CITY OF

SARATOGA SPRINGS

CULINARY WATER CAPITAL FACILITY PLAN, IMPACT FEE FACILITY PLAN AND ANALYSIS

(HAL Project No.: 360.01.100)

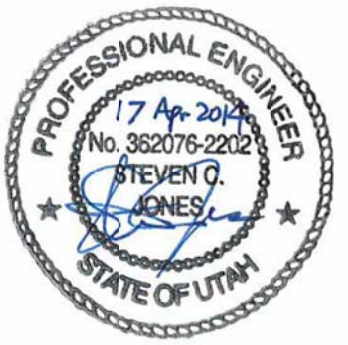
APRIL 2014

HANSEN ALLEN & LUCE INC
ENGINEERS

CITY OF SARATOGA SPRINGS

CULINARY WATER CAPITAL FACILITY PLAN

(HAL Project No.:360.01.100)



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IMPACT FEE CERTIFICATION

IFFP Certification
Hansen, Allen & Luce, Inc. certifies that the Impact Fee Facilities Plan (IFFP) prepared for the culinary water system:

1. includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents;
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. complies in each and every relevant respect with the Impact Fees Act.

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IFA Certification
Hansen, Allen & Luce, Inc. certifies that the Impact Fee Analysis (IFA) prepared for the culinary water system:

1. includes only the costs of public facilities that are:
    a. allowed under the Impact Fees Act; and
    b. actually incurred; or
    c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. does not include:
    a. costs of operation and maintenance of public facilities;
    b. costs for qualifying public facilities that will raise the level of service for the facilities, through impact fees, above the level of service that is supported by existing residents;
    c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement;
    d. offsets costs with grants or other alternate sources of payment; and
3. complies in each and every relevant respect with the Impact Fees Act.

Hansen, Allan & Luce, Inc. makes this certification with the following caveats:

1. All of the recommendations for implementation of the IFFP made in the IFFP documents or in the IFA documents are followed by City Staff and elected officials.
2. If all or a portion of the IFFP or IFA are modified or amended, this certification is no longer valid.
3. All information provided to Hansen, Allen & Luce, Inc. is assumed to be correct, complete, and accurate. This includes information provided by the City as well as outside sources.

HANSEN, ALLEN & LUCE, INC.

CITY OF SARATOGA SPRINGS
CULINARY WATER CAPITAL FACILITY PLAN

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SECTION 1
INTRODUCTION

1.1 Background

The City of Saratoga Springs has experienced tremendous growth since the early 2000's that has transformed the once largely agricultural community into an urbanized region of northern Utah County. Residential and commercial developments are being established at a rapid pace with additional open space available for future growth. As this growth continues additional culinary water facilities will be required to provide an adequate water system that meets the City's current level of service for outdoor watering.

The City has recognized the importance to plan for increased demands on its Culinary Water System from new development as a result of the rapid growth. A Culinary Water Capital Facilities Plan (CFP) and Impact Fee Facilities Plan (IFFP) were requested by the City in order to prepare an Impact Fee Analysis (IFA). Hansen Allen and Luce, Inc. (HAL) was retained by the City to prepare this Culinary Water CFP and IFFP. This report was prepared in conjunction with Zions Bank Public Finance (Zions). Growth projections for Saratoga Springs were made by evaluating the history of building permit issuance over the last decade. The City experienced rapid growth at the beginning of 2000 followed by a cooling period from 2007 to 2010 with growth rebounding rapidly in the last few years. The City has conservatively projected growth for the near future with stronger growth occurring in about 6 years due to the planned development of the LDS Church property.

1.2 Purpose

The purpose of the IFFP component of this report is to comply with the requirements of the Utah Impact Fees Act by identifying demands placed on the existing Culinary Water System by new development and by identifying the means by which the City will meet the new demands. The IFFP portion of this report projects the need for new growth-related facilities for the 10-year planning range contemplated by the Impact Fees Act. The CFP portion of this report is more comprehensive. It provides the basis for the Impact Fee Facilities Plan (IFPP) as well as identifies all Capital Facilities required of the Culinary Water System for the 20-year planning range including maintenance, repair, replacement, as well as growth related additions.

This report identifies those items that the Utah Code specifically requires for an IFFP along with facilities required by existing deficiencies in the system. The IFFP is required to identify the following:

1. Demands placed upon existing facilities by new development activity; and
2. The proposed means by which the municipality will meet those demands;

In preparing this report a systematic approach was utilized to evaluate the existing and planned culinary water facilities identified in the City's master planning efforts. Each facility's capacity

was evaluated in accordance with the selected level of service to determine the appropriate share between existing demand and future demands. This approach was taken in order to determine the "proportional share" of improvement costs between existing users and future development users. The basis for this report was to provide proposed project costs and the fractional cost associated with future development to be used within the impact fee analysis. The following analyses were performed to meet the study's objectives:

1) Identify the existing and proposed City culinary water facilities;
2) Identify the existing level of service for the system;
3) Identify a proposed level of service for the system;
4) Identify if any deficiencies are present in the existing system utilizing the proposed level of service;
5) Identify any excess capacity in the existing system facilities using the proposed level of service;
6) Identify the phasing of new development and the appropriate facilities needed to support the development;
7) Project growth in water demands attributable to new development within the existing system;
8) Determine projects required by the new water demands to provide the proposed level of service to future development without compromising the level of service provided to existing residents;
9) Establish construction phasing of proposed capital facilities;
10) Prepare detailed cost estimates for each proposed project;
11) Determine if proposed projects will provide capacity for growth beyond the IFFP planning period
12) Separate and identify infrastructure costs to maintain the proposed level of service for existing residents versus infrastructure costs to provide an capacity at the proposed level of service for future development, and then identify and subtract the proportionate cost of any excess capacity for growth that is projected to occur beyond the 10 year planning window for the IFFP;

1.3 Impact Fee Collection

Impact fees enable local governments to finance public facility improvements necessary to service new developments without burdening existing development with capital facilities construction costs that are exclusively attributable to growth.

