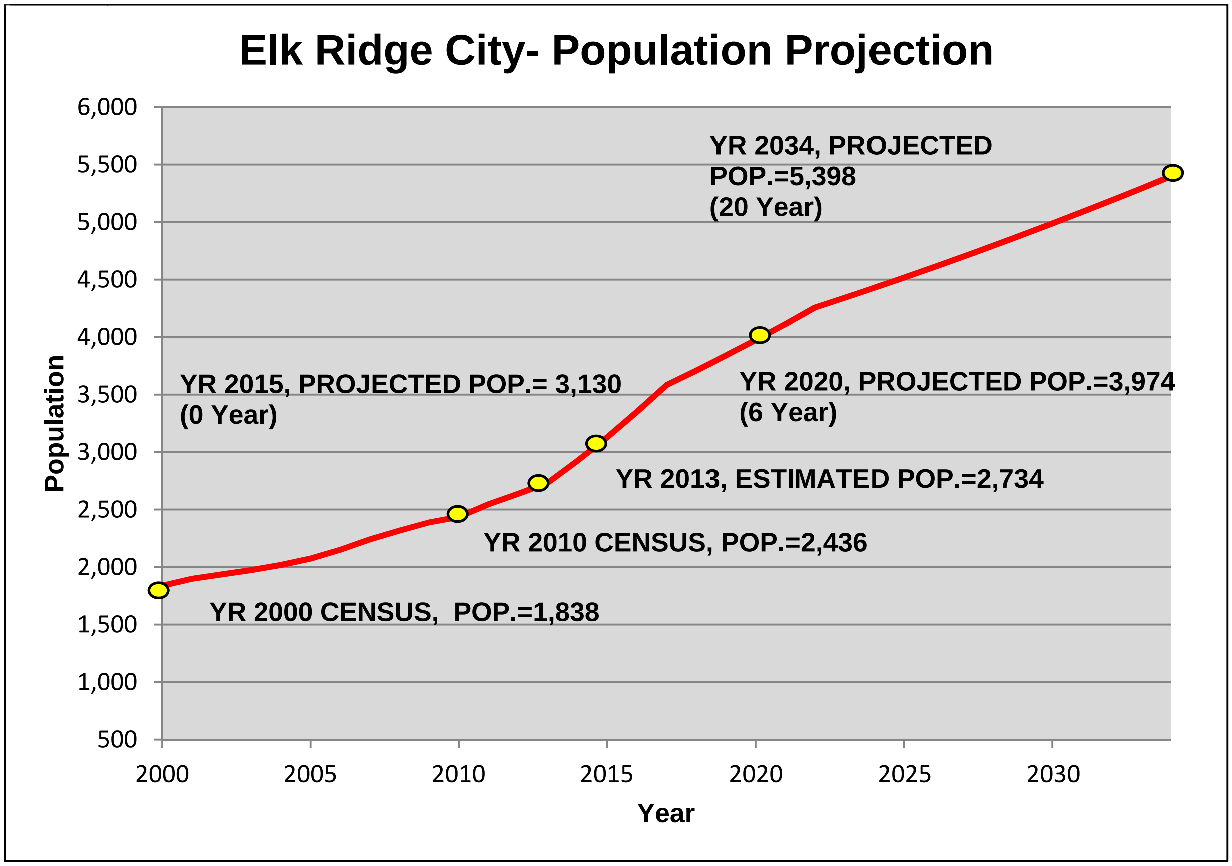


Table 16: Other Government Entities Population Projections

Year	Population Projection
2010	2,436 (2010 Census)
2020	3,898
2030	4,696
2040	5,888
2050	7,100
2054	7,902

2.3 PLANNING AREA

The City limits currently encompass approximately 1,725 gross acres. Approximately 600 acres are currently developed. The City anticipates its boundary will expand to approximately 2,040 gross acres in the future. Table 17 and Table 18 show the land use and zoning designations and the corresponding area for the remaining developable area. Refer to Figure 5 for the City Land Use map.

2.4 LAND USE AND BUILD-OUT CAPACITY

In order to define potential growth areas and more accurately determine needed improvements, the City's designated land use densities are used to project future land use. These densities are listed in Table 17 and are shown on Figure 5.

Table 17: Land Use Densities

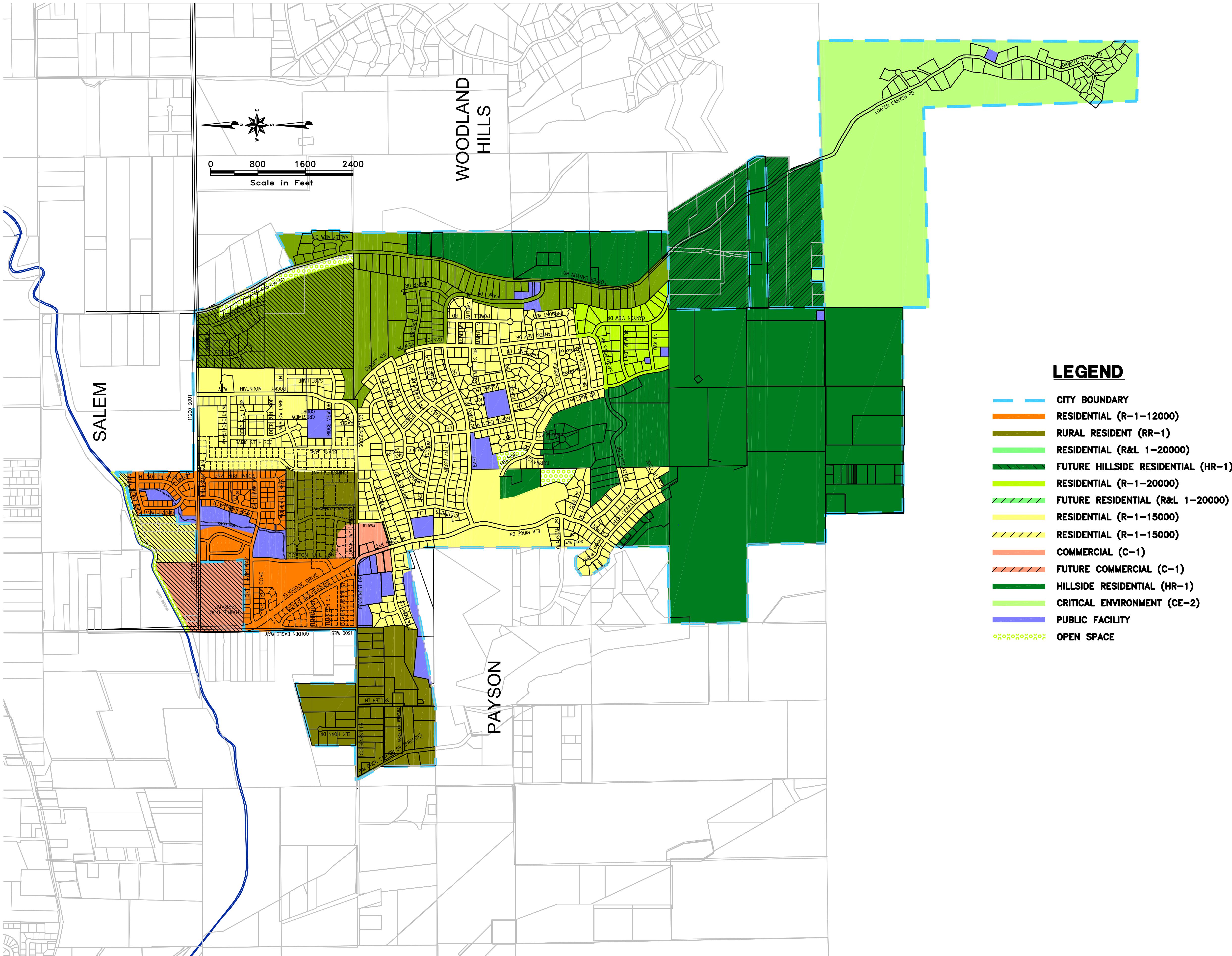
Land Use	Land Use Density
Residential (R-1-12000)	12,000 sf (min. lot size)
Rural Residential (RR-1)	20,000 sf (min. lot size)
Residential (R&L 1-20000)	20,000 sf (min. lot size)
Hillside Residential (HR-1)	40,000 sf (min. lot size)
Residential (R-1-20000)	20,000 sf (min. lot size)
Residential (R-15000)	15,000 sf (min. lot size)
Critical Environment (CE-2)	5.0 acres (min. lot size)

Existing developments within the City were analyzed to determine these undevelopable percentages. To account for roads, setbacks, easements, utilities, and other non-buildable areas approximately 30% of a typical residential lot is non-buildable. The amount of non-buildable land is less for the Critical Environment land use designation (15%) and greater for Hillside Residential land use designation (50%).

The future land uses were analyzed using data provided by the city to determine future growth capacity. The established land use densities shown in Table 2.3 were used to determine the total number of units for each land use designation at build-out. The total number of units and developable acreage for the build-out condition are shown in Table 18.

Table 18: Build-out Units and Developable Acreage

Land Use	Land Use Density (acres)	Total Undeveloped Area (acres)	Developable Area (%)	Total Developable Area (acres)	Units
Residential (R-1-12000)	0.28 (min. lot size)	82.78	70%	57.95	210
Rural Residential (RR-1)	0.46 (min. lot size)	134.38	70%	94.07	204
Residential (R&L 1-20000)	0.46 (min. lot size)	136.05	70%	95.23	207
Hillside Residential (HR-1)	0.92 (min. lot size)	662.35	50%	331.18	360
Residential (R-1-20000)	0.46 (min. lot size)	0.00	70%	0.00	0
Residential (R-15000)	0.34 (min. lot size)	160.32	70%	112.23	324
Critical Environment (CE-2)	5.00 (min. lot size)	217.63	85%	184.99	37
Totals	**N/A**	**1,439.23**	**N/A**	**921.35**	**1,342**



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REVISIONS

ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ZONING AND FUTURE LAND USE MAP

AQUA ENGINEERING
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FIGURE
5

03/31/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 5 AND 6.dwg

2.5 PLANNING CONVERSIONS

When planning for future service needs, the Equivalent Residential Connection (ERC) is the recognized standard planning unit. One ERC represents a single family dwelling with known demand characteristics or requirements. Other types of uses such as commercial or industrial uses are typically factored based upon comparison of their demand to the residential single family unit.

In order to determine the total number of existing ERCs, it is necessary to convert the number of physical units and metered service connections on the system to ERCs. The conversion between service connections and ERC's has been calculated using approved methods as outlined in the State of Utah Administrative Code R309-510. The calculations to determine ERCs per unit for churches and elementary schools are shown in Appendix B. Since the City does not currently have any commercial development, 2.5 ERCs per acre will be used as the planning conversion to determine commercial ERCs. This conversion is based on AQUA's experience with capital facility plans and master plans completed for similar communities. As illustrated in Table 19, the total current number of ERCs in the City is estimated to be 719.

Table 19: Current Service Connections and ERCs

Land Use	Connections	ERCs
Residential	694	694
Multi-Family Residential (Assisted Living Facility)	1	16
Churches	3	9
Total	**698**	**719**

Note: 1 Church equals 3 ERCs.

2.6 GROWTH PROJECTIONS

Converting the build-out for residential and commercial land use to ERCs was the first step in projecting capital improvement requirements. Developable land and land use densities established in 2.4 were used to calculate existing residential ERCs. As stated the conversion from developable land to ERCs for commercial land use is 2.5 ERC/acre. These areas are shown on Figure 6 and summarized in Table 20.

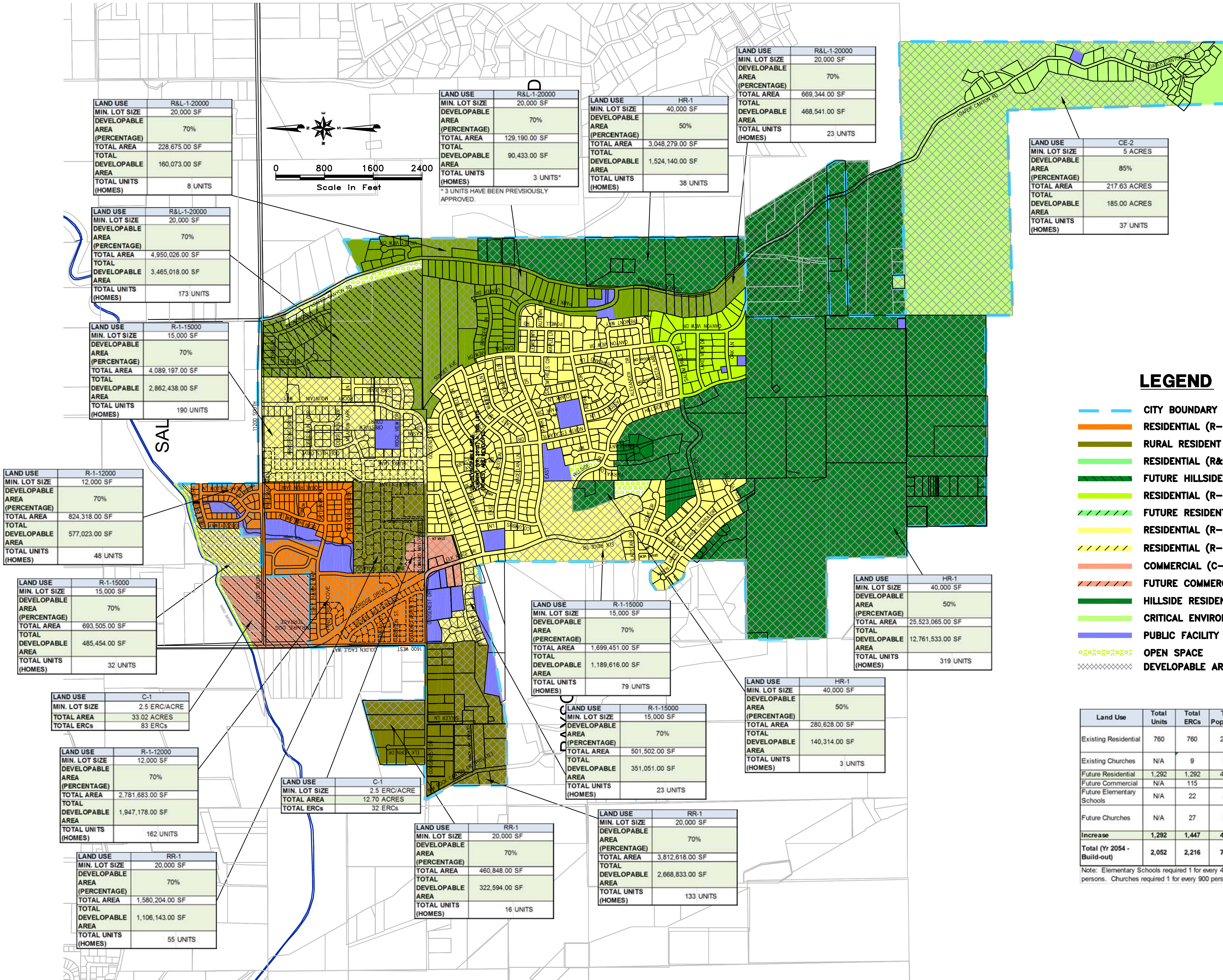
Table 20: Projected Build-out ERCs based on Land Use

Land Use	Land Use Density		Total Developable Area (acres)	Units	ERCs
Residential (R-1-12000)	0.28	acres (min. lot size)	57.95	210	210
Rural Residential (RR-1)	0.46	acres (min. lot size)	94.07	204	204
Residential (R&L 1-20000)	0.46	acres (min. lot size)	95.23	207	207
Hillside Residential (HR-1)	0.92	acres (min. lot size)	331.18	360	360
Residential (R-1-20000)	0.46	acres (min. lot size)	0.00	0	0
Residential (R-15000)	0.34	acres (min. lot size)	112.23	324	324
Commercial	2.50	ERC per acre	45.72	N/A	115
Critical Environment (CE-2)	5.00	acres (min. lot size)	184.99	37	37
Totals	**N/A**		**921.35**	**1,342**	**1,457**

The process used for projecting future population growth and converting it to ERCs has been developed in three parts. The first part uses the growth rate established in Section 2.2 for all residential units to project future residential units and ERCs. The second part evenly distributed the projected number of commercial ERCs from year 2020 to build-out (year 2054). Commercial development is unlikely occur until 11200 South improvements are completed. This is expected to occur by year 2020. The third part applied to churches and schools and projects future units and ERCs based upon their density within the current population. The present ratio of churches to population is approximately 1 per 900 persons. The density of schools is anticipated to be 1 per 4,000 persons based on recent discussions with the School District. These three parts are applied to the projected growth rate to determine future demand. Table 21 summarizes these ERC projections.