An impact fee is a one-time charge on new development to pay for that portion of a public facility that is required to support that new development.

In order to determine the appropriate impact fee, the cost of the facilities associated with future development must be proportionately distributed. As a guideline in determining the "proportionate share", the fee must be found to be roughly proportionate and reasonably related to the impact caused by the new development.

1.4 Master Planning

The City's current Master Planning provided the framework for the CFP by identifying the existing culinary water facilities and proposed water improvements that would alleviate current and future demands. Assumptions made within this report are in order with current City policies and standard engineering practices.

A new hydraulic model of the Culinary Water System was prepared to aid in the analyses performed to complete the Culinary Water System Capital Facilities Plan. The model was used to assess existing performance, level of service, to establish a proposed level of service and to confirm the effectiveness of the proposed capital facility projects to maintain the proposed level of service as growth occurs.

SECTION 2
EXISTING CULINARY WATER SYSTEM

2.1 General

The purpose of this section is to provide information regarding the existing Culinary Water System, identify the current level of service, and analyze the remaining capacity of the existing system's facilities.

Saratoga Springs' existing Culinary Water System is comprised of a pipe network, water storage facilities, and water supply sources. The facilities are found within three separate pressure zones. Figure 2-1 illustrates the existing water system. As shown, the system services the entire City. This section summarizes the City's existing 'level of service', water demands, system facilities and system capacity available for new growth.

2.2 Pressure Zones

Currently, the drinking water distribution system serving Saratoga Springs has three pressure zones. Presently Zone 2 and 3 are split into the north and south as they are not interconnected yet. These zones were designed to provide pressures between 40-120 psi.

2.3 Existing City Secondary Water System

To preserve drinking water sources, the City has a Secondary Water System that provides outdoor irrigation. The secondary system is master planned to be an independent system, but currently the Secondary Water System can be supplemented by excess capacity in the Culinary Water System. Separate culinary water and secondary water pipelines exist in all developments. However, a few isolated developments currently rely on the Culinary Water System to provide storage and source water to the secondary water pipelines. As the excess capacity in the Culinary Water System is needed for future growth, Secondary Water System facilities will be constructed to increase the capacity of the Secondary Water System. A Secondary Water System CFP was prepared in conjunction with the Culinary Water System CFP. For both the Culinary Water System CFP and the Secondary Water System CFP each system was analyzed with no sharing of capacity for future projections. It was assumed for all calculations that no Secondary Water System facilities are being supplemented by Culinary Water System capacity. Additional information regarding the Secondary Water System may be found in Secondary Water System CFP.

2.4 Existing Equivalent Residential Connections

Water demands from non-residential water users, such as commercial, industrial, or civic water users have been converted to an Equivalent Residential Unit (ERC) for analytical purposes. The use of ERCs is a common engineering practice to describe the entire system's usage

based upon a common unit of measurement. An ERC is equal to the average demand of one residential connection. The method of using ERCs for analysis is a way for allocating existing and future demands over non-residential land uses. An ERC quantifies the ratio of non-residential water demands relative to an equivalent residential level of service demand. For this analysis all residential connections, including townhouses and apartments were equated to one ERC for indoor water demands.

The City assigns non-residential development an ERC value based on a fixture count that is performed at the issuance of the Building Permit. The fixture count is based on the International Plumbing Code (IPC), issued by the International Code Council. The IPC fixture count method was developed to predict water use for various fixture types. Each fixture type is assigned a load value in water supply fixture units (wsfu). For example, a kitchen sink has a load factor of 1.4 wsfu based on how much water is used at a kitchen sink. A typical residential toilet has a load factor of 2.2 wsfu because a toilet uses more water than a kitchen sink. Once all the fixtures are identified, all the fixture units are added together for a total fixture unit count. One ERC is equivalent to 40 wsfu.

At the beginning of 2012, the City's database had a total of 5,059 ERCs. For a validation of the City's ERC calculation, past water meter information was used to calculate an ERC for each non-residential connection based on actual drinking water use. For example, a non-residential connection with an average usage 20 times more than the average day residential usage was assigned an ERC of 20. A total of 5,025 ERCs were calculated from using past water meter data which is within 1% of the ERCs calculated by the City from fixture counts.

Even though ERC's were used to quantify existing demand and to predict future demand for the CFP and IFFP, it is recommended that the City continue to use the IPC fixture count method to calculate predicted demand of new development.

The level of service provided by the Culinary Water System has been established by the City to provide a reasonable supply of indoor water, fire suppression capacity, and water rights to assure that the system does not run out of water. This level of service establishes the sizing criteria for the City's distribution (pipelines), source, storage facilities, and water rights for the Culinary Water System. The level of service standards are provided below:

Indoor Water Supply

- Well Source Capacity: 10 gpd per wsfu plus 10 gpd per wsfu for redundancy
- Pump Station Source Capacity: 10 gpd per wsfu plus 10 gpd per wsfu for redundancy
- Wholesale Indoor Water Source Capacity: 10 gpd per wsfu
- Indoor Water Storage Capacity: 10 gpd per wsfu
- Pipe Capacity: 40 psi minimum during peak day demand conditions and 30 psi minimum during peak instantaneous conditions

Well and pump station sources require more capacity than source supplied by a wholesale connection because it cannot be assumed that pumps run 100% of the time. Also, redundant pumps are required to provide source when primary pumps fail. Wholesale connections rely on the redundancy provided by the wholesaler and do not rely on mechanical facilities maintained by the City.

Fire Suppression

- Minimum Fire Flow: 1,500 gpm for 2 hours (180,000 gallons) as directed by the Fire Marshall from the International Fire Code (IFC), issued by the International Code Council).
- Maximum Fire Flow: 4,000 gpm for 4 hours (960,000 gallons) as directed by the Fire Marshall from the IFC.
- Fire Suppression Storage Capacity: as required by the Fire Marshall (see Table 2-2 for a summary of fire suppression storage by pressure zone)
- Minimum Pressure: 20 psi residual during peak day + fire flow event

Water Rights

- Yearly Volume: 10 gpd per wsfu (0.011 ac-ft per wsfu)

2.5 Methodology Used to Determine Existing System Capacity

The method for determining the remaining capacity in the system for indoor water supply was based on the defined level of service in terms of wsfu. Each component of the Culinary Water System was assessed a capacity in terms of wsfu. The components include: Source (wells and pump stations), Storage (tanks and associated transmission lines), Transmission (main transmission lines not directly associated with source, storage or fire), Fire Suppression (storage and main transmission lines associated with providing fire suppression capacity), and water rights. Each component was also assigned a number of existing wsfu currently using each component. The difference between the wsfu capacity and wsfu existing demand for each component is the remaining capacity. For example, to calculate the remaining capacity for source in wsfu, the required source for existing users in wsfu is subtracted from the capacity of the wells in wsfu. For storage, the required storage for existing users in wsfu is subtracted from the capacity of the tanks in wsfu to calculate the remaining capacity for storage in wsfu.

A hydraulic model was developed for the purpose of assessing system operation and capacity. For pipelines, the model was used to calculate a capacity in terms of wsfu for each pipeline and to assign capacity for indoor water use and fire suppression. The capacity for each pipeline in wsfu is estimated by the flow capacity of the pipe at a velocity of 5 feet per second subtracted by the minimum fire flow requirement of 1,500 gpm and dividing the remainder by 10 gpd per wsfu. The transmission pipelines out of Tanks 4, 5, 6 and 7 down to the first intersection include a fire flow capacity of 2,000 gpm and larger based on the fire flow assumed from these tanks.

Capacity, demand and remaining capacity is presented in the following paragraphs for each component of the Culinary Water System.

2.6 Water Source & Remaining Capacity

Saratoga Springs' current drinking water sources are all groundwater sources. All current wells, located on the eastern border of the City, are actively used throughout the year on a rotating basis. The active wells are equipped with either submersible or vertical turbine pumps. These wells provide the well source capacity level of service of 10 gpd/wsfu for indoor water use and 10 gpd/wsfu for redundancy. Table 2-1 summarizes the information of each well and all sources total. A wsfu count was not allocated to specific wells as all sources are in the same zone. Currently the City has chlorination stations at Wells 2 and 6.

HAL provided recommendations for operation and maintenance of all City wells as part of a well rehabilitation project for the City. The operations and maintenance memorandum is found in Appendix B.

Table 2-1: Existing Well Water Sources

Name	Capacity (gpm)	Capacity (wsfu)	Existing Demand (gpm)	Existing Demand (wsfu)	Remaining Capacity (gpm)	Remaining Capacity (wsfu)
Well No. 1	1,000	72,000	-	-	-	-
Well No. 2	1,020	73,440	-	-	-	-
Well No. 3	1,750	126,000	-	-	-	-
Well No. 4	1,000	72,000	-	-	-	-
Well No. 6	1,100	79,200	-	-	-	-
TOTAL	**5,870**	**422,640**	**2,810**	**202,360**	**3,121**	**220,280**

2.7 Distribution System & Remaining Capacity

Pipe diameters range from 6-inches to 20-inches, with the majority being 8 inches within the individual subdivision developments. The larger pipes in the system were provided as transmission lines to deliver water from storage tanks during peak demands and fire flow scenarios. All pipes are in good condition as they have been constructed within the last 15 years. The City's current standard is to utilize Ductile Iron Pipe (DIP) for pipe diameters of 12-inches and larger. Figure 2-2 illustrates those system/transmission lines with remaining capacity. The total capacity of the distribution system can be assumed to match the capacity of the indoor water storage facilities because the main transmission lines out of the storage tanks match the capacity of the storage. The total capacity of the existing storage is 1,073,000 wsfu

or 26,825 ERCs. Existing demand is about 201,000 wsfu or 5025 ERCs, which leaves a remaining capacity of 872,000 wsfu or 21,800 ERCs.

2.8 Storage Facilities & Remaining Capacity

Saratoga Springs currently operates seven buried concrete water storage tanks serving the City. Each pressure zone has at least one tank to provide storage. Storage requirements are determined on a per zone basis. Some fire flow is shared between zones through PRV's in the system to transfer water from a higher zone to a lower zone during fire events or high peak demands. The total storage capacity is 13.95 million gallons. All tanks were constructed in the last 15 years and are in good condition.

The storage level of service is 10 gallons of storage per wsfu plus fire flow storage. The fire flow storage requirements were provided by the Fire Marshall as per IFC. The amount of fire suppression storage was assigned to each tank based on available capacity for fire storage in the tank, the amount of fire flow in the pressure zone or zones the tank can serve, and the capacity of the transmission lines from the tank to where the largest fire flows are required. The required fire storage capacity and existing capacity for each pressure zone is found in Table 2-2. The capacity of each tank was analyzed in respect to the zone it serves. It was assumed that storage in upper pressure zones could assist in providing a portion of the required fire flow demand to a lower zone. Table 2-3 is a summary of the storage facility information. Capacity calculations shown in Table 2-3 for each tank account for fire suppression storage volumes.