Table 21: Summary of Projected Future Units and ERCs

	Year	**2014 (Current Year)**	**2020**	**2025**	**2030**	**2034**	**Build-Out (Year 2054)**
	Projected Pop.	**3,130**	**3,974**	**4,517**	**4,987**	**5,398**	**7,902**
Land Use	**Growth Rate (%)**	**ERC**	**ERC**	**ERC**	**ERC**	**ERC**	**ERC**
Residential	Variable	760	1,032	1,173	1,295	1,402	2,052
Commercial	Variable	0	4	24	43	55	115
Church	1 per 900 Pop.	9	12	15	18	18	27
Elementary School	1 per 4,000 Pop.	0	11	11	11	11	22
	Totals	**769**	**1,059**	**1,223**	**1,367**	**1,486**	**2,216**
	Increase From 2014 (Current)	0	290	454	598	717	1,447



LEGEND

- CITY BOUNDARY
- RESIDENTIAL (R-1-12000)
- RURAL RESIDENT (RR-1)
- RESIDENTIAL (R&L 1-20000)
- FUTURE HILLSIDE RESIDENTIAL (HR-1)
- RESIDENTIAL (R-1-20000)
- FUTURE RESIDENTIAL (R&L 1-20000)
- RESIDENTIAL (R-1-15000)
- RESIDENTIAL (R-1-15000)
- COMMERCIAL (C-1)
- FUTURE COMMERCIAL (C-1)
- HILLSIDE RESIDENTIAL (HR-1)
- CRITICAL ENVIRONMENT (CE-2)
- PUBLIC FACILITY
- OPEN SPACE
- DEVELOPABLE AREA

Land Use	Total Units	Total ERCs	Total Population
Existing Residential	760	760	2,926
Existing Churches	N/A	9	N/A
Future Residential	1,292	1,292	4,977
Future Commercial	N/A	115	N/A
Future Elementary Schools	N/A	22	N/A
Future Churches	N/A	27	N/A
Increase	**1,292**	**1,447**	**4,977**
Total (Yr 2054 - Build-out)	**2,052**	**2,216**	**7,902**

Note: Elementary Schools required 1 for every 4,000 persons. Churches required 1 for every 900 persons.

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REVISIONS

ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
LAND USE MAP & BUILD OUT CAPACITY

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DRAWING IS TO SCALE IF BAR MEASURES:
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FIGURE
6

03/31/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 5 AND 6.dwg

SECTION 3 - EXISTING FACILITIES

3.1 INTRODUCTION

A brief summary of the existing facilities is provided to describe the current capacity of the water rights, source, storage and distribution systems. This information is used as a baseline to determine upgrades required to meet future demands. Section 3.1.1 provides information directly from the 2014 CFP/IFA.

3.1.1 Inventory of Existing Facilities

Elk Ridge City's potable water system consists of three (3) water sources with associated water rights (Oak Lane Well has been abandoned and the Dugway Well is currently active but has a capacity of approximately 40 gpm), three (3) water storage tanks, and associated distribution infrastructure as detailed below. For locations of the existing sources, tanks, and distribution system layout please refer to Figure 7.

3.1.1.1 Sources – Potable Water Rights

Elk Ridge City holds water rights available for municipal and irrigation use. The City has also acquired other minor water rights via standard development policy. In July 2008, the City held 914 acre-feet of water rights approved for municipal and irrigation uses (Elk Ridge City Impact Fee Analysis & Recommendations, AQUA Engineering, October 2008). A excel spreadsheet of Elk Ridge City's water rights was emailed from John Briem with the Utah Division of Water Rights to AQUA Engineering on March 6th, 2014. Per this spreadsheet, the City now holds 1,467.32 acre-feet of municipal use water rights. Table 22 lists the state of these municipal rights as certificated, pending, or permitted municipal use water rights. A detailed list of the city's water rights can be found in Appendix C of the Capital Facilities Plan and Impact Fee Analysis Update 2014.

Table 22: Existing Municipal Use Certificated, Pending, and Permitted Water Rights

Classification	Duty Cap (acre-feet)
Certificated	544.33
Pending (Proof submitted to State)	493.98
Permitted (Estimated)	429.01
Total	**1,467.32**

The City aquires water rights via an ordinance that requires developers of a subdivision to purchase existing water rights held by the City in lieu of providing water rights for their development or to contribute water rights sufficient for their needs.

3.1.1.2 Sources

Table 23 summarizes the City's potable water sources. The location the City's potable water sources are shown in Figure 7.

Table 23: Existing Potable Water Sources

Source	Location	Casing, (inches)/ Depth (feet)	Pump Intake Depth (feet below ground surface)	Static Water Level (feet below ground surface)	Drawdown (feet below ground surface)	Rated Capacity (gpm)
Highline Well [1]	South 24 feet, East 39 feet from the North Quarter Corner of Section 23, T9S, R2E, S.L.B.&M.	16 / 928, Total Depth=928 ft	500 feet	280 feet on October 28, 2002	354.66 feet at 1,850 gpm (74.66 feet of drawdown)	1,233 gpm
Upper Loafer Canyon Well [2]	South 2841 feet, East 1589 feet from the North Quarter Corner of Section 36, T9S, R 2E, S.L.B.&M.	12 / 305, Total Depth=305 ft	285 feet	120 feet on October 1, 1993	245 feet at 1,000 gpm (125 feet of drawdown)	667 gpm
					Total	**1,900 gpm**

[1] The Highline Well is capable of pumping at a greater capacity depending on the water level and drawdown in the well at the time of pumping. The well was test pumped at 1,850 gpm; but its rating per the Utah Division of Drinking Water is 2/3 of test capacity.
[2] The Upper Loafer Canyon Well is equipped with a motor that can pump 850 to 950 gpm depending on the water level and drawdown in the well at the time of pumping. The well test pumped at 1,000 gpm; but its rating per the Utah Division of Drinking Water is 2/3 of test capacity.
[3] The Dugway Well is currently active but has not been included in the source totals because it produces only approximately 40 gpm and is considered to be an emergency source of supply.
Source: Modified from Elk Ridge City, Utah – Impact Fee Analysis & Recommendations, October 2008

3.1.1.3 Storage

Elk Ridge City currently has three (3) storage tanks which provide drinking water and fire suppression storage for the City as shown in Table 24. The location of the City's potable water storage tanks are shown in Figure 7.

Table 24: Existing Potable Water Storage Tanks

Tank	Diameter / Dimensions (feet)	Depth (feet)	Primary Supply Source(s) [1]	Equipped Capacity (Gallons)
Upper Tank	65	21	Upper Loafer Canyon and Highline Well	500,000
Hillside Tank	78	15	Upper Loafer Canyon and Highline Well	500,000
Fairway Tank	83	30	Upper Loafer Canyon and Highline Well	1,000,000
Total	**N/A**	**N/A**	**N/A**	**2,000,000**

[1] The Highline Well supplies the Hillside Tank via the Fairway Booster Pump Station. The Highline Well supplies the Upper Tank via the Hillside Booster Pump Station.
Source: Modified from Elk Ridge City, Utah – Impact Fee Analysis & Recommendations, October 2008

3.1.1.4 Distribution

An inventory of distribution facilities was completed in the 2008 Impact Fee Analysis. The existing distribution system layout is shown in Figure 7. The City's current distribution system meets the City's required level of service. The City's fire flow requirement for residential structures is 1,000 gpm for 2 hours with a minimum residual pressure of 20 psi and 1,500 gpm for 2 hours with a minimum residual pressure of 20 psi for non-residential structures. The distribution system consists of lines 6-inches to 14-inches in diameter.

The City has two (2) pump stations with capacities shown in Table 25. The location of the pump stations are shown in Figure 7.

Table 25: Existing Potable Water Pump Stations

Pump Station	Single Pump Capacity	Duplex Pump Capacity
Fairway Booster Pump	600 gpm @ 250 feet TDH	940 gpm (470 gpm/pump) @ 270 feet TDH
Hillside Booster Pump	350 gpm @ 406 feet TDH	N/A

Note: Fairway Booster Pump Station is equipped with 3 pumps (1 is a standby pump). Hillside Booster Pump Station consists of 1 pump.

SB 03/31/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 7.dwg

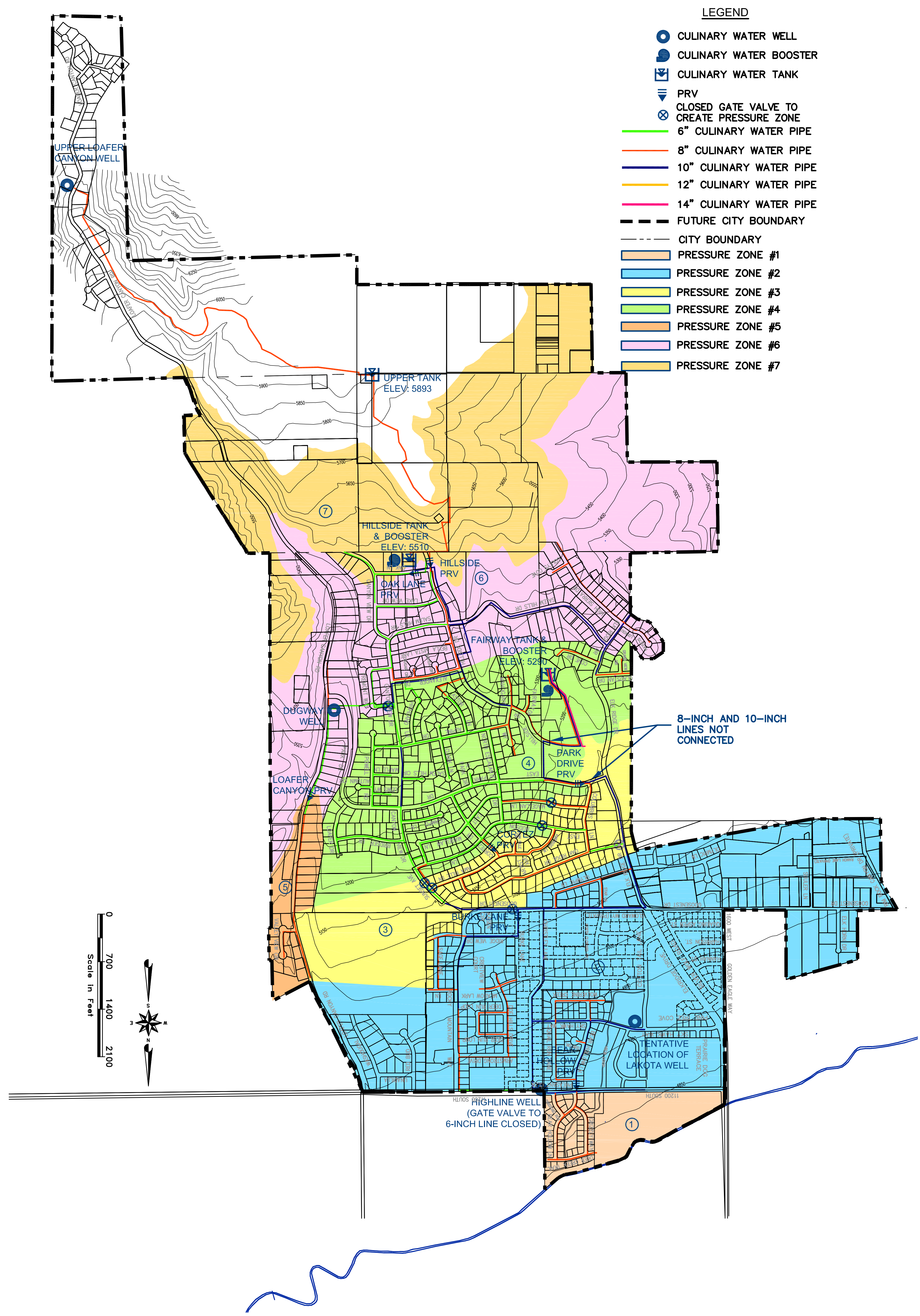

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FIGURE 7

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ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
EXISTING POTABLE WATER INFRASTRUCTURE MAP

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REVISIONS

SECTION 4 - SECONDARY WATER ALTERNATIVES

4.1 INTRODUCTION

With the demographics and existing water infrastructure quantified in the previous sections, a basis for secondary water demand and capacity can be established and alternatives for meeting future demands evaluated. The three alternatives considered are as follows:

- Alternative 1: Developing groundwater sources, and expanding existing culinary water infrastructure to provide culinary water for both indoor and outdoor demands. To maximize the use of the already installed, but not yet operational irrigation piping, a limited number of connections between the culinary water lines and these lines would be made, equipped with backflow prevention, and operated only during the irrigation season.
- Alternative 2: Acquiring water via the Central Utah Project (CUP), which will provide access to pressurized raw water from the Utah Lake Drainage Basin Water Deliver System (ULS) pipeline to a location near the City limits, and constructing adequate infrastructure within the City for the storage and distribution of this water. This water would supply outdoor water for approximately 44% of the total ERCs expected at build-out. The remaining ERCs would have outdoor water provided from culinary water sources.
- Alternative 3: Buying capacity in the Highline Canal Enclosure Project for conveying to the City Central Utah Project (CUP) water, purchased and used as described in Alternative 2 above, and constructing adequate infrastructure within the City for the storage, pumping and distribution of this water. As mentioned, this water would supply outdoor water for approximately 44% of the total ERCs expected at build-out.

While the alternatives considered are given to address secondary water demands, demands of both indoor and outdoor uses are affected. Therefore, each alternative addresses impacts to water rights, sources, storage and distribution of both the culinary and secondary systems. As these systems provide water for both indoor and outdoor uses, these demands are calculated using the same unit demands as given in the 2014 CFP/IFA. See Table 26.

Table 26: Water Demand Factors

Demand Factor	Units	Unit Demand, per ERC
Indoor Water Rights	acre-feet/year	0.375
Outdoor Water Rights	acre-feet/year	0.885
Average Daily – Combined	gpd	1,125
Average Daily – Indoor	gpd	335
Average Daily – Outdoor	gpd	790
Peak Daily – Combined	gpd	2,363
Peak Daily – Outdoor	gpd	2,028
Peak Instantaneous – Outdoor	gpd	2,965
Peak Instantaneous – Combined, gpd	gpd	4,441

It is noted that these alternatives only consider solutions to meeting build-out demands and do not address any redundancy. In each alternative, it is recommended that another well be drilled with enough capacity to provide source redundancy. It is estimated that this well would cost approximately $2 million to complete this but this cost is excluded from the analysis.

4.2 ALTERNATIVE 1 – MEETING BUILD-OUT WATER DEMAND WITH GROUNDWATER DEVELOPMENT

The first alternative to meeting future demands considers developing groundwater sources to supply all of the City's future indoor and outdoor demand with groundwater. Using the water demand factors from Table 26, 20-year and build-out demands are given based on the projected number of ERCs, as given in Section 2. (See Table 27). Because both indoor and outdoor water would be provided through the culinary water system, indoor and outdoor demands are not separated in this table.

Table 27: Projected Culinary Water Demands

Description	20-Year	Build-Out	Units
ERCs	1,468	2,216	-
Water Right Demand	1,850	2,793	acre-feet
Average Day Demand	1,651,500	2,493,000	gpd
Peak Day Demand	3,468,900	5,236,400	gpd
Peak Instantaneous	6,519,400	9,841,250	gpd

4.2.1 Water Rights

The City will continue to acquire water rights for growth via an ordinance that requires developers to transfer to the City's sources water rights sufficient for their needs. Very small developments or undeveloped pre-existing lots can purchase surplus rights held by the City under a "cash-in-lieu" program. By enforcing these ordinances, the City will be able to maintain a sufficient number of water rights to match demands. Water rights imported by developers require approval of change applications by the Utah Division of Water Rights in order to be diverted from the City's sources. Future sources will be required to meet future demand. Potential new well sites, as discussed in the next section, include Loafer Canyon or near 11200 South.