Table 2-2
Existing Fire Suppression Storage by Zone

Zone	Fire Flow (GPM)	Fire Duration (HOURS)	Fire Storage (MG)	Existing Fire Storage in Zone (MG)	Existing Fire Storage From Upper Zones (MG)
1	4,000	4	0.96	0.74	0.22
2 North	3,000	3	0.54	0.30	0.24
2 South	4,000	4	0.96	0.70	0.26
3 North	2,000	2	0.24	0.24	-
3 South	2,000	2	0.24	0.24	-
Total	**-**	**-**	**2.94**	**2.22**	**0.72**

The following are assumptions for fire flow storage at each tank:

- Tank 1 – The assumed fire flow for Zone 1 is 4,000 gpm for 4 hours. When running a 4,000 gpm fire flow in the model during peak day conditions, about 1,000 gpm of the fire flow comes from Tank 1. 1,000 gpm for 4 hours is a total volume of 240,000 gallons.
- Tank 5 – When running a 4,000 gpm fire flow in the model during peak day conditions, about 2,000 gpm of the fire flow comes from Tank 5. The remaining 1,000 gpm would in reality come from sources in Zone 1 but, could also come from Tank 5 or Tank 3 in Zone 2 North. It was assumed that the remaining 1,000 gpm fire flow would be assigned to Zone 2 North.

Table 2-3
Existing Storage Tank Summary

Tank	Zone	Total Capacity (MG)	Fire Storage (MG)	Demand Storage (MG)	Emergency Storage (MG)	Remain. Capacity (MG)	Total Capacity (wsfu)	Remain. Capacity (wsfu)
1	1	0.75	0.20	0.40	0.15	0.00	40,000	0
5	1	3.0	0.80	0.20	0.15	1.85	205,000	185,000
3	2 N	2.0	0.30	0.64	0.15	0.91	155,000	91,000
2	2 S	1.0	0.20	0.22	0.15	0.43	65,000	43,000
6	2 S	3.0	0.50	0.50	0.15	1.85	235,000	185,000
4	3 N	1.2	0.24	0.05	0.15	0.76	81,000	76,000
7	3 S	2.0	0.24	0.00	0.15	1.61	161,000	161,000
Total		**12.95**	**2.58**	**2.01**	**1.05**	**7.41**	**942,000**	**741,000**

- Tank 3 – The assumed fire flow for Zone 2 North is 3,000 gpm for 3 hours. 0.3 MG is assigned to Tank 3 and the remaining 0.24 MG is assumed in Tank 4.
- Tank 2 – The assumed fire flow for Zone 2 South is 4,000 gpm for 4 hours. When running a 4,000 gpm fire flow in the model during peak day conditions, about 850 gpm of the fire flow comes from Tank 2. 850 gpm for 4 hours is a total volume of about 0.2 MG.
- Tank 6 – The assumed fire flow for Zone 2 South is 4,000 gpm for 4 hours. When running a 4,000 gpm fire flow in the model during peak day conditions, about 2,000 gpm of the fire flow comes from Tank 6. It was assumed that the remaining 1,000 gpm fire flow would be assigned to Zone 3 South.
- Tank 4 – It is assumed the fire flow of 2,000 gpm for 2 hours for Zone 3 North is provided by Tank 4.
- Tank 7 – It is assumed the fire flow of 2,000 gpm for 2 hours for Zone 3 North is provided by Tank 7.

2.9 Pump Stations & Remaining Capacity

The City operates pump stations required to boost water from a lower zone to a higher zone. These pump stations provide the water source to the upper zones and therefore must meet the pump station source capacity level of service of 10 gpd/ wsfu for indoor use and 10 gpd/ wsfu for redundancy. Table 2-4 is a summary of the pump station information for culinary water demands in units of ERCs. Table 2-5 is a summary of the pump station information for culinary water demands in GPM. The Fox Hollow pump station has no existing demand because it is a new facility with no existing connections.

Table 2-4
Existing Pump Station Summary by wsfu

Zone	Name	Capacity (wsfu)	Existing Demand (wsfu)	Remaining Capacity (wsfu)
2 South	PS 1 (Grandview)	180,000	71,840	108,160
2 North	PS 2 (Harvest Hills)	72,000	69,000	3,000
3 North	PS 3 (Harvest Moon)	36,000	4,680	31,320
3 South	PS 4 (Fox Hollow)	313,200	0	313,200

Table 2-5
Existing Pump Station Summary by GPM

Zone	Name	Capacity (gpm)	Existing Demand (gpm)	Remaining Capacity (gpm)
2 South	PS 1 (Grandview)	2,500	998	1,502
2 North	PS 2 (Harvest Hills)	1,000	958	42
3 North	PS 3 (Harvest Moon)	500	65	415
3 South	PS 4 (Fox Hollow)	4,350	0	4,350

2.10 Water Rights & Remaining Capacity

The City owns a total of 3,872 acre-feet of water rights attributed to the Culinary Water System. The existing demand at the proposed level of service of 10 gpd per wsfu is 3,482 acre-feet. Both the 3,872 acre-feet of water rights owned and the 3,482 acre-feet existing demand

includes 1,206 acre-feet of water rights that were given to the City in exchange for development credit agreements for future development. Subtracting 3,482 from 3,872 leaves a remaining capacity available for future development of 389 acre-feet, in addition to the existing development credit.

2.11 Capital Facilities to Meet System Deficiencies

The existing culinary water system meets the current level of service. However, the City has several Capital Projects planned to improve the Existing System operationally. These projects are not impact fee related, but project costs are provided in the CFP Section for City budgeting purposes only.

Tank 4
Tank 5
Tank 3
PS
Pump Station 3
PS
Pump Station 2
Well 4
W
Well 6
W
Well 3
Well 2
W
W
W
Well 1
0
0.5
1 Miles
N
North
South
PS
Pump Station 1
Tank 1
Tank 6
Tank 2
Tank 7
PS
Pump Station 4

Legend

Facilities

- W — Well
- PS — Pump Station
- Tank
- PRV

PIPELINES

Diameter (inches)

- 6
- 8
- 10
- 12
- 14
- 16
- 18
- 20
- 24

Pressure Zones

- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Zone 5
- Zone 6

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SARATOGA SPRINGS CULINARY WATER SYSTEM

EXISTING SYSTEM

FIGURE 2-1

SECTION 3
CAPITAL FACILITIES REQUIRED BY NEW DEVELOPMENT

3.1 General

The purpose of this section is to identify the culinary facilities that are required, for the 20-year planning period, to meet the demands placed on the system by future development. Proposed facility capacities were sized to adequately meet the 20-year growth projections and were compared to current master planned facilities. A detailed design analysis will need to be provided before construction of the facilities to ensure that the location and sizing is appropriate for the actual growth that has taken place since this CFP was developed. Specific projects with costs are presented in Section 4.