The existing Loafer Canyon well is located in the perched aquifer, as described in Section 1. This perched aquifer may, through leakage, recharge groundwater in the basin fill aquifer below. Other water users claim to rely on both the perched aquifer and the lower basin fill aquifer for culinary water. Therefore, deepening or drilling a new well at this location will likely result in protests from downstream water users. Section 5 addresses possible solutions to satisfy the concerns of these downstream water users.

4.2.2 Water Source

The current water source capacity (including the new Lakota well to be drilled as part of the 6-year plan), is estimated to be 3,200 gpm, or 4,610,000 gallons per day. No additional groundwater sources would be required in the 20-year planning window, but an additional 632,000 gpd would be required at build-out to meet the peak day demand. This would require an additional 450 gpm of capacity.

A new well could be drilled in the basin fill aquifer similar to the Highline Well and the future Lakota Well, or alternately, adjacent to the Loafer Canyon Well. A new well at this location could either supplement or replace the existing well. The well report from 1993 shows the water surface in the Loafer Canyon well was within 62 feet of the bottom of the well while the pump was in operation. A new well drilled adjacent to the existing Loafer Canyon well could be drilled deeper to tap into additional fractured bedrock. Additionally, groundwater diverted at this higher elevation would require less energy to supply the system due to less pumping head, and would reduce annual power costs. As such, this report favors the drilling of a new Loafer Canyon well over a third major producing well in the basin fill aquifer. For this analysis it is assumed that this new Loafer Canyon Well would replace the existing well (with a capacity of 667 gpm), and would need to have the capacity of that well, plus the additional 450 gpm described above. Table 28 summarizes the expected completion and production of the new well.

Table 28: Proposed Loafer Canyon Well

Source	Casing / Depth	Static Water Level (feet below ground surface)	Required Capacity (gpm)
New Loafer Canyon Well	12 in / 750 ft	120 feet in 1993	1,117 gpm

4.2.3 Water Storage

The City currently has a capacity of 2.0 million gallons (MG) of storage available from three tanks. Table 29 shows the existing and future storage demand and surplus or (deficit) capacity in volume.

Table 29: Projected Culinary Water Storage Demands

Parameter	20-Year	Build-out
ERCs	1,468	2,216
Total Average Daily Demand, gpd	1,651,500	2,493,000
Max Fire Storage, gpd	240,000	
Current Storage Capacity, gpd	2,000,000	
Storage Demand, gpd	1,891,500	2,733,000
Surplus (Deficit), gpd	108,500	(733,000)

It is estimated that the storage capacity will be exceeded in the year 2037. At that time, a fourth storage tank, with a capacity of 750,000 gallons will be required to meet build-out storage requirements. By constructing this new tank near the Upper Tank, and using the new Loafer Canyon well as the primary source of supply, the water demands of future developments can be met without constructing additional booster pump stations.

4.2.4 Water Distribution

Culinary water piping for each new development will be installed by the developer, in accordance with current City building codes. The Capital Facilities Plan did not identify major distribution system upgrades that would be required in the 20-year planning period, and it is not anticipated that any major upgrades beyond that period will be required.

Because of an existing City ordinance, a certain number of new developments have had 8" secondary distribution lines installed. These are shown in Figure 8. While these lines are currently not being used, they were required by the City in anticipation of meeting future outdoor watering needs. This alternative of developing groundwater sources would provide potable-quality water for both indoor and outdoor uses. As such, these existing 8" secondary distribution lines should be connected to the City's culinary system and used during the irrigation season. The secondary service lines to each connection will need to be equipped with service flow meters to accurately meter and bill water usage.

4.2.5 Capital Costs

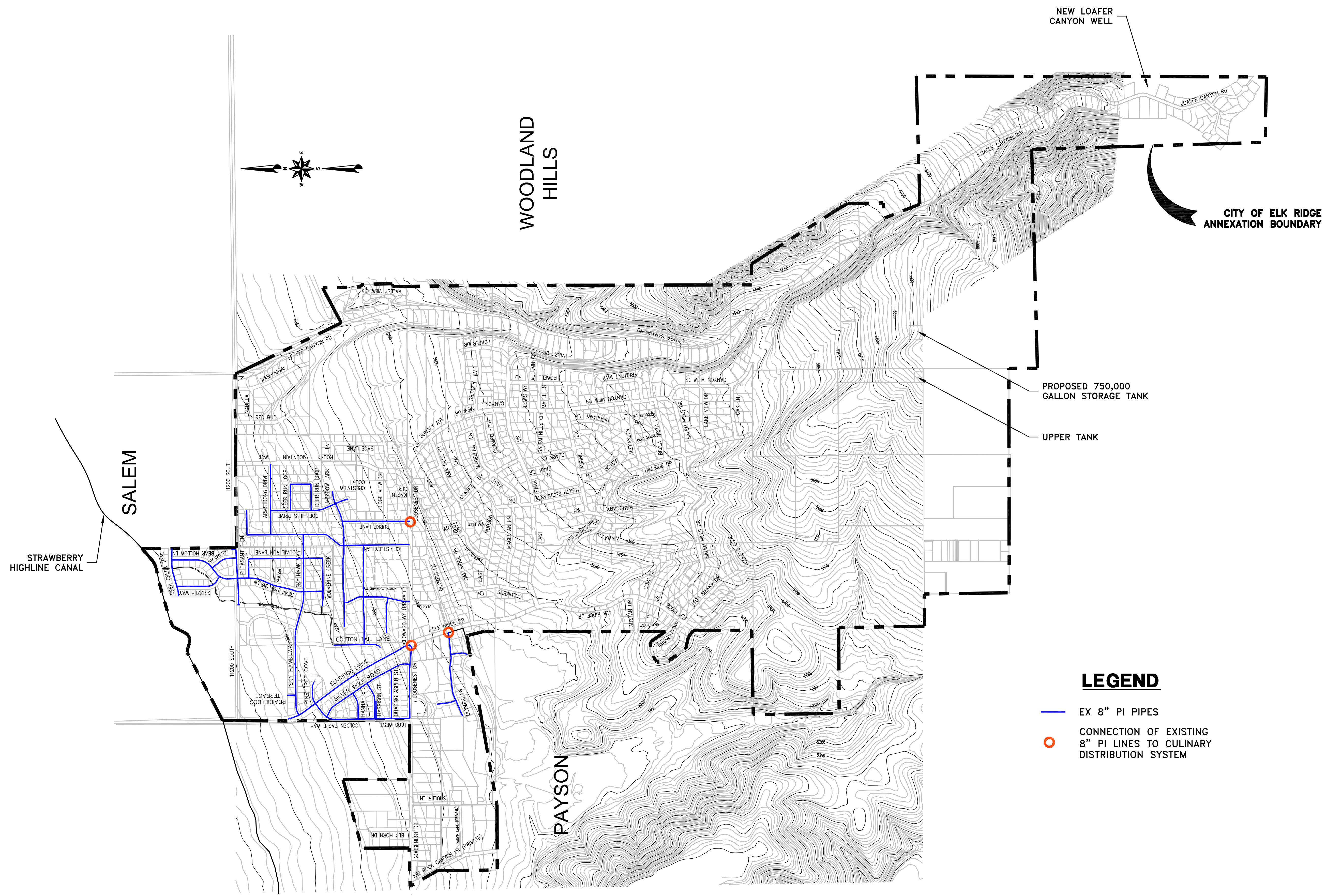
Table 30 summarizes the estimated capital costs for each component associated with developing groundwater to meet future indoor and outdoor water demands.

Table 30: Alternative 1 Capital Costs

Description	Cost
New Loafer Canyon Well	$2,311,200
750,000 Gallon Storage Tank	$1,792,125
Dry Line Commissioning	$533,250
TOTAL CAPITAL COST	**$4,636,575**

4.2.6 Annual Operations and Maintenance Costs

The primary costs associated with operating and maintaining this alternative includes power costs for operating the wells and booster pumps, pump maintenance, cleaning and repairs to storage tanks, and replacement of inoperable or malfunctioning water meters. For the purposes of this report, the cost of maintaining existing infrastructure that is consistent between the various alternatives is not included. Table 31 below shows the costs associated with this alternative.



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ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 1 - PRESSURE IRRIGATION SYSTEM MAP

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FIGURE 8

W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 8.dwg
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Table 31: Alternative 1 O&M Costs

Description	Annual Cost
Pump Operation	$105,192
Storage Tank Maintenance	$4,000
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$111,892**

4.3 ALTERNATIVE 2 – SECONDARY WATER THROUGH THE UTAH LAKE DRAINAGE BASIN WATER DELIVERY SYSTEM

The Utah Lake Drainage Basin Water Delivery System (ULS) is part of the Central Utah Project, which is a participating project of the Colorado River Water Storage Project to develop a portion of Utah's share of Colorado River water. The main trunk pipeline conveys water down the Spanish Fork Canyon, where it divides between the northern and southern parts of Utah County. The south pipeline (the Spanish Fork-Sataquin Pipeline) will pass between Salem and Elk Ridge City, and will continue south to Santaquin. This project allotted approximately 23,000 acre-feet of water to the Southern Utah Valley Municipal Water Association, which has then allotted 395 acre-feet to Elk Ridge City under current agreement.

This water could be beneficial to Elk Ridge City as it could be used to supply outdoor watering for a portion of the city and reduce the demands on potable groundwater sources. As discussed in greater detail in later sections, this secondary water is planned for certain areas of the City due to 1) available system pressure in the ULS pipeline and 2) the fact that the higher areas of the City have no secondary distribution lines and installing these lines to pump water to upper zones would be cost prohibitive. The areas of the City which are planned to receive secondary water are shown in Figure 9. Using the factors from Table 26, water demands for connections that would not have access to secondary water from the ULS are calculated and provided in Table 32.

Table 32: Projected Water Demand for Connections without Secondary Water

Demands	20-Year	Build-Out
ERCs	819	1,236
Water Rights, acre-feet	1,032	1,558
Average Indoor, gpd	274,365	414,060
Average Outdoor, gpd	647,010	976,440
Average Total, gpd	921,375	1,390,500
Peak (Combined), gpd	1,935,297	2,920,668
Peak Instantaneous (Combined), gpd	3,637,179	5,489,076

Using the same demand factors as described previously, water demands for connections that would have access to secondary water from the ULS are calculated. (See Table 33). The number of ERCs that have access to secondary water are based on the location of existing secondary infrastructure and elevation limitations. See Figure 9 for a graphic that shows ERCs that would have access to secondary water.

Table 33: Projected Water Demand for Connections with Secondary Water

Demands	20-Year	Build-Out
ERCs	649	980
Outdoor Water Rights, acre-feet	574	867
Indoor Water Rights, acre-feet	244	377
Average Indoor, gpd	217,415	328,300
Average Outdoor, gpd	512,710	774,200
Average Total, gpd	730,125	1,102,500
Peak (Outdoor), gpd	1,316,172	1,987,440
Peak (Combined), gpd	1,533,587	2,315,740
Peak Instantaneous (Outdoor), gpd	1,924,285	2,905,700
Peak Instantaneous (Combined), gpd	2,882,209	4,352,180

The water demands as given in Table 32 and Table 33 above are then combined to give the total expected demands for the culinary and secondary water systems as follows: Indoor and outdoor water demands for connections without secondary water are added to indoor water demands for connections with secondary water. This is the total culinary demand. The secondary demand is simply the outdoor water demand for connections with access to secondary water.

Table 34: Total Projected Water Demands for Culinary and Secondary Systems

Total Culinary	20-Year	Build-Out
Water Rights, acre-feet	1,032	1,935
Average Daily, gpd	1,138,790	1,718,800
Peak Daily, gpd	2,152,712	3,248,968
Total Secondary	**20-Year**	**Build-Out**
Water Rights, acre-feet	574	867
Average Daily, gpd	512,710	774,200
Peak Daily, gpd	1,316,172	1,987,440

4.3.1 Water Rights – Culinary

The City will continue to require developers to import water rights sufficient for their needs, as described in Section 3.1.1.1.

4.3.2 Water Rights - Secondary

Water delivered to Elk Ridge City through the ULS would be owned by the SUVMWA, and no rights would need to be acquired by the City. However, an annual fee, currently estimated to be $202.00 per acre-foot of water delivered would be required to be paid by the City. This fee, established in the Petition of SUVMWA to the CUWCD for the Allotment of Water for Municipal and Industrial Use, is required to cover the cost share of construction and maintenance of the ULS pipeline and would be assessed each year for a period of 50 years.

4.3.3 Water Source – Culinary

The peak daily flow for culinary water, is given in Table 34 as 3,248,968 gpd, or 2,256 gpm. The capacity of the culinary sources (including the proposed Lakota Well) is expected to be 3,200 gpm. Thus, there will be no need for another well to meet build-out demands.

4.3.4 Water Source – Secondary

A total annual volume of 867 acre-feet is needed to meet the secondary demand at build-out, and as the current SUVMWA agreement had only allotted Elk Ridge 395 acre-feet, an additional 472 acre-feet would need to be acquired. Acquiring this additional water is subject to the decision of the SUVMWA board. If it were to be acquired, this water would provide outdoor water to a portion of the City during the irrigation season, estimated to be six months long, without the need to pump.

It is noted that the availability of ULS water is dependent on the completion of the Spanish Fork-Santaquin pipeline through the Elk Ridge area. Because of various factors, this project has been delayed and it is anticipated that this portion of the ULS project will not be completed for at least another 10 years.

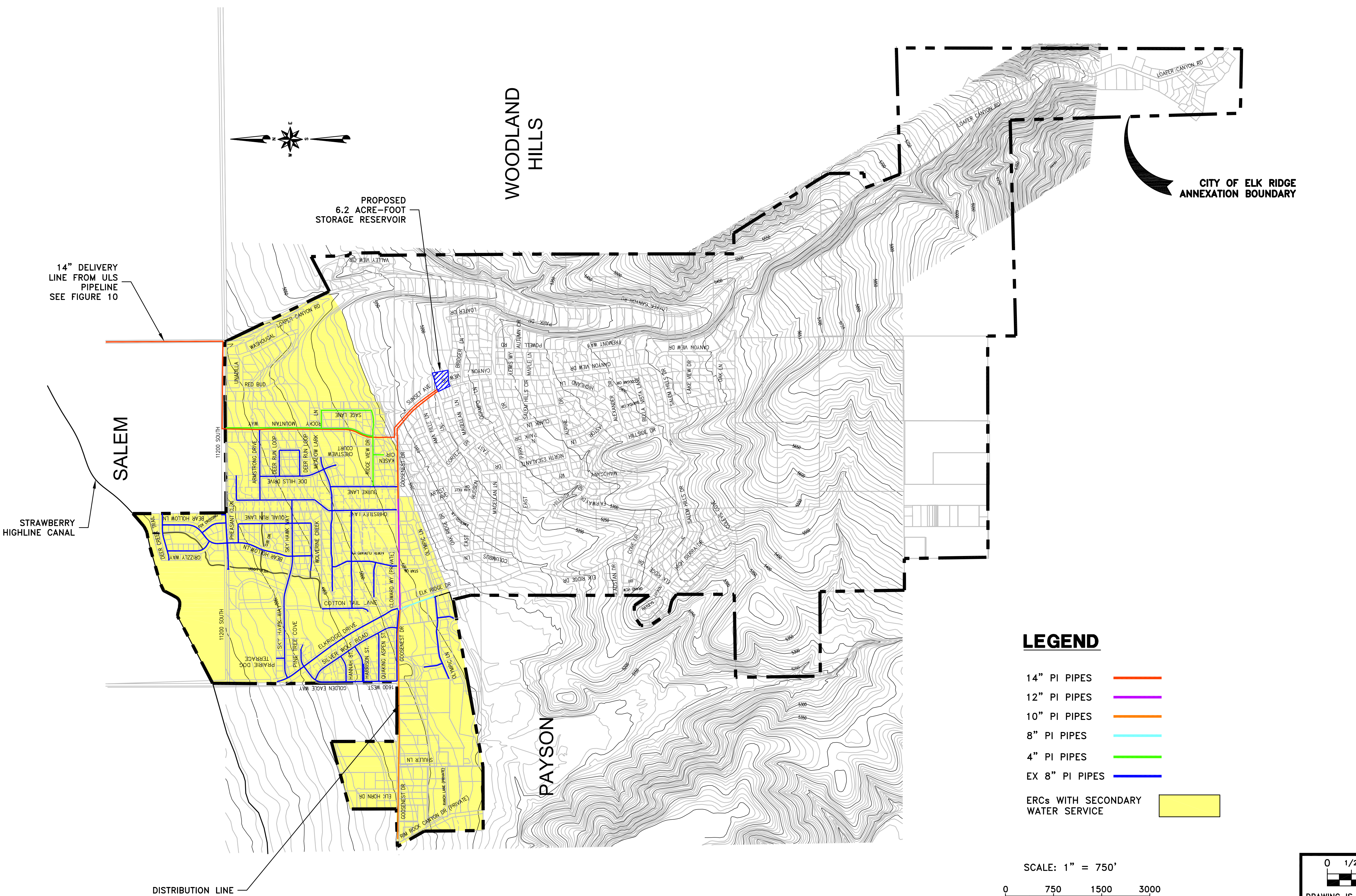
4.3.5 Water Storage – Culinary

The total average daily culinary water storage is given in Table 34 as 1,138,790 gpd. With the required fire flow storage of 240,000 gallons, the total storage required is 1,378,790 gallons. As described in the first section of this chapter, the total current storage capacity is 2 million gallons. Therefore, under this alternative, no additional storage is required.

4.3.6 Water Storage – Secondary

The pressure of the water in the ULS pipeline allows it to be delivered to an elevation as high as 5,200 MSL using a 14” pipeline. A storage reservoir would be constructed at this elevation to provide adequate storage volume to meet peak demands and to deliver minimum required pressures to each connection. See Figure 9 for the location selected for this reservoir, as well as areas of the City to which pressurized irrigation water could be provided.

The ULS pipeline will be able to deliver the peak daily flow of 1,987,440 gallons per day (1,380 gpm). The peak instantaneous flow, as given in Table 33, is 2,905,700 gpd or 2,018 gpm. Storage requirements for secondary water are based on 1) equalization storage to meet demands above the peak daily flows, and 2) emergency storage to provide capacity in case of downtime.



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ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ALTERNATIVE 2 - PRESSURE IRRIGATION SYSTEM MAP

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FIGURE
9

04/08/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 9.dwg

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As outlined in their Pressurized Irrigation System Master Plan, Spanish Fork City has designed secondary storage to provide 25% of the peak daily flow for equalization storage and 33% for emergency reserve storage. Because Elk Ridge City is smaller, it is likely that peak flows will be higher (due to simultaneous demand) and consequently storage requirements will be greater. To provide a larger buffer, a total storage volume of 100% of the peak daily flow is used. A surface storage pond, with 6.2 acre-feet of storage and a water depth of six feet would be constructed with an impermeable membrane liner to eliminate water losses through infiltration.

4.3.7 Water Distribution – Culinary

Culinary water piping for each new development will be installed by the developer, in accordance with current City building codes. The Capital Facilities Plan did not identify major distribution system upgrades that would be required in the 20-year planning period, and it is not anticipated that growth beyond that period will require major upgrades.

4.3.8 Water Distribution – Secondary

The Spanish Fork-Sataquin pipeline alignment would pass near the Salem Canal, north of Elk Ridge City. The ULS project provides a point of connection at this location for Elk Ridge. The cost of delivering the water from the point of connection to the storage reservoir would be the responsibility of the City. Additional piping from the reservoir to the City's secondary distribution system would need to be completed as well. This would include a 14-inch main, reducing to 12-inch and later to 10-inch, running the length of Goosenest Drive that would connect to both the existing 8" secondary mains, as well as any future secondary mains. Figure 10 shows the connection point and the proposed alignment of the delivery pipeline. The new secondary main pipeline, and existing dry pressure irrigation mains are shown on Figure 9.

Part of the requirement for receiving ULS water established in the SUVMWA agreement, is for SUVMWA to reduce collective water consumption by 12.5% by 2020 and 25% by 2050. Based on correspondence with the CUWCD, this goal is on track for SUVMWA because of water conservation methods that have been implemented by other municipalities in the association. To assist in meeting these conservation requirements possible conservation methods for Elk Ridge City are discussed in greater detail in Section 6.

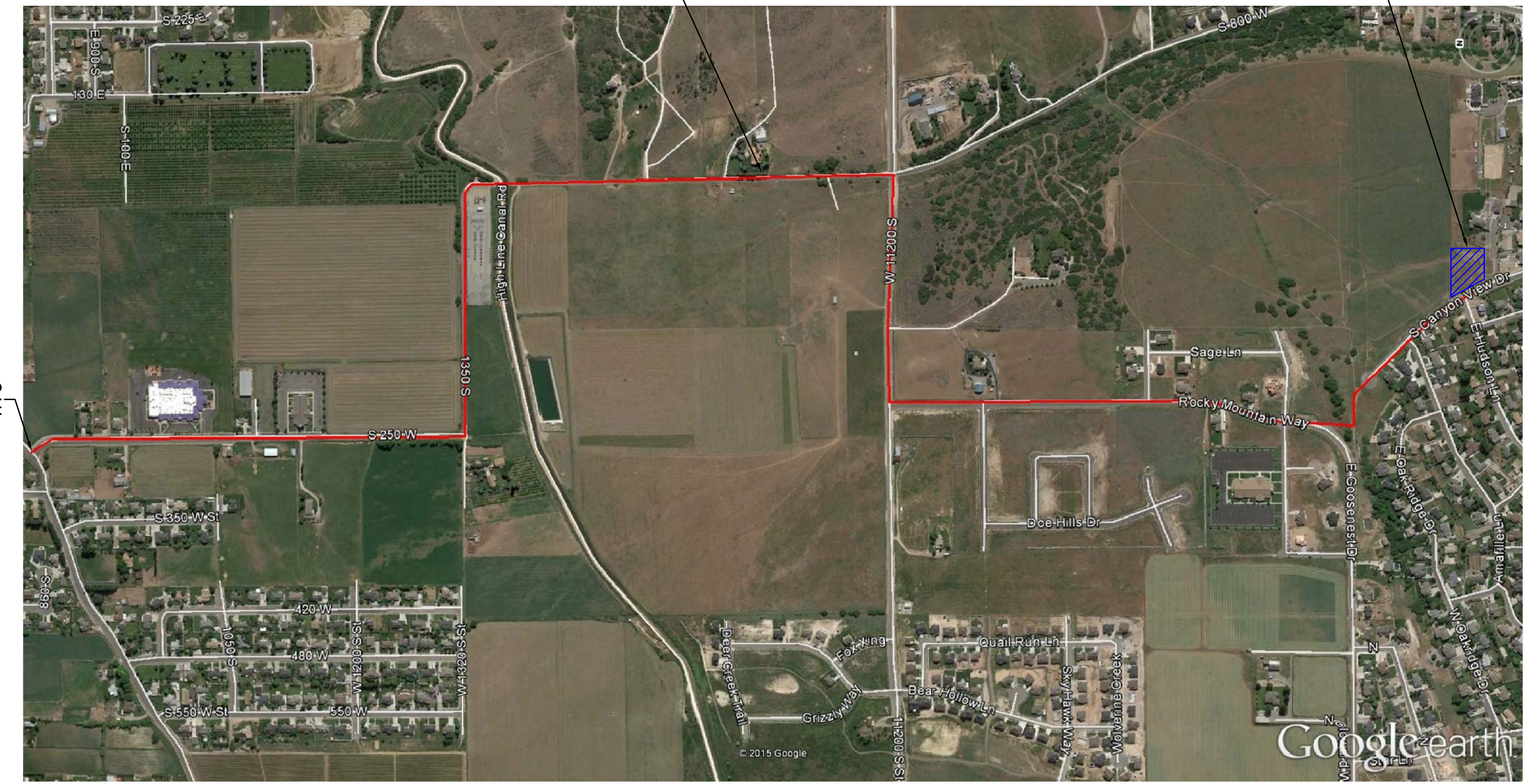
4.3.9 Capital Costs

Table 35 summarizes the estimated capital costs for each component associated with acquiring, delivering and distributing ULS water to meet secondary water demands.

TOTAL LENGTH
~12,000 FEET

1 ACRE SURFACE
STORAGE RESERVOIR

CONNECTION TO
SPANISH FORK–
SANTAQUIN PIPELINE



LEGEND

14" ULS DELIVERY PIPELINE

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ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ULS DELIVERY PIPELINE ALIGNMENT

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FIGURE
10

03/31/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 10.dwg

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Table 35: Alternative 2 Capital Costs

Description	Cost
Surface Storage Reservoir	$759,150
Secondary Distribution Upgrades	$2,736,788
TOTAL CAPITAL COST	**$3,459,938**

4.3.10 Annual Operations and Maintenance Costs

The primary costs associated with operating and maintaining this water system include maintenance of the storage reservoir, the annual cost of purchasing water from the ULS project, and replacement of faulty water meters. For the purposes of this report, the cost of maintaining existing infrastructure that is unchanged between the various alternatives is not included. Table 36 shows the O&M costs associated with this alternative.

Table 36: Alternative 2 O&M Costs

Description	Annual Cost
Storage Reservoir Maintenance	$20,000
ULS Water Repayment	$175,189
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$197,889**

4.4 ALTERNATIVE 3 – SECONDARY WATER THROUGH THE HIGH LINE CANAL ENCLOSURE PROJECT

The Strawberry High Line Canal Company (SHLCC) Enclosure Project is another external project from which Elk Ridge City may be able to benefit. This project proposes to enclose the existing unlined Highline Canal to reduce seepage losses, provide a greater degree of protection against canal failure, and to better provide for the needs of current and future canal users. The benefit to Elk Ridge City is that capacity could be purchased in the pipeline to convey ULS water to the City. This may be advantageous over Alternative 2, because the completion of the Highline project is anticipated to occur sooner than the ULS pipeline project. Similar to water received through the Spanish Fork-Sataquin ULS pipeline, water delivered through the Canal pipeline would be stored in a surface reservoir. However, because the enclosed canal would be under gravity flow with resulting low pressure, the reservoir should be located near to the canal to allow a low head diversion. From that point the water would need to be pumped into the secondary distribution system.

This alternative would use the same peaking factors and water demands as the ULS alternative. Refer to Table 32, Table 33 and Table 34 for calculated culinary and secondary water demands.

4.4.1 Water Rights – Culinary

The City will continue to require developers to import water rights sufficient for their needs, as described in Section 3.1.1.1.

4.4.2 Water Rights - Secondary

The ULS water delivered through the Highline Canal pipeline would be subject to a capacity buy-in cost per cubic foot per second (cfs) of capacity in the pipeline. This buy-in is the cost share for construction of the pipeline. A capacity in the canal equal to the peak daily demand of 1,987,440 gpd (3.08 cfs) would be needed. Refer to Section 4.4.8 for calculated buy-in costs.

In addition to this buy-in cost, the Canal Company would also charge an annual maintenance fee, based on volume of water delivered. Based on correspondence with project engineer Jay Franson of Franson Civil Engineers, the annual cost is currently estimated to be $90 per acre-foot. Per correspondence with the CUWCD, the City would not be exempt from the $202.00 per acre foot fee associated with obtaining ULS water. Therefore, the annual maintenance cost in the Canal pipeline would be in addition to the ULS fee.

It is also noted that the original intent for the use of the ULS water was transmission through the Spanish Fork-Santaquin pipeline, and an associated environmental impact study (EIS) was completed on this basis. If Elk Ridge City were able to convey water through the Highline Canal pipeline, it is likely that a separate EIS would need to be completed. The City's cost share is included in the capital cost estimate in Section 4.4.8.

4.4.3 Water Source – Culinary

The changes to the culinary water sources would be equal to those described in Alternative 2. Refer to Section 4.3.3.

4.4.4 Water Source – Secondary

The changes to the secondary water sources would be equal to those described in Alternative 2. Refer to Section 4.3.4.

4.4.5 Water Storage – Culinary

The changes to the culinary water storage would be equal to those described in Alternative 2. Refer to Section 4.3.5.

4.4.6 Water Storage – Secondary

As mentioned previously, the water delivered from the Highline Canal would be under low pressure. To minimize pumping costs, a surface storage reservoir would be located near the same elevation the canal and the water would flow into the reservoir. See Figure 11 for potential location of the reservoir, as well as areas of the City that would be supplied with secondary water. The reservoir would be sized the same as that given in Section 4.3.6.

4.4.7 Water Distribution – Secondary

From the surface storage reservoir, pressurized water would need to be provided to those ERCs with secondary service connections. A pumping station, located at the reservoir, with pumps equipped with variable frequency drives (VFDs) would be used to provide pressure to the system and meet the daily peak and instantaneous demands. Additional piping from the pumps at the reservoir into the City's secondary distribution system would need to be completed as well. This would include a main pipeline, with 14-, 12- and 10-inch sections, running the length of 11200 South from 1600 West to Loafer Canyon Road that would connect to both the existing 8" secondary lines, as well as any future secondary connections. See Figure 11.

As noted previously, the installation of flow meters on each secondary service line to monitor and regulate usage at each connection will be beneficial in helping to meet conservation goals.

4.4.8 Capital Costs

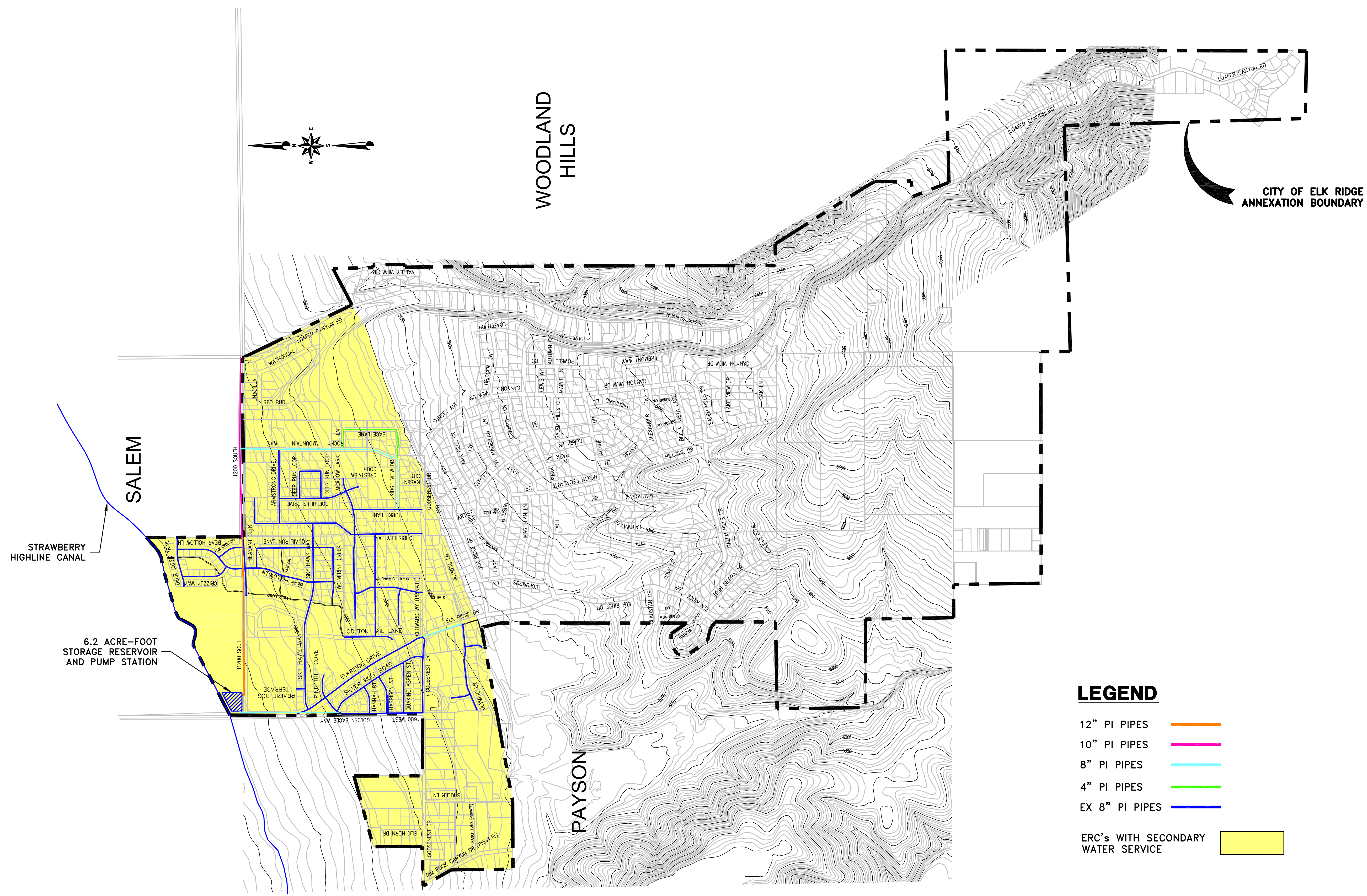
The following Table 37 summarizes capital costs for each component associated with acquiring ULS water to meet secondary water demands.