3.2 Growth Projections

Growth projections for Saratoga Springs were made by evaluating the history of building permit issuance over the last decade as summarized in Table 3-1.

Table 3-1
Residential Building Permit History

Year	Annual Residential Permits	Annual Growth
2000	169	63.1%
2001	483	110.5%
2002	369	40.1%
2003	437	33.9%
2004	383	22.2%
2005	656	31.1%
2006	658	23.8%
2007	489	14.3%
2008	193	4.9%
2009	186	4.5%
2010	232	5.4%
2011	464	10.3%

Saratoga experienced rapid growth at the beginning of 2000 followed by a cooling period from 2007 to 2010 with growth rebounding rapidly in the last few years. The City has conservatively projected growth for the near future with stronger growth occurring in about 6 years due to the

projected development of the LDS Church property. Total growth projections for the City are summarized in Table 3-2.

Table 3-2
Growth Projections

Year	Total Projected ERCs	Total Projected wsfu	Annual Growth
2012	5,059	202,360	-
2013	5,430	217,200	7.3%
2014	5,812	232,480	7.0%
2015	6,194	247,760	6.6%
2016	6,576	263,040	6.2%
2017	7,377	295,080	12.2%
2018	7,986	319,440	8.3%
2019	8,671	346,840	8.6%
2020	9,541	381,640	10.0%
2021	10,207	408,280	7.0%
2022	10,877	435,080	6.6%
2023	11,616	464,640	6.8%
2024	12,401	496,040	6.8%
2025	13,235	529,400	6.7%
2026	14,124	564,960	6.7%
2027	15,066	602,640	6.7%
2028	16,068	612,720	6.7%
2029	17,141	685,640	6.7%
2030	18,270	730,800	6.6%
2031	18,826	753,040	3.0%

3.3 Methodology

The future water demands were added incrementally by year to the facility analysis. At the year a facility reaches capacity, a solution was identified that will accommodate growth for the 20-year planning period. A hydraulic model was developed for the purpose of assessing the system operation and capacity with future demands added to the system. The model was used to identify problem areas in the system and to identify the most efficient way to make improvements to transmission pipelines, sources, pumps, and storage facilities.

Currently the Culinary Water System supplements the Secondary Water System as needed during peak demands in portions of the City. In several cases the future culinary water demands required the secondary water system demand be removed from a culinary water system facility triggering a project required for the secondary water system but not the culinary water system. For both the Culinary Water System CFP and the Secondary Water System CFP each system was analyzed with no sharing of capacity for future projections. It was assumed for all calculations that no Secondary Water System facilities are being supplemented by Culinary Water System capacity.

The future system was evaluated in the same manner as the existing system, by modeling (1) Peak Instantaneous Demands and (2) Peak Day Demands plus fire flow conditions.

3.4 Future Water Source

The future system will continue to utilize groundwater sources for drinking water. With the future availability of drinking water through the Central Water Project (CWP) provided by Central Utah Water Conservancy District (CUWCD), the City should have sufficient drinking water source at their disposal for the Culinary Water System well into the future even if groundwater sources become limited. CUWCD plans to have water available as early as 2014 or once the CWP project is completed. Through the year 2022 it is assumed that the SLR development will use CUWCD water and the rest of the City will use groundwater sources. By 2022, however, the City will need to decide whether or not to contract through CUWCD for future water source. If CUWCD is not used, the City will need to acquire additional water rights and develop new culinary water wells for additional demand from the year 2023 through 2031.

Future growth projections indicate that the City will need to provide additional drinking water source. The CFP analysis utilized a source capacity level of service of 10 gpd/wsfu for indoor water use and 10 gpd/wsfu for redundancy. It was assumed that CUWCD will provide for mechanical redundancy in their own system at 10 gpd/wsfu.

The following are source projects selected to meet the source requirements for future growth:

- CWP North & Redwood Road Turnouts – Provide source to the entire City through the CWP project.

- CWP 2300 West & Pony Express Turnouts – Provide source to the entire City through the CWP project.

3.5 Future Water Storage

The proposed level of service requires that the water system have 10 gallons per wsfu for equalization storage along with appropriate fire suppression storage requirements. The future 20-year growth projection requires a number of tanks to supply storage to future pressure zones. It is anticipated that fire flow pressure reducing valves (PRVs) will be placed between zones to convey fire flows from upper zones to lower zones during fire events. The following tanks are anticipated to meet future demands:

- Zone 4 South Tank – Zone 4b South Tank with a capacity of 1,700,000 gallons.
- Zone 4 North Tank – Zone 4 North Tank with a capacity of 1,200,000 gallons.
- Zone 5 South Tank – Zone 5 South Tank with a capacity of 1,000,000 gallons.

3.6 Future Zone Pumping

Future zone pumping requirements were evaluated to determine pump station needs to meet future peak day demands. All zones requiring pump stations were evaluated using the source capacity level of service of 10 gpd/wsfu for indoor water use and 10 gpd/wsfu for redundancy. The growth model required new pump stations to provide water to meet future demands. Zone pumping must provide source capacity to the pump station from the lower zone and provide the needed source to the zone above. The required pump stations to meet future demands are shown below:

- Zone 2 North Pump Station – Pump Station along U-73 to provide more source capacity to the upper north zones (2000 gpm @ 200 HP).
- Zone 2 South Pumping – Increase the capacity of the Grandview Pump Station.
- Zone 4 South Pump Station – Pump Station for the new zone 4 south zone (750 gpm @ 75 HP).
- Zone 3 North Pump Station – Pump Station for additional capacity for growth in Zone 3 (900 gpm @ 100 HP).
- Zone 4 North Pump Station – Pump Station for the new zone 4 north zone (800 gpm @ 80 HP).
- Zone 5 South Pump Station - Pump Station for the new zone 5 south zone (450 gpm @ 50 HP).