Table 37: Alternative 3 Capital Cost

Description	Cost
SHLCC Enclosure Project Buy-In Cost	$1,054,300
Surface Storage Reservoir	$759,150
Reservoir Pump Station	$1,407,524
Secondary Distribution Upgrades	$1,431,000
Environmental Impact Study Update	$100,000
TOTAL CAPITAL COST	**$4,751,974**

4.4.9 Annual Operations and Maintenance Costs

The primary costs associated with operating and maintaining this water system include power costs for operating the secondary water pumps, pump maintenance, maintenance of the storage reservoir, the annual cost of purchasing water from the Highline Canal, the fee for the ULS water, and replacement of faulty water meters. For the purposes of this report, the cost of maintaining existing infrastructure that is consistent between the various alternatives is not included. Table 38 below shows the costs associated with each component.



LEGEND

12" PI PIPES	orange line
10" PI PIPES	magenta line
8" PI PIPES	cyan line
4" PI PIPES	green line
EX 8" PI PIPES	blue line
ERC's WITH SECONDARY WATER SERVICE	yellow fill

SCALE = 1" = 750'

0 750 1500 3000
Scale in Feet

0 1/2 1
DRAWING IS TO SCALE IF BAR MEASURES:
1" = FULL SCALE
1/2" = HALF SCALE

NO.	DATE	DESIGN	DRAWN	CHECKED
-	2/24/2015	DPS	SSB	-

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ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
ALTERNATE 3 - PRESSURE IRRIGATION SYSTEM MAP

AQUA ENGINEERING
533 W. 2600 S. SUITE 275, BOUNTIFUL, UT 84010
PHONE (801) 299-1327 FAX (801) 299-0153

FIGURE
11

04/08/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 11.dwg

SB

Table 38: Alternative 3 O&M Cost

Description	Annual Cost
Pump Operation	$72,874
Storage Reservoir Maintenance	$20,000
ULS Water Repayment	$175,134
SHLCC Pipeline O&M	$78,055
Flow Meter Replacement	$2,700
TOTAL O&M COSTS	**$348,762**

4.5 SUMMARY OF ALTERNATIVES

Each of the alternatives discussed have benefits and disadvantages. While capital cost is a significant factor in considering the most feasible alternative, operation and maintenance cost, the time frame of implementation, or public perception should also be considered. Table 39 summarizes the capital and O&M costs of each alternative.

Table 39: Summary of Alternatives – Capital and O&M Costs

Alternative	Capital Cost	O&M Cost
Alt. 1: Groundwater Only	$4,636,575	$111,892
Alt. 2: Water via ULS Pipeline	$3,459,938	$197,889
Alt. 3: Water via SHLCC Pipeline	$4,751,974	$348,762

Alternative 1 has the lowest operating costs. This is primarily because the cost of purchasing the ULS water is a significant factor in the other two alternatives. This alternative has the second highest capital cost and includes the risk of protests from other water users. If these protests can be resolved, the City can then carry out this alternative on the timeline needed to meet future demands. However, if the protests and resistance to more groundwater diversions cannot be resolved, other means should be considered to mitigate the impact to downstream water users. Section 5 evaluates the feasibility of aquifer storage and recovery as a possible solution to mitigate impacts to downstream water users.

Alternative 2 is the least expensive option and proposes to obtain water from the CUP through SUVMWA. However, acquiring this water is conditional upon the completion of the ULS project which is outside the control of the City. If this project is completed before the demands in the City require a secondary system, this option is the most viable. However, if the project is not completed in time, other alternatives need to be considered.

Alternative 3 is the most expensive option, in both capital and O&M costs. While capital costs are similar to Alternative 1, the additional pumping costs and annual fees associated with the SLHCC enclosure project become significant. This alternative should only be considered if the other alternatives are not feasible.

SECTION 5 - AQUIFER STORAGE AND RECOVERY

5.1 INTRODUCTION

As mentioned in Section 3, the City will continue to acquire water rights from developers as land is developed via current City ordinance. However, in order to drill and complete new wells, water rights imported from outside the City boundaries require application to change the points of diversion. Changing the point of diversion of these rights will likely be met with protest from downstream water users.

One possible method to mitigate adverse impacts to downstream water users is for the City to provide aquifer recharge equivalent to groundwater diversions that could cause impairment. Aquifer recharge can simply consist of a retaining basin located in an area with adequate infiltration rates (3-6 feet/day). Water for this recharge would be provided by the CUP and conveyed either through the ULS Pipeline or through the enclosed Highline Canal. Figure 12 shows two possible locations for aquifer storage based on the conveyance method and the available pressure.

5.1.1 Pond Sizing

The size of the aquifer recharge area is based on the volume of water to be recharged and the infiltration rate. Matching the excess water demands from Section 4.2.2, the recharge amount would be 450 gpm. This is equivalent to 1.94 acre-feet of recharge water per day. With a minimum infiltration rate of 3 feet per day, the total surface area required is about 2/3 of an acre. This recharge would only be used during the summer months. The capital cost associated with the two locations for construction of an aquifer recharge area is shown in Table 40. This table also shows the annual costs to be paid for operation and maintenance of the ASR system. These costs are based on information provided in the SUVMWA Groundwater Recharge Feasibility Study, (Caldwell Richards Sorensen, 2013).

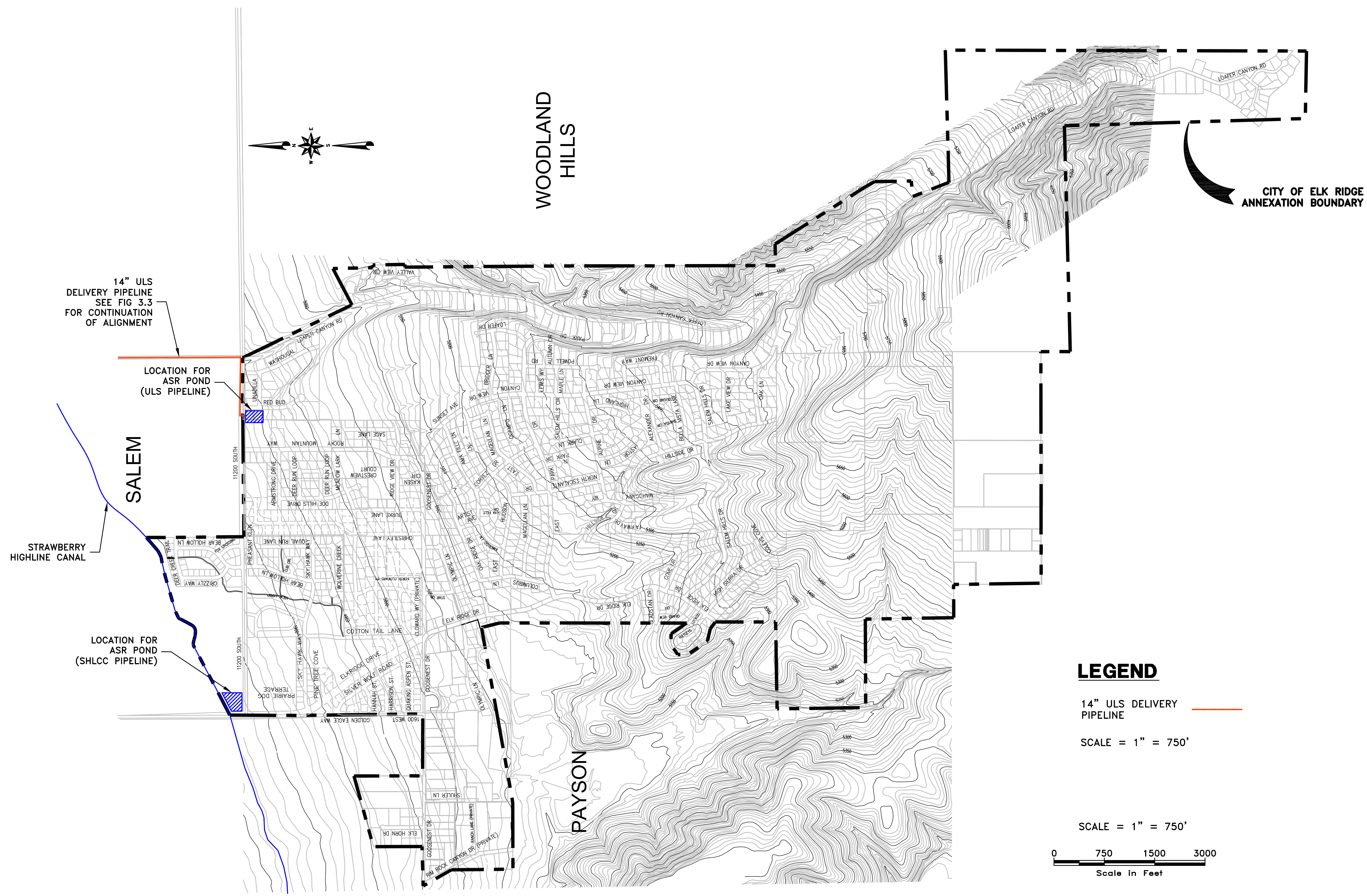
Table 40: Capital and Annual O&M Cost of ASR Options

Description	Capital Cost	Annual O&M Costs
Highline Canal Pipeline	$1,525,300	$102,200
Spanish Fork-Santaquin Pipeline	$1,248,300	$70,700

Maintenance includes scarifying the basin floor each year to loosen the soil to maintain adequate infiltration rates. Every ten years the basin would need to be rehabilitated which consists of removing the top 12" of material, using a tumbler to remove the finer material, and placing the recovered coarser materials in the basin. Table 41 gives the total annual operation and maintenance costs.

Table 41: ASR Pond O&M Costs

Description	Annual Cost
Scarify Basin Surface (Annually)	$28,000
Rehabilitate Basin (Every 10 Years)	$8,400
Total Annual Cost	**$36,400**



ELK RIDGE CITY CORPORATION

SECONDARY WATER SYSTEM
PRELIMINARY ENGINEERING REPORT
POTENTIAL ASR POND LOCATIONS

NO.	DATE	DESIGN	DRAWN	CHECKED
-	2/24/2015	DPS	SSB	-

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AQUA ENGINEERING
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PHONE (801) 299-1327 FAX (801) 299-0153

0 1/2 1
DRAWING IS TO SCALE IF BAR MEASURES:
1" = FULL SCALE
1/2" = HALF SCALE

FIGURE
12

04/08/2015 W:\Elk Ridge\Water\Secondary Water\Pressure Irrigation\Drawings\FIG 12.dwg

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SECTION 6 - CONSERVATION AND DEMAND REDUCTION

6.1 INTRODUCTION

Acquiring ULS water requires that SUVMWA meet certain water conservation requirements. These conservation requirements were established at 12.5% overall water consumption reduction by the year 2020 and 25% reduction by the year 2050, with certain penalties if compliance is not achieved by these dates. Per correspondence with the CUWCD, SUVMWA and its entities are on track to meet the 12.5% reduction goal. Even without specific requirements, implementing conservation measures with all of three alternatives discussed in previous sections will financially benefit the City by either delaying or avoiding capital improvements and by reducing operation and maintenance costs.

Current water usage in Elk Ridge City is significantly higher than the Utah average. (See Figure 13). The difference between actual use and state average use suggests that there may be some relatively simple solutions to conserving water, thereby reducing or eliminating infrastructure that would otherwise be necessary to meet future demands. Four possible methods include 1) education of the public about existing rebate programs for water conserving technology, 2) upgrading metering software to better identify leaks, high water users, or otherwise monitor water usage, 3) provide incentives for water reduction efforts such as xeriscaping, and 4) adjusting user fees to encourage reduction in consumption.

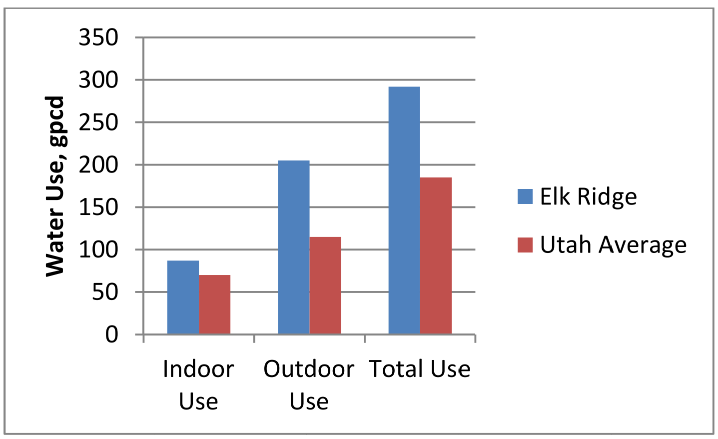

Figure 13: Water Consumption

6.2 CONSERVATION METHODS

The City currently implements two methods to encourage water conservation. The first is a tiered water fee schedule, and the second is the requirement to prohibit outdoor watering between 10:30 am and 6:00 pm.

<u>6.2.1 Education on CUWCD Rebate Program</u>

The Central Utah Water Conservancy District maintains a program that allows participants within the district to be reimbursed for installing eligible irrigation products that help to reduce outdoor water usage.

Qualifying products include smart irrigation controllers, specialized nozzles and sprinkler bodies and drip regulators and filters. Each of these products may help to reduce water consumption and reach conservation goals within the City.

Of particular note are the pressure regulating valves (PRVs). Because of the significant elevation drop across the City from south to north, high pressures develop in certain areas of the distribution system, and some connections are subject to pressures in excess of 100 psi. Many of the connections already have installed PRVs. However, connections without PRVs or with failed PRVs may see significant reductions in water consumption up to 30%, and consequently consumer water bills could be reduced significantly.

<u>6.2.2 Upgrading Metering Software</u>

The City currently uses a service flow meter, manufactured by Sensus© for culinary water metering, with radio transmitters at each meter that allows monthly usages to be read from a vehicle-mounted receiver. These meters can be upgraded with software and hardware to provide automatic meter reading on an hourly basis to a central location. With an hourly metering system, a more accurate accounting of water usage in the City could be determined. With proper SCADA programming, alerts could be delivered to the City of individual residences or businesses that are watering during prohibited hours, of areas where pipe leaks are likely, or where residences are using excessive water. Warnings or fines could be delivered to these residences for repeat offenses. Alternatively, the City could establish watering goals, that when achieved by individual residences, would result in rewards, such as deductions in water bills or other incentives to residents. These goals could include a maximum frequency of watering per week or maximum total watering volume in a given month.

<u>6.2.3 Xeriscaping Incentives</u>

Xeriscaping is landscaping that uses native vegetation with minimal water requirements in place of traditional grass or other water intensive vegetation. Xeriscaping has the potential to significantly reduce water consumption. One study conducted in Nevada reported residents used 76% less water on xeriscaped areas than on traditional turfgrass areas. Another study conducted in Kaysville, UT reported that public perception of xeriscaped areas was only slightly less favorable than traditional turfgrass areas. Currently, City zoning ordinances do not prohibit xeriscaping on residences. However, if this type of landscaping were to be more strongly encouraged, either by education or by rebate incentives, a review of the code is recommended to ensure the aesthetic value of the City is not diminished by varying xeriscape designs.