3.7 Future Transmission Piping

Future transmission lines would need to be constructed to allow for future growth in the undeveloped areas of the City. The model was used to determine the most efficient way to keep waterline velocities and pressures within the criteria limits with added future demands. The majority of the waterline projects are required to connect sources to storage tanks and to the existing and future areas of the system. These transmission lines are described below:

- Zone 2 North Transmission Line – 18-inch Line along SR-73 connecting the proposed U-73 Pump Station to the existing zone water lines.

- Zone 1 Transmission Line – 18-inch Redwood Road line increasing the transmission capacity in zone 1 between the source and storage.

- Zone 4 South Transmission Line – 16-inch line interconnecting the proposed tank and pump station to the existing water lines.

- Zone 3 North Transmission Line – 12-inch line connecting the proposed pump station to the existing zone water lines.

- Zone 4 North Transmission Line – 12-inch line interconnecting the proposed tank and pump station to the existing water lines.

- Zone 5 South Transmission Line – 12-inch line interconnecting the proposed tank and pump station to the existing water lines.

3.8 Future Water Rights

Water rights need to be acquired for future growth in the undeveloped areas of the City. The City owns a total of 3,872 acre-feet of water rights attributed to the Culinary Water System. This includes water rights that were given to the City in exchange for development credit agreements. The existing demand at the proposed level of service of 10 gpd per wsfu is 3,482 acre-feet, which includes 1,206 acre-feet of developer credit. Developer credit is water rights given to the City before the development is actually built. Subtracting 3,482 from 3,872 leaves a remaining capacity available for future development of 389 acre-feet in addition to developer credits. With an assumed additional demand of 1,125 acre-feet by 2022, the City will need to acquire 736 acre-feet (1125 -389) by then. By the year 2031 the City will need to acquire an additional 3,876 acre-feet of culinary water rights or about 400 acre-feet per year. Another option is to contract with CUWCD for culinary water.

- 736 acre-feet of culinary water rights by the year 2022.

- 3,867 acre-feet of culinary water rights or contract through CUWCD by the year 2031.

SECTION 4
CAPITAL FACILITY PLAN, PHASING & COST ESTIMATES

4.1 General

The purpose of this section is to provide a detailed list of the proposed Capital Facilities to meet both existing deficiencies and also future growth. Table 4-1 provides a complete list of the CFPs. Also included in the list is the anticipated year of construction based upon current City budgeting and need for the project. The actual phasing of projects will be dependent on actual growth and the location of the growth. The years shown are only a guide for the City and may be revised at any time. Figure 4-1 details the locations of each project.

4.2 Cost Estimating

Cost estimates were prepared for each project and are shown in Table 4-1. Table 4-2 provides a summary of the costs associated with existing deficiencies versus projects required to meet future growth demands.

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

- "Means Heavy Construction Cost Data, 2013"
- Price quotes from equipment suppliers
- Recent construction bids for similar work along the Wasatch Front

Costs include construction, land acquisition, planning and engineering. All costs are presented in 2013 dollars. Recent price and economic trends indicate that future costs are difficult to predict with certainty. Engineering cost estimates given in this study should be regarded as conceptual level as appropriate for use as a planning guide. Only during final design can a definitive and more accurate estimate be provided. A cost estimate calculation for each project is provided in Appendix A.

TABLE 4-1
CAPITAL IMPROVEMENT PROJECTS

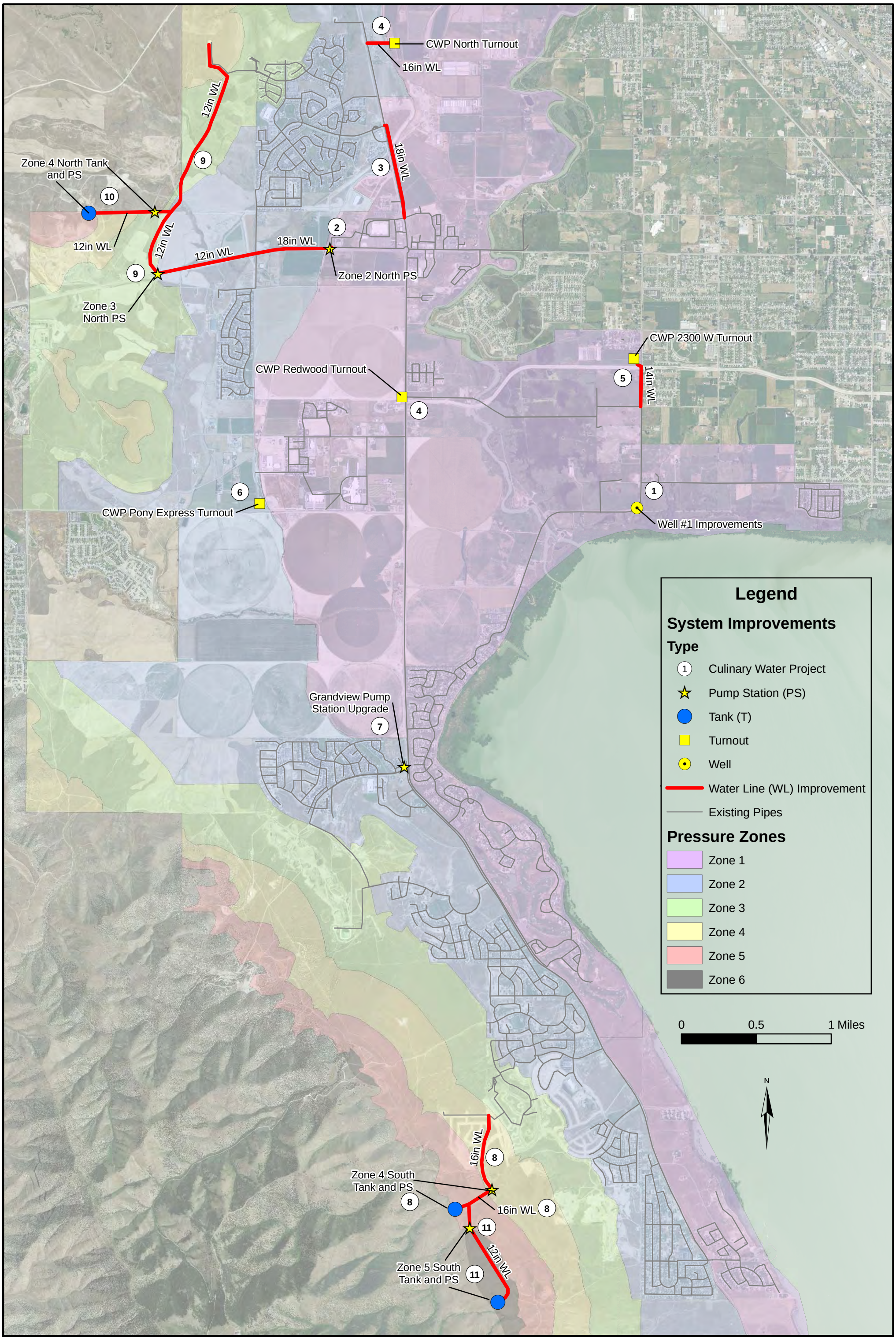
TYPE & PHASING YEAR	MAP ID	RECOMMENDED PROJECT	COST
Well Source Reconstruction - Existing Deficiency **2013**	1	Improvements at Well #1 – Reconstruction of the well house, including the pump, piping, electrical and, mechanical equipment.	$420,000
Source – Growth Project **2014**	2	Zone 2 North Source – Install 2,700 feet of 18-inch transmission line along SR-73 to connect the existing Zone 2 piping to a new pump station. Construct a new pump station along SR-73 to deliver water into Zone 2. The pump station will provide 2,000 gpm and require 200 HP.	$1,211,000

TYPE & PHASING YEAR	MAP ID	RECOMMENDED PROJECT	COST
Transmission – Growth Project **2014**	3	Install 3,200 feet of 18-inch transmission line in Redwood Road from Harvest Hills Blvd to Commerce Drive.	$653,000
Source – Growth Project **2016**	4	Improvements to provide additional source to the Culinary System will be required for the North and Redwood Road CWP turnouts. Piping from the turnouts to the existing system will be installed. The North Turnout will require installation of 700 feet of 16-inch DIP. For this project it was assumed that all associated fees for project water and the capital costs of the CWP facilities were provided by SLR. The cost does not include the CWP meter vault.	$206,000
Water Rights – Growth Project **2022**	-	The City will need to acquire an additional 736 acre-feet of culinary water rights to meet anticipated demand growth by the year 2022. (This does not include water rights needed for the SLR development)	$2,164,000
Source – Growth Project **2023**	5	Improvements to provide additional source to the Culinary System will be required for the 2300 West CWP turnouts. Piping from the turnout to the existing system will be installed. The 2300 West Turnout will require installation of 1800 feet of 14-inch DIP. For this project it was assumed that all associated fees for project water and the capital costs of the CWP facilities were provided by SLR. The cost does not include the CWP meter vault.	$360,000
Source – Growth Project **2023**	6	Improvements to provide additional source to the Culinary System will be required for the Pony Express CWP turnouts. Piping from the turnout to the existing system will be installed. For this project it was assumed that all associated fees for project water and the capital costs of the CWP facilities were provided by SLR. The cost does not include the CWP meter vault.	$72,000
Source – Maintenance & Growth Project **2025**	7	The Zone 2 South Pump Station at Grandview is planned for upgrading to meet future growth. New pumps and electrical components will be required. The pump station boosts from Zone 1 to an existing storage tank in Zone 2. The portion of the cost to upgrade capacity above the current capacity is available for impact fees.	$600,000
Transmission, Storage & Source – Growth Project **2026**	8	Improvements to provide service to a new Zone 4 South area identified in the growth projections. The improvements include a new 1.7 MG Tank, 750 gpm pump station and 9,000 feet of 16-inch transmission line.	$4,428,000
Source – Growth Project **2027**	9	Growth will require the Construction of a new Zone 3 North pump station to supply water to the zone. A 900 gpm pump station along with 12,000 feet of 12-inch transmission line is planned.	$2,358,000

TYPE & PHASING YEAR	MAP ID	RECOMMENDED PROJECT	COST
Transmission, Storage & Source – Growth Project **2028**	10	Improvements to provide service to a new Zone 4 North area identified in the growth projections. The improvements include a new 1.2 MG Tank, 800 gpm pump station and 2,500 feet of 12-inch transmission line.	$2,520,000
Transmission, Storage & Source – Growth Project **2030**	11	Improvements to provide service to a new Zone 5 South area identified in the growth projections. The improvements include a new 1.0 MG Tank, 450 gpm pump station and 4,500 feet of 12-inch transmission line.	$2,568,000
Water Rights – Growth Project **2031**	-	The City will need to acquire an additional 3,562 acre-feet of culinary water rights to meet anticipated demand growth from the year 2023 through 2031. This is about 400 acre-feet per year or $1,163,000 a year. (This assumes the City decides not to use CUWCD water other than for the SLR development)	$10,520,000