6.2.4 Increasing Block Rates

While the City currently generates adequate revenue from billing for water usage to fund its capital improvements and maintenance, an increase in block rates may result in lower consumption per ERC. Table 42 shows the current water billing rates. Rates may be restructured by raising all block rates equally, or by increasing the per usage rate in the higher ranges. Further investigation of these rate changes should be considered to evaluate the effectiveness of this method. It is noted that it is beyond the scope of this report to suggest how these block rates could be adjusted.

Table 42: Current Water Billing Rates

Water Usage, gallons per month		Cost per 1,000 gallons
0	12,000	$40.00*
12,001	50,000	$1.80
50,001	75,000	$2.00
75,001	125,000	$2.25
125,001	and up	$2.75

*Flat rate fee

6.3 EFFECTS OF CONSERVATION

Reducing secondary water demands as part of the ULS project water requirements has some financial benefit to the City. As the City must pay for each acre-foot of water received annually, reduction of water usage has a direct impact on annual cost. Additionally, where the ULS water must be pumped into the distribution system (such as with Alternative 3), the cost of pumping is reduced proportionately.

These costs savings can be extended when considering conservation efforts for both secondary and culinary water systems. While the conservation methods discussed above do not necessarily apply to indoor water consumption, a significant portion of the City uses culinary water for outdoor irrigation. Table 43 shows resulting water demand if the conservation efforts were applied to all ERCs at build-out for Alternative 1. Note that these reductions only apply to outdoor usage.

Table 43: Projected Water Demand Reductions with Conservation

Build-Out Demands	No Reduction	12.5% Reduction	25% Reduction	Units
ERCs	2,216			-
Average Day	2,493,000	2,274,170	2,055,340	gpd
Peak Day Indoor	742,360	742,360	742,360	gpd
Peak Day Outdoor	4,494,048	3,932,292	3,370,536	gpd
Peak Day Total	5,236,408	4,674,652	4,112,896	gpd
	3,636	3,246	2,856	gpm

Of significant note is the peak day demand, which relates to the required capacity of the groundwater wells. As mentioned in Section 4, the total available capacity from the groundwater sources, including the

Lakota well, which is to be constructed within the 6 year planning period, is expected to be 3,200 gpm. Thus, if at least a 13% reduction were achieved, the existing and proposed wells would have sufficient capacity to meet peak demands under build out conditions. However, as has previously been noted, while the three wells will meet the demand requirements, the need for a redundant source is still strongly recommended.

SECTION 7 - CONCLUSION AND RECOMMENDATIONS

7.1 CONCLUSION

This study evaluated the feasibility of three alternatives to providing a secondary water system to meet water demands as the City continues to develop. The demographics and existing culinary water system infrastructure was reviewed from the Capital Facilities Plan and Impact Fee Analysis to provide the context of evaluating the proposed alternatives. Following this review, the three alternatives were evaluated. These consisted of:

1. Developing additional groundwater sources.
2. Purchasing water from the Central Utah Project and delivering it to the City via the Utah Lake Drainage Basin Water Delivery System.
3. Purchasing water from the CUP and delivering it to the City via the Strawberry Highline Canal Enclosure Project.

Section 4.5 summarized the disadvantages of each alternative. While Alternative 1 is the least expensive, it also carries with it the possibility of delays due to protests from downstream water users. Alternative 2 is the next least expensive option, but the uncertainty of the project timeline may not be favorable in considering long-term planning for the City. Alternative 3 is the most expensive option, and has the same disadvantage as Alternative 2 in the uncertainty of project completion.

7.2 RECOMMENDATIONS

While the intention of this report was to evaluate alternatives to meet the future water demands of the City, Section 6 of this report identified conservation as a viable option that would potentially reduce or eliminate the need for capital improvements to meet demands. These capital improvements can be avoided if conservation methods result in a reduction of outdoor water usage by 13% or more. It is the recommendation of Aqua Engineering that the City first considers and pursues one or more of the conservation methods discussed in Section 6 to determine if per capita water usage can be reduced. These conservation efforts can be monitored over a certain time period to determine their effectiveness. If after a reasonable evaluation period, it is determined that the conservation efforts will not be sufficient to meet the reduction goals, one or more of the alternatives discussed in this report can be considered. Figure 14 is a flowchart that provides a recommended sequence for considering each alternative.

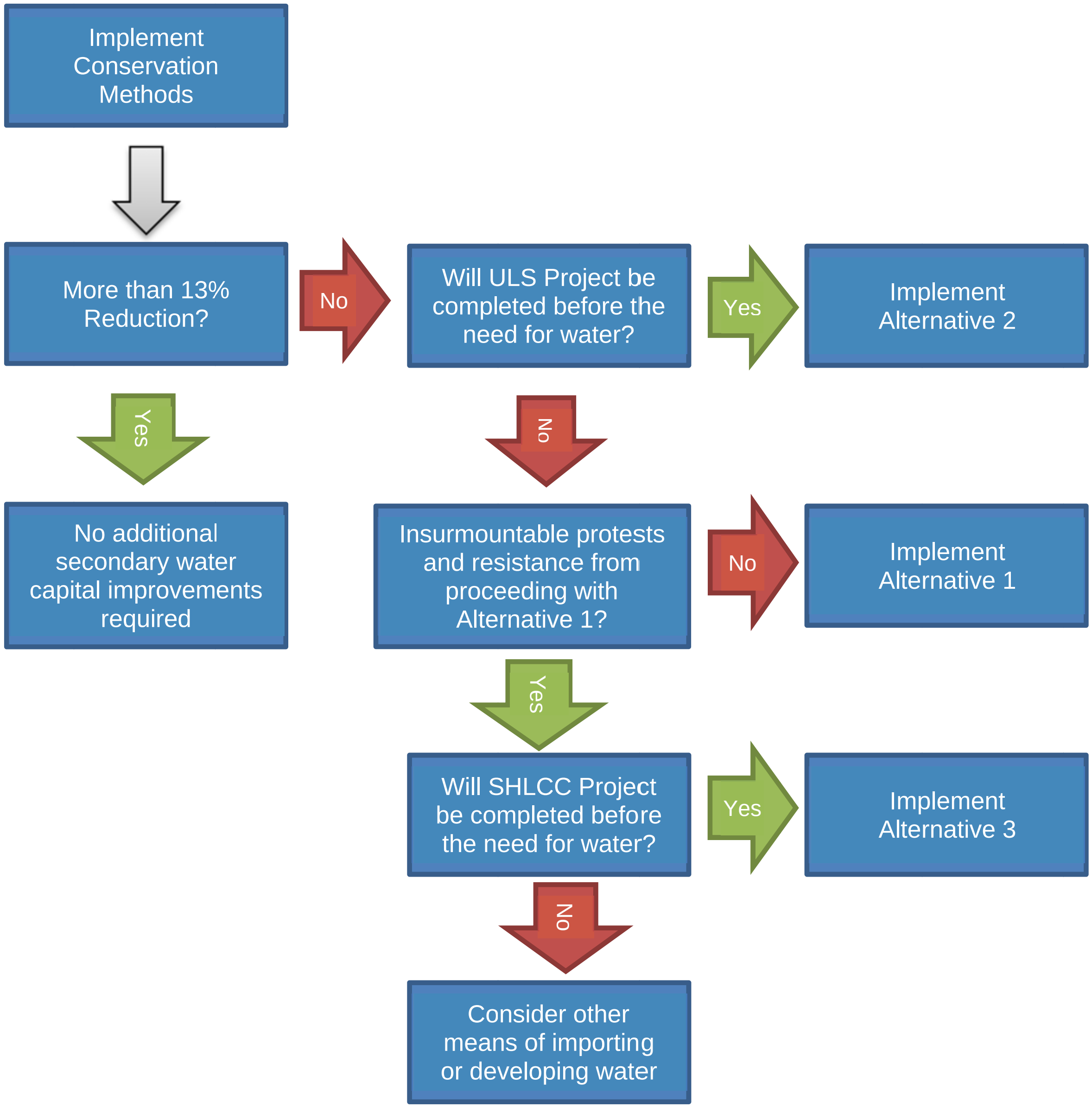

Figure 14: Decision Flow Chart

As shown above, the first alternative to consider if conservation efforts fall short, is Alternative 2, which has the lowest capital cost. If the ULS project is completed before the City needs to expand its water system, this project is the most economically feasible, but O&M costs are higher than Alternative 1 and this must be taken into consideration. However, if the time of completion for the project is beyond the time when the water is needed, or if the time of completion of the project is uncertain, this alternative is not viable.

Alternative 1 is the next most economic option in terms of capital cost and has the lowest O&M cost. If the resistance from downstream water users can be resolved without mitigation, this alternative should be implemented. However, if the project resistance cannot be resolved, Alternative 3 could be considered as a last resort. While Alternative 3 is the most expensive of the three options, it is still a better option than implementing an Aquifer Storage and Recovery system, as described in Section 5, as the cost of implementing this system, in addition to Alternative 1, will be more expensive than any of the other options, both in capital and O&M costs.

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APPENDIX B

SUPPLEMENTAL DEMOGRAPHIC INFORMATION, WATER USAGE, AND CALCULATIONS FOR WATER DEMAND

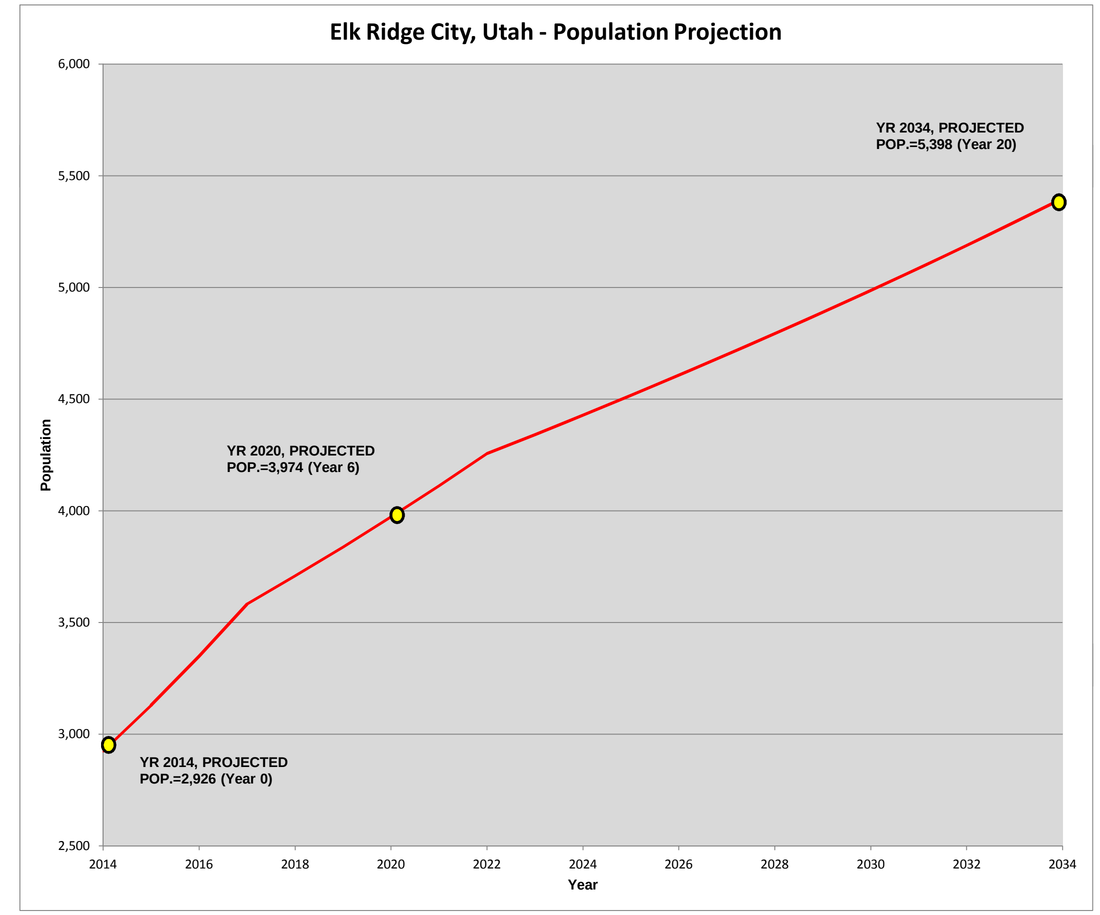
Population Projection

2013 Water Residential Connections=	698	
2013 Single Family Connection=	694	
Connections serving church and assisted living facility units=	4	
Total ERCs=	719	
Total Residential ERCs (includes assisted living facility)=	**710**	
ERC to Population Conversion =	3.85 persons=	1 ERC
Population=	**2,734**	

Population Projection used for 2014 CFP and Impact Fee Analysis

Year	Growth Rate	Elk Ridge Population	Residential ERCs	Church ERCs	Commercial ERCs	Elementary School	Total Commercial, School, and Church ERCs	Total ERCs	Increase in Residential ERCs	Increase in Total ERCs	
2013	7.00%	2,734	710	9	0	0	9	719	0	0	
2014	7.00%	2,926	760	9	0	0	9	769	0	0	0-year
2015	7.00%	3,130	813	9	0	0	9	822	53	53	
2016	7.00%	3,350	870	12	0	0	12	882	110	113	
2017	7.00%	3,584	931	12	0	0	12	943	171	174	
2018	3.50%	3,709	963	12	0	0	12	975	204	207	
2019	3.50%	3,839	997	12	0	0	12	1,009	237	240	
2020	3.50%	3,974	1,032	12	4	11	27	1,059	272	290	6-year
2021	3.50%	4,113	1,068	15	8	11	34	1,102	308	333	
2022	3.50%	4,257	1,105	15	12	11	38	1,143	346	375	
2023	2.00%	4,342	1,127	15	16	11	42	1,169	368	401	
2024	2.00%	4,429	1,150	15	20	11	46	1,196	390	427	
2025	2.00%	4,517	1,173	15	24	11	50	1,223	413	454	
2026	2.00%	4,608	1,196	15	28	11	54	1,250	437	482	
2027	2.00%	4,700	1,220	15	32	11	58	1,278	461	510	
2028	2.00%	4,794	1,245	15	36	11	62	1,307	485	538	
2029	2.00%	4,890	1,270	15	40	11	66	1,336	510	567	
2030	2.00%	4,987	1,295	18	43	11	72	1,367	535	598	
2031	2.00%	5,087	1,321	18	46	11	75	1,396	561	627	
2032	2.00%	5,189	1,347	18	49	11	78	1,425	588	657	
2033	2.00%	5,293	1,374	18	52	11	81	1,455	615	687	
2034	2.00%	5,398	1,402	18	55	11	84	1,486	642	717	20-year
2035	2.00%	5,506	1,430	18	58	11	87	1,517	670	748	
2036	2.00%	5,617	1,458	18	61	11	90	1,548	699	780	
2037	2.00%	5,729	1,488	18	64	11	93	1,581	728	812	
2038	2.00%	5,843	1,517	18	67	11	96	1,613	758	845	
2039	2.00%	5,960	1,548	21	70	11	102	1,650	788	881	
2040	2.00%	6,080	1,579	21	73	22	116	1,695	819	926	
2041	2.00%	6,201	1,610	21	76	22	119	1,729	851	961	
2042	2.00%	6,325	1,642	21	79	22	122	1,764	883	996	
2043	2.00%	6,452	1,675	21	82	22	125	1,800	916	1,032	
2044	2.00%	6,581	1,709	21	85	22	128	1,837	949	1,068	
2045	2.00%	6,712	1,743	21	88	22	131	1,874	983	1,105	
2046	2.00%	6,847	1,778	24	91	22	137	1,915	1,018	1,146	
2047	2.00%	6,984	1,813	24	94	22	140	1,953	1,054	1,185	
2048	2.00%	7,123	1,850	24	97	22	143	1,993	1,090	1,224	
2049	2.00%	7,266	1,887	24	100	22	146	2,033	1,127	1,264	
2050	2.00%	7,411	1,924	24	103	22	149	2,073	1,165	1,305	
2051	2.00%	7,559	1,963	24	106	22	152	2,115	1,203	1,346	
2052	2.00%	7,710	2,002	27	109	22	158	2,160	1,242	1,391	
2053	2.00%	7,865	2,042	27	112	22	161	2,203	1,283	1,435	
2054	2.00%	7,902	2,052	27	115	22	164	2,216	1,292	1,447	Build-out

Assumes commercial development will not occur until year 6 (i.e. when 11200 South is improved) and will grow consistently until build-out.