TABLE 4-2
CAPITAL IMPROVEMENT PROJECT SUMMARY

TYPE	DESCRIPTION	TOTAL COST
Existing Deficiency Projects	Projects required for the system that are necessary to eliminate existing deficiencies.	$420,000
Growth Projects	Projects to resolve system deficiencies placed on the system by new growth. These projects may be impact fee projects or projects directly funded by the developer.	$28,080,000
	TOTAL	**$28,500,000**



HANSEN ALLEN & LUCE inc ENGINEERS

SARATOGA SPRINGS CULINARY WATER SYSTEM

CAPITAL FACILITY PLAN IMPROVEMENTS

FIGURE 4-1

SECTION 5
IMPACT FEE FACILITY PLAN AND ANALYSIS

5.1 General

This section relies on the data presented in the previous sections to present a proposed impact fee based on the appropriate proportion of cost of projects planned in the next 10 years to increase capacity for new growth and an appropriate buy-in cost of available existing excess capacity previously purchased by the City.

The following data on the Culinary Water System facilities are presented in previous sections: Growth projections, Definition of the proposed level of service, Existing and future anticipated demand, Existing and excess capacity, Capital facilities analysis to determine projects required to resolve existing deficiencies and projects required in the next ten to twenty years to accommodate anticipated growth.

The Culinary Water System facility projects planned in the next 10 years to increase capacity for new growth included within the impact fee are presented. Also included in this section are the possible revenue sources that the City may consider to fund the recommended projects. The three components of the impact fee are then presented with the proposed fee. The Culinary Water System impact fee units include the indoor water capacity unit, fire flow capacity unit and the water right unit.

5.2 Cost of Existing and Future Facilities

The facilities and costs presented in Table 5-1 are existing facilities with remaining buy-in capacity and proposed projects essential to maintain the current level of service while accommodating future growth within the next 10 years. The historical costs for the existing facilities come from City records. Documentation for the costs is found in Appendix A. The facility sizing for the future proposed projects was based on City planning data and hydraulic modeling. All future projects have a design life greater than 10-years, as required by the Impact Fee Act, and all of the projects are 100% growth related. Each project is divided by the different components of the Culinary Water System: Source (wells and pump stations), Storage (tanks and associated transmission lines), Pipe (main transmission lines not directly associated with source or storage), Fire (storage and main transmission lines associated with providing fire suppression capacity), Planning (costs related to preparing master plans, CFPs, IFFPs, IFFAs), and water rights.

TABLE 5-1
COST OF EXISTING AND FUTURE FACILITIES

PROJECT	SOURCE	STORAGE	PIPE	FIRE	PLANNING	WATER RIGHTS	TOTAL
Lake Mountain Mutual Purchase	$11,000,000	$4,710,000	$1,916,000	$2,240,000	$0	$1,134,000	**$21,000,000**
Lake Mountain Development Purchase (2005 Bond)	$914,578	$639,500	$755,047	$765,057	$0	$0	**$3,074,183**
Tank 5 (2006 Bond)	$0	$2,645,796	$0	$2,269,090	$0	$0	**$4,881,886**
Zone 2 South SID (2009 Bond)	$0	$1,579,763	$0	$547,938	$0	$0	**$2,127,701**
Water Right Purchases	$0	$0	$0	$0	$0	$2,088,825	**$2,088,825**
400 North Pipeline (SAR.159)	$0	$0	$186,278	$310,809	$0	$0	**$497,087**
Saratoga Rd Pipeline (SAR.163)	$575,780	$0	$0	$0	$0	$0	**$575,780**
Booster Pump Station (SAR.140)	$99,995	$0	$0	$0	$0	$0	**$99,995**
1200 North Pipeline (SAR.115)	$0	$0	$26,659	$65,022	$0	$0	**$91,681**
2014 IFFP Project – Zone 2 North Source	$937,961	$0	$0	$273,039	$0	$0	**$1,211,000**
2014 IFFP Project – Redwood Road Transmission	$0	$0	$323,701	$329,299	$0	$0	**$653,000**
2016 IFFP Project – CWP Turnout Transmission	$0	$0	$206,000	$0	$0	$0	**$206,000**
2022 IFFP Project – Water Rights	$0	$0	$0	$0	$0	$2,164,000	**$2,164,000**
TOTAL	**$13,528,314**	**$9,575,060**	**$3,423,695**	**$6,757,244**	**$140,000**	**$5,430,825**	**$38,855,138**

Only those costs attributed to the new growth in the next 10 years can be included in the impact fee. Table 5-2 is a summary of the existing and future facility costs by Culinary Water System component and by time period. Existing costs are those costs attributed to capacity currently being used by existing connections. Costs attributed to the next 10 years are costs for the existing capacity or new capacity for the assumed growth in the next 10 years. Costs attributed to beyond 10 years are costs for the existing capacity or new capacity for the assumed growth beyond 10 years.

TABLE 5-2
FACILITY COST BY TIME PERIOD

	EXISTING	NEXT 10 YEARS	BEYOND 10 YEARS	TOTAL
SOURCE	$7,195,095	$7,365,763	$466,494	**$13,528,314**
STORAGE	$2,772,608	$3,188,581	$4,191,521	**$9,575,060**
PIPE	$991,384	$1,140,121	$1,498,736	**$3,423,695**
FIRE	$1,718,853	$1,900,819	$3,432,944	**$6,757,244**
WATER RIGHTS	$3,222,825	$2,208,000	$0	**$5,430,825**
PLANNING	$0	$140,000	$0	**$140,000**
TOTAL COST	**$13,322,290**	**$15,943,285**	**$9,589,694**	**$38,855,138**

5.3 Revenue Options

Revenue options for the recommended projects, in addition to use fees, could include the following options: general obligation bonds, revenue bonds, State/Federal grants and loans, and impact fees. In reality, the City may need to consider a combination of these funding options. The following discussion describes each of these options.

General Obligation Bonds