Water Usage

2012

Month	Days in Month	Total (acre-ft)	Total (gallons)	Total (gallons/day)	Peak Day Demand (gpd/ERC)
January	31	14.6	4,757,431	153,466	222
February	29	12.67	4,128,538	142,363	206
March	31	13.49	4,395,736	141,798	205
April	30	29.01	9,452,950	315,098	456
May	31	71.97	23,451,527	756,501	1,096
June	30	113.33	36,928,742	1,230,958	1,783
July	31	155.16	50,559,108	1,630,939	2,363
August	31	113.96	37,134,029	1,197,872	1,735
September	30	210.61	68,627,569	2,287,586	3,314
October	31	80.57	26,253,850	846,898	1,227
November	30	14.6	4,757,431	158,581	230
December	31	12.64	4,118,762	132,863	192
Total	**366**	**842.61**	**274,565,672**	**N/A**	**Highest Monthly Peak Day Demand (gpd/ERC)**
Unmetered (est)		**15**	**4,887,771**	**N/A**	**3,314**
Total Reported		**857.61**	**279,453,444**	**N/A**	

2013

Month	Days in Month	Total (acre-ft)	Total (gallons)	Total (gallons/day)	Peak Day Demand (gpd/ERC)
January	31	9.78	3,186,827	102,801	143
February	28	17.96	5,852,292	209,010	291
March	31	38.91	12,678,879	408,996	569
April	30	38.18	12,441,008	414,700	577
May	31	114.28	37,238,301	1,201,236	1,671
June	30	119.59	38,968,572	1,298,952	1,807
July	31	147.97	48,216,236	1,555,362	2,163
August	31	127.38	41,506,955	1,338,934	1,862
September	30	115.44	37,616,289	1,253,876	1,744
October	31	89.18	29,059,430	937,401	1,304
November	30	39.66	12,923,268	430,776	599
December	31	46.11	15,025,009	484,678	674
Total	**365**	**904.44**	**294,713,066**	**N/A**	**Highest Monthly Peak Day Demand (gpd/ERC)**
Unmetered (est)		**15**	**4,887,771**	**N/A**	**2,163**
Total Reported		**919.44**	**299,600,837**	**N/A**	

Note: Metered water data provided by Water Priority & Information Consulting, LC which they obtained from Elk Ridge City.

2012 ERCs => 690

Winter (November to March) Usage (Avg Daily.)	**145,776**	**gpd**
Summer (June to August) Usage (Avg. Daily)	**1,354,586**	**gpd**
Avg. Yearly Demand	**763,534**	**gpd**

Average Winter Usage	**212**	**gpd/ERC**
Average Summer Usage	**1,963**	**gpd/ERC**
Average Yearly Demand	**1,107**	**gpd/ERC**

2013 ERCs => 719

Winter (November to March) Usage (Avg Daily.)	**328,916**	**gpd**
Summer (June to August) Usage (Avg. Daily)	**1,398,824**	**gpd**
Avg. Yearly Demand	**820,824**	**gpd**

Average Winter Usage	**458**	**gpd/ERC**
Average Summer Usage	**1,946**	**gpd/ERC**
Average Yearly Demand	**1,142**	**gpd/ERC**

Average between 2012 and 2013

Average Winter Usage	**335**	**gpd/ERC**
Average Summer Usage	**1,955**	**gpd/ERC**
Average Yearly Demand	**1,125**	**gpd/ERC**

Potable Water - Level of Service

2012			2013		
2012 Water Residential Connections (Estimate based on water usage)=	669		2013 Water Residential Connections=	698	
Connections serving multiple units=	4		Connections serving multiple units=	4	
Single Family Residential ERCs=	665		Single Family Residential ERCs=	694	
Multi-Unit ERCs (Assited Living Facility)=	16		Multi-Unit ERCs (Assited Living Facility)=	16	
Residential ERCs=	681		Residential ERCs	710	
Chruch ERCs=	9		Church ERCs=	9	
Total ERCs=	**690**		**Total ERCs=**	**719**	
ERC to Population Conversion (using existing Master Plan)=	3.85		ERC to Population Conversion (using existing Master Plan)=	3.85	persons
Population=	**2,637**		**Population=**	**2,734**	
Total Yearly Water Use=	279,453,444	gpy	Total Yearly Water Use=	299,600,838	gpy
Avg. Day Residential Water Use=	763,534	gpd	Avg. Day Residential Water Use=	820,824	gpd
Water Use per ERC=	**1,107**	**gpd/ERC**	**Water Use per ERC=**	**1,142**	**gpd/ERC**
Average Water Use per ERC=	**1,125**	**gpd/ERC**			

Yearly Growth Rate	
2012 to 2013	3.69%

Average Daily Demand (Using Water Usage)

Average Day Demand per ERC=	**1,125**	**gpd/ERC**	(using water usage)

Peak Day Demand (Using Water Usage)

Peak Day Demand per ERC=	**2,363**	**gpd/ERC**	(using water usage)	Peak Day Demand Factor 2.10

Using Peak Instantaneous Demand Tables from R309-510-9

Res. Indoor Use (Peak Instantaneous Demand)=	$10.8 \times N^{0.64}$	gpm	(from R309-510-9.2.a)	Peak Instantaneous Factor 3.95
Number of Residential Connections (N)=	694			
Res. Indoor Use (Peak Instantaneous	711	gpm		
Res. Indoor Use (Peak Instantaneous Demand)=	1,023,897	gpd		
Res. Indoor Use (Peak Instantaneous Demand)=	1,475	gpd/ERC		
Res. Outdoor Use (Peak Instantaneous Demand)=	7.92	gpm/ irrigated acre	(Map Zone 4, Table 510-7)	
Average Irrigated lot size (from 2008 CFP)=				
	11,326	sf	or	0.26 acres
Res. Outdoor Use (Peak Instantaneous Demand per ERC)=	2.06	gpm/ERC		
Res. Outdoor Use (Peak Instantaneous Demand per ERC)=	2,965	gpd/ERC		
Residential Use (Peak Instantaneous Demand per ERC)=	**4,441**	**gpd/ERC**	(using UAC R309-510)	

Potable Water - Level of Service			
Average Day Demand	1,125 gpd/ERC	or	0.78 gpm/ERC
Peak Day Factor	2.10		
Peak Day Demand	2,363 gpd/ERC	or	1.64 gpm/ERC
Peak Instantaneous Factor	3.95		
Peak Instantaneous Demand	4,441 gpd/ERC	or	3.08 gpm/ERC

Non-Residential Outdoor Demand		
Elk Ridge Avg. Day Demand =	1,125	gpd/ERC
Elk Ridge Avg. Indoor Demand=	335	gpd/ERC
Avg. Day (Summer) Outdoor Demand=	Avg. Day Demand - Avg. Indoor Demand	
Avg. Day (Summer) Outdoor Demand=	790	gpd/ERC
Irrigation Duty in Utah County=	4.00	acre-feet/acre
Irrigation Duty in Utah County=	3,571	gpd/irrigated acre
Unit Equivalency in ERC=	Irrigation Duty / Avg. Day Outdoor Demand	
Unit Equivalency in ERC~	4.52	ERC/irrigated acre
Unit Equivalency in Fixture Units=	20 Fixture Units/ ERC x Unit Equivalency in ERC	
Unit Equivalency in Fixture Units=	90	Fixture Units/irrigated acre

Estimated Sewage Flow based on Water Usage

Using UAC R317-3.2.2.1		
Annual Average Daily Rate of Flow	100	gallons per capita day
1 ERC =	3.85	persons
Annual Average Daily Rate of Flow	**385**	**GPD per ERC**

Using an Average Daily Water Usage Data from 2012 and 2013 for the Months of November through March to determine Indoor Use		
Total Usage for Winter Months - 2012	22,157,897	gallons
Total Usage for Winter Months - 2013	49,666,275	gallons
Total Winter Number of Days - 2012	152	days
Total Winter Number of Days - 2013	151	days
Average Daily Demand - 2012	145,776	GPD
Average Daily Demand - 2013	328,916	GPD
Total ERCs - 2012	690	ERCs
Total ERCs - 2013	719	ERCs
Average Daily Demand - 2012	211	GPD per ERC
Average Daily Demand - 2013	457	GPD per ERC
Average Daily Demand - 2012 & 2013	**335**	**GPD per ERC**

Church - Estimate of ERCs per Unit

Using Peak Day Demand Tables from R309-510-7

Church Indoor Use (Peak Day Demand per Person)=	5	gpd/person	(Table 510-2)		
Church Indoor Use (Peak Day Demand per Unit)=	2,250	gpd/unit (Assume approximately 50% of population goes to church)			
Church Outdoor Use (Average Yearly Demand)=	3.96	gpm/irrigated acre	(Map Zone 4, Table 510-3)		
Average Irrigated lot size=	43,560	sf	or	1.00	(Irrigated Acreage equal to 4 ERCs. Average Irrigated Acreage was determined from existing church properties in the City obtained from Google Earth.)
Church Outdoor Use (Peak Day Demand Demand per Unit)=	3.96	gpm/unit			
Church Outdoor Use (Peak Day Demand per Unit)=	5,702	gpd/unit			
Church Use (Peak Day Demand per Unit)=	**5,707**	**gpd/unit**	(using UAC R309-510)		
ERC per Church Unit=	**3**	**ERCs/unit**			
Church per Population	**912**	**Persons per Church**			
Use	**1**	**Church per**	**900**	**Persons**	

School - Estimate of ERCs per Unit

Using Peak Day Demand Tables from R309-510-7

School Indoor Use (Peak Day Demand per Person)=	25	gpd/person	(Table 510-2 , school with cafeteria and gym)		
School Indoor Use (Peak Day Demand per Unit)=	10,253	gpd/unit (Assume approximately 15% of population is in elementary school based on US Census data from American FactFinder Results)			
School Outdoor Use (Average Yearly Demand)=	3.96	gpm/irrigated acre	(Map Zone 4, Table 510-3)		
Average Irrigated lot size=	108,900	sf	or	2.50	acres (Assumes approximately 1 soccer field, 1 baseball field, and playground area)
School Outdoor Use (Peak Day Demand Demand per Unit)=	9.90	gpm/unit			
School Outdoor Use (Peak Day Demand per Unit)=	14,256	gpd/unit			
School Use (Peak Day Demand per Unit)=	**24,509**	**gpd/unit**	(using UAC R309-510)		
ERC per School Unit=	**11**	**ERCs/unit**			
Use	**1**	**Elementary School per**	**4,000**	**Persons**	

Note: It anticipated that Elk Ridge will not construct a high school or junor high school.

Existing 2014 (Year 0) - Potable Water Source and Storage Demand

2014 Source Demand		
Total ERCs (2014)	769	ERCs
Peak Day Demand	2,363	gpd/ERC
Peak Day Demand	1.64	gpm/ERC
Total Source Demand	**1,261**	**gpm**
Existing Source Pumping Rate	**1,900**	**gpm**
Existing Source ERCs	**1,159**	**ERCs**
Surplus Source Capacity	**639**	**gpm**
Surplus Source ERCs	**390**	**ERCs**

2014 Storage Demand			
Total ERCs (2014)	769	ERCs	
Avg. Day Demand	1,125	gpd/ERC	
Avg. Day Demand	864,788	gpd	
Fire Storage Requirement	2,000	gpm	for 2 hours
Fire Storage Requirement	240,000	gallons	
Total Storage Demand	**1,104,788**	**gallons**	
Existing Storage Capacity	**2,000,000**	**gallons**	
Existing Storage ERCs	**1,564**	**ERCs**	
Surplus Storage Capacity	**895,212**	**gallons**	
Surplus Storage ERCs	**796**	**ERCs**	

Year 2020 (Year 6) - Potable Water Source and Storage Demand

6 Year Planning Period Source Demand		
Total ERCs (2020)	1,059	ERCs
Peak Day Demand	2,363	gpd/ERC
Peak Day Demand	1.64	gpm/ERC
Total Source Demand	**1,737**	**gpm**
Existing Source Pumping Rate	**1,900**	**gpm**
Existing Source ERCs	**1,159**	**ERCs**
Surplus Source Capacity	**163**	**gpm**
Surplus Source ERCs	**100**	**ERCs**

6 Year Planning Period Storage Demand			
Total ERCs (2020)	1,059	ERCs	
Avg. Day Demand	1,125	gpd/ERC	
Avg. Day Demand	1,191,201	gpd	
Fire Storage Requirement	2,000	gpm	for 2 hours
Fire Storage Requirement	240,000	gallons	
Total Storage Demand	**1,431,201**	**gallons**	
Existing Storage Capacity	**2,000,000**	**gallons**	
Existing Storage ERCs	**1,564**	**ERCs**	
Surplus Storage Capacity	**568,799**	**gallons**	
Surplus Storage ERCs	**506**	**ERCs**	

Year 2034 (Year 20) - Potable Water Source and Storage Demand

20 Year Planning Period Source Demand		
Total ERCs (2034)	1,486	ERCs
Peak Day Demand	2,363	gpd/ERC
Peak Day Demand	1.64	gpm/ERC
Total Source Demand	**2,437**	**gpm**
Existing Source Pumping Rate	**1,900**	**gpm**
Existing Source ERCs	**1,159**	**ERCs**
Surplus Source Capacity	**-537**	**gpm**
Surplus Source ERCs	**-327**	**ERCs**

20 Year Planning Period Storage Demand			
Total ERCs (2034)	1,486	ERCs	
Avg. Day Demand	1,125	gpd/ERC	
Avg. Day Demand	1,671,566	gpd	
Fire Storage Requirement	2,000	gpm	for 2 hours
Fire Storage Requirement	240,000	gallons	
Total Storage Demand	**1,911,566**	**gallons**	
Existing Storage Capacity	**2,000,000**	**gallons**	
Existing Storage ERCs	**1,564**	**ERCs**	
Surplus Storage Capacity	**88,434**	**gallons**	
Surplus Storage ERCs	**79**	**ERCs**	

Year 2054 (Build-Out) - Potable Water Source and Storage Demand

Build Out Source Demand		
Total ERCs (Build-Out)	2,218	ERCs
Peak Day Demand	2,363	gpd/ERC
Peak Day Demand	1.64	gpm/ERC
Total Source Demand	**3,638**	**gpm**
Existing Source Pumping Rate	**1,900**	**gpm**
Existing Source ERCs	**1,159**	**ERCs**
Surplus Source Capacity	**-1,738**	**gpm**
Surplus Source ERCs	**-1,059**	**ERCs**

20 Year Planning Period Storage Demand			
Total ERCs (Build-Out)	2,218	ERCs	
Avg. Day Demand	1,125	gpd/ERC	
Avg. Day Demand	2,495,250	gpd	
Fire Storage Requirement	2,000	gpm	for 2 hours
Fire Storage Requirement	240,000	gallons	
Total Storage Demand	**2,735,250**	**gallons**	
Existing Storage Capacity	**2,000,000**	**gallons**	
Existing Storage ERCs	**1,564**	**ERCs**	
Surplus Storage Capacity	**-735,250**	**gallons**	
Surplus Storage ERCs	**-654**	**ERCs**	

APPENDIX C

ELK RIDGE CITY POTABLE WATER RIGHTS

UNDERLYING WATER RIGHT					CHANGE APPLICATION						
NUMBER	STATUS	SOURCE	AC-FT	CFS	NUMBER	STATUS	SOURCE	AC-FT	CFS	PROOF	
51-1138	PD	Well	136.5	0.675							
51-4885	CERT	5 Wells	119.88	0.75	a31745	APP	W3264, W23368, W26179, Highline Well	493.98		Proof Due 5/31/2014	
51-7755	DEC	Utah Lake	237.6								
51-1356	CERT	5 Wells	10.76								
51-1720	PD	Spring Creek	15		a19186		W3269, W3226, W3264, W3276, W23369, W23368	15		Cert	
51-1912	UGWC	Irrigation Well	80	1	a32526		W3264, W23368, W26179, Highline Well	80	1	Proof Due 10/31/2021	
51-2247	PD	Well	2.29								
51-2717	PD	Well	0.54		a18569	APP	W3264, W3269, W23368	6.71		Cert	
51-5203	PD	Mill Pond Springs	3.88								
51-6174	DEC	Provo River	254.5	1.5							
51-6662	PD	Spring Creek	17		a29300	APP	W3264, W23368, W26179, W3266	17		Cert	
51-6753	CERT	W3264, W23368, W23369, W26179	40								
51-6783	CERT	W3276, W3264, W23369, W26179	25.6								
51-6854	CERT	Wells	14		a19184	APP	W3269, W3264, W3226, W23369, W3276, W23368	14		Cert	
51-6855	CERT	Well	25.6	0.21	a19185	APP	W3269, W3264, W3226, W23369, W3276, W23368	25.6	0.21	Cert	
51-6887	CERT	W3264, W26179	5								
51-6889	CERT	W3678	80	0.37	a19524	APP	W3269, W3264, W3226, W23369, W3276, W23368	90	0.37	cert	10 AF seg'd 51-8442
51-6900	CERT	W3264, W3276, W26179, W23369	25.64								
51-6943	CERT	W26179, W3264, W23369, W23368	13								
51-6950	CERT	W26179, W3264, W23369, W23368	1								
51-6972	CERT	W26179, W3264, W3276, W23369, W23368	15								
51-6973	CERT	W3678	10		a20176	APP	W3269, W3264, W3226, W23369, W3276, W23368	10		cert	
51-6974	UGWC	W5027	4		a20179	APP	W3269, W3264, W3226, W23369, W3276, W23368	4		cert	
51-7112	CERT	W26179, W3264, W23369, W23368	2								

UNDERLYING WATER RIGHT					CHANGE APPLICATION					
NUMBER	STATUS	SOURCE	AC-FT	CFS	NUMBER	STATUS	SOURCE	AC-FT	CFS	PROOF
51-7169	DEC	Utah Lake & Jordan River	31.46							
51-7271	CERT	W26179, W3264, W23368	103.74							
51-7281	CERT	W26179, W3264, W23368	10.4							
51-7655	DEC	Hobble Creek	24							
51-8343	CERT	W427850	19		a34850	APP	W3264, W23368, W26179, Highline Well	19		Proof Due 2/28/2014
51-8442	CERT	W3678	10		a37821	APP		10		1/31/2017
55-12340	DEC	Provo River	129.93		a34123	APP	W3264, W23368, W26179, Highline Well	129.93		Proof Due 1/31/2014
		Total	**1467.32**							

Total of 544.33 acre-feet of municipal well water is certificated. Highest reported water use year is 2007 allowing an additional 8.39 acre-feet to be certificated

APPENDIX D

COST ESTIMATES

ALTERNATIVE 1 – CAPITAL AND O&M COSTS

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - New Loafer Canyon Well - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$30,000	$30,000
2	Well Drilling and Completion	LS	1	$850,000	$850,000
3	Site Work	LS	1	$25,000	$25,000
4	Construct New Pump House	LS	1	$400,000	$400,000
5	3 Phase Underground Power	LF	13,300	$30	$399,000
6	Water Sampling	LS	1	$4,000	$4,000
7	Revegetation	LS	1	$4,000	$4,000
				Construction Subtotal	**$1,712,000**
				Construction Contingency (20%)	$342,400
				Engineering and Construction Management (15%)	$256,800
				PROJECT TOTAL	**$2,311,200**

AQUA ENGINEERING

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - 750,000 Gallon Storage Tank - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$20,000	$20,000
2	Site Clearing and Grubbing	LS	1	$10,000	$10,000
3	Excavate & Stabilize Slopes	LS	1	$50,000	$50,000
4	Construct Distribution Building	LS	1	$250,000	$250,000
5	Construct Concrete Storage Tank	GAL	750,000	$1.25	$937,500
6	Final Site Grading	LS	1	$50,000	$50,000
7	Revegetation	LS	1	$10,000	$10,000
				Construction Subtotal	**$1,327,500**
				Construction Contingency (20%)	$265,500
				Engineering and Construction Management (15%)	$199,125
				Land Purchase	$90,000
				PROJECT TOTAL	**$1,792,125**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - Secondary Distribution System - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Furnish and Install Service Meters	EA	300	$1,000	$300,000
2	Flush and Pressure Test	LS	1	$50,000	$50,000
3	Water Sampling	LS	1	$15,000	$15,000
4	Traffic Control	LS	1	$30,000	$30,000
				Construction Subtotal	**$395,000**
				Construction Contingency (20%)	$79,000
				Engineering and Construction Management (15%)	$59,250
				PROJECT TOTAL	**$533,250**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - New Loafer Canyon Well O&M
REVISED: 30-Mar-15

Item	Description	Avg. Flow	Head	hp Draw	Cost
1	Power Consumption	450	360	61.12	$39,942
2	Annual Pump Maintenance				$5,250
3	Pump Start-up Demand Charge ($5,000 per start)				$60,000
				ANNUAL OPERATION	**$105,192**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - 750,000 Gallon Storage Tank O&M
REVISED: 30-Mar-15

Item	Description	Qty	Units	Unit Price	Cost
1	Rehab/Repairs	1	PER YEAR	$20,000	$2,000
2	Cleaning	0.1	PER YEAR	$20,000	$2,000
				ANNUAL MAINTENANCE	**$4,000**

AQUA ENGINEERING

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 1 - Secondary Distribution O&M
REVISED: 30-Mar-15

Item	Description	Qty	Unit Price	Units	Cost
1	Replace meters (5% Failure/Year)	15	180	EA	$2,700
				ANNUAL MAINTENANCE	**$2,700**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT Aquifer Storage Recovery Pond - SHLCC Pipeline O&M
REVISED: 30-Mar-15

Item	Description	Units	Qty	Unit Price	Annual Cost
1	Water Through SHLCC Pipeline	Acre-feet	350	$90	$31,500
2	ULS Water Repayment	Acre-feet	350	$202	$70,700
3	Scarify Basin Surface	LS	1	$28,000	$28,000
4	Rehabilitate Basin (Every 10 Years)	LS	1	$8,400	$8,400
				ANNUAL MAINTENANCE	**$138,600**

ALTERNATIVE 2 – CAPITAL AND O&M COSTS

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 2 - Surface Storage Reservoir - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$15,000	$15,000
2	Site Clearing and Grubbing	LS	1	$10,000	$10,000
3	Excavate & Stabilize Slopes	CY	9,900	$10	$99,000
4	Furnish and Install Membrane	SF	45,000	$2	$90,000
5	Install Sand Underliner (12" Thick)	CY	1,667	$20	$33,333
6	Install Sand Overliner (12" Thick)	CY	1,667	$20	$33,333
7	Install Riprap Layer (12" Thick)	CY	1,667	$40	$66,667
8	Furnish and Install Chain Link Fence	LF	1,000	$40	$40,000
9	Furnish and Install Diverter Structures	EA	2	$7,500	$15,000
10	Final Site Grading	LS	1	$50,000	$50,000
11	Revegetation	LS	1	$10,000	$10,000
				Construction Subtotal	**$462,333**
				Construction Contingency (20%)	$92,467
				Engineering and Construction Management (15%)	$69,350
				Land Purchase	$135,000
				PROJECT TOTAL	**$759,150**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 2 - Secondary Distribution System - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Furnish and Install Service Meters	EA	300	$1,000	$300,000
2	Saw Cut and Remove Asphalt (Full Depth)	LF	22,500	$3	$56,250
3	Furnish and Install 14-inch Waterline	LF	14,000	$60	$840,000
4	Furnish and Install 12-inch Waterline	LF	1,500	$50	$75,000
5	Furnish and Install 10-inch Waterline	LF	4,000	$45	$180,000
6	Furnish and Install 4-inch Waterline	LF	3,000	$10	$30,000
7	Connect to Existing 8" Lines	EA	4	$4,000	$16,000
8	Pavement Restoration	SF	90,000	$5	$450,000
9	Flush and Pressure Test	LS	1	$50,000	$50,000
10	Traffic Control	LS	1	$30,000	$30,000
				Construction Subtotal	**$2,027,250**
				Construction Contingency (20%)	$405,450
				Engineering and Construction Management (15%)	$304,088
				PROJECT TOTAL	**$2,736,788**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 2 - Surface Storage Reservoir O&M
REVISED: 30-Mar-15

Item	Description	Qty	Units	Unit Price	Cost
1	Pond Maintenance	1	per Year	$10,000	$10,000
2	Repair of Riprap, Overliner and Membrane	1	per Year	$10,000	$10,000
				ANNUAL MAINTENANCE	**$20,000**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 2 - Secondary Distribution O&M
REVISED: 30-Mar-15

Item	Description	Qty	Units	Unit Price	Cost
1	Replace meters*	15	EA	$180	$2,700
				ANNUAL MAINTENANCE	**$2,700**

*Assuming 5% meter failures per year

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT Alternative 2 - ULS Water Purchase Cost
REVISED: 30-Mar-15

Item	Description	Units	Qty	Unit Price	Cost
1	Water Purchase	Acre-feet	867	$202	$175,189
				ANNUAL MAINTENANCE	**$175,189**

ALTERNATIVE 3 – CAPITAL AND O&M COSTS

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Secondary Water Pumping Station - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$15,000	$15,000
2	Site Clearing and Grubbing	LS	1	$7,500	$7,500
3	Excavation	CY	37	$30	$1,110
4	Construct Lift Station*	LS	1	$1,000,000	$1,000,000
5	Furnish and Install Chain Link Fence	LF	100	$40	$4,000
6	Final Site Grading	LS	1	$10,000	$10,000
7	Revegetation	LS	1	$5,000	$5,000
				Construction Subtotal	**$1,042,610**
				Construction Contingency (20%)	$208,522
				Engineering and Construction Management (15%)	$156,392
				PROJECT TOTAL	**$1,407,524**

*Lift Station includes cost for construction of the building, pumps, mechanical, electrical, and HVAC

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Surface Storage Reservoir - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$15,000	$15,000
2	Site Clearing and Grubbing	LS	1	$10,000	$10,000
3	Excavate & Stabilize Slopes	CY	9,900	$10	$99,000
4	Furnish and Install Membrane	SF	45,000	$2	$90,000
5	Install Sand Underliner (12" Thick)	CY	1,667	$20	$33,333
6	Install Sand Overliner (12" Thick)	CY	1,667	$20	$33,333
7	Install Riprap Layer (12" Thick)	CY	1,667	$40	$66,667
8	Furnish and Install Chain Link Fence	LF	1,000	$40	$40,000
9	Furnish and Install Diverter Gates	EA	2	$7,500	$15,000
10	Final Site Grading	LS	1	$50,000	$50,000
11	Revegetation	LS	1	$10,000	$10,000
				Construction Subtotal	**$462,333**
				Construction Contingency (20%)	$92,467
				Engineering and Construction Management (15%)	$69,350
				Land Purchase	$135,000
				PROJECT TOTAL	**$759,150**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Secondary Distribution System - Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Furnish and Install Magmeters	EA	300	$1,000	$300,000
2	Saw Cut and Remove Asphalt (Full Depth)	LF	12,000	$3	$30,000
3	Furnish and Install 12-inch Waterline	LF	2,500	$50	$125,000
4	Furnish and Install 10-inch Waterline	LF	3,000	$45	$135,000
5	Furnish and Install 8-inch Waterline	LF	3,500	$40	$140,000
6	Furnish and Install 4-inch Waterline	LF	3,000	$10	$30,000
7	Connect to Existing 8" Lines	EA	4	$4,000	$16,000
8	Pavement Restoration	SF	48,000	$5	$240,000
9	Flush and Pressure Test	LS	1	$4,000	$4,000
10	Traffic Control	LS	1	$40,000	$40,000
				Construction Subtotal	**$1,060,000**
				Construction Contingency (20%)	$212,000
				Engineering and Construction Management (15%)	$159,000
				PROJECT TOTAL	**$1,431,000**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Secondary Water Pumping O&M
REVISED: 30-Mar-15

Item	Description	Avg. Flow	Head	hp Draw	Cost
1	Power Consumption	510	350	64.46	$42,124
2	Pump Maintenance				$15,750
3	Pump Start-Up Demand Charge				$15,000
				ANNUAL OPERATION	**$72,874**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Surface Storage Reservoir O&M
REVISED: 30-Mar-15

Item	Description	Qty	Units	Unit Price	Cost
1	Pond Maintenance	1	per Year	$10,000	$10,000
2	Repair of Riprap, Overliner and Membra	1	per Year	$10,000	$10,000
				ANNUAL MAINTENANCE	**$20,000**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Secondary Distribution System O&M
REVISED: 30-Mar-15

Item	Description	Qty	Units	Unit Price	Cost
1	Replace meters*	15	EA	$180	$2,700
				ANNUAL MAINTENANCE	**$2,700**

*Assuming 10% meter failures per year

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Alternative 3 - Capacity in SHLCC Annual Fees
REVISED: 30-Mar-15

Item	Description	Units	Qty	Unit Price	Cost
1	Annual Fees	Acre-feet	867	$90	$78,055
2	ULS Payment	Acre-feet	867	$202	$175,134
				ANNUAL MAINTENANCE	**$253,189**

ALTERNATIVE 1 – ASR CAPITAL AND O&M COSTS

CLIENT: Elk Ridge City
PROJECT: Culinary Water Pumping
WORKSHT: Alternative 1 - ASR Pond via ULS Pipeline Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$10,000	$10,000
2	Saw Cut and Remove Asphalt (Full Depth)	LF	8,000	$3	$20,000
3	Furnish and Install 14-inch Waterline	LF	8,000	$60	$480,000
4	Pavement Restoration	SF	32,000	$5	$160,000
5	Excavate & Stabilize Slopes	CY	13,500	$10	$135,000
6	Excavate for Sediement Forebay	CY	3,200	$10	$32,000
7	Construct Concrete Weirs	LS	1	$6,000	$6,000
8	Final Site Grading	LS	1	$20,000	$10,000
9	Revegetation	LS	1	$5,000	$5,000
				Construction Subtotal	**$858,000**
				Construction Contingency (20%)	$171,600
				Engineering and Construction Management (15%)	$128,700
				Land Purchase	$90,000
				PROJECT TOTAL	**$1,248,300**

CLIENT: Elk Ridge City
PROJECT: Culinary Water Pumping
WORKSHT: Alternative 1 - ASR Pond via SHLCC Pipeline Engineer's Opinion of Probable Cost
REVISED: 30-Mar-15

Item	Description	Unit	Qty	Unit Price	Total Cost
1	Mobilization	LS	1	$10,000	$10,000
2	Excavate & Stabilize Slopes	CY	13,500	$10	$135,000
3	Excavate for Sediement Forebay	CY	3,200	$10	$32,000
4	Construct Concrete Weirs	LS	1	$6,000	$6,000
5	Final Site Grading	LS	1	$20,000	$10,000
6	Revegetation	LS	1	$5,000	$5,000
				Construction Subtotal	**$198,000**
				Construction Contingency (20%)	$39,600
				Engineering and Construction Management (15%)	$29,700
				Purchase of 3.12 cfs Capacity in SHLCC Pipeline	$1,068,000
				Environmental Impact Study	$100,000
				Land Purchase	$90,000
				PROJECT TOTAL	**$1,525,300**

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT: Aquifer Storage Recovery Pond - ULS Pipeline O&M
REVISED: 30-Mar-15

Item	Description	Units	Qty	Unit Price	Annual Cost
1	ULS Water Repayment	Acre-feet	350	$202	$70,700
2	Scarify Basin Surface	LS	1	$28,000	$28,000
3	Rehabilitate Basin (Every 10 Years)	LS	1	$8,400	$8,400
				ANNUAL MAINTENANCE	**$107,100**

AQUA ENGINEERING

CLIENT: Elk Ridge City
PROJECT: Secondary Water System PER
WORKSHT Aquifer Storage Recovery Pond - SHLCC Pipeline O&M
REVISED: 30-Mar-15

Item	Description	Units	Qty	Unit Price	Annual Cost
1	Water Through SHLCC Pipeline	Acre-feet	350	$90	$31,500
2	ULS Water Repayment	Acre-feet	350	$202	$70,700
3	Scarify Basin Surface	LS	1	$28,000	$28,000
4	Rehabilitate Basin (Every 10 Years)	LS	1	$8,400	$8,400
				ANNUAL MAINTENANCE	**$138,600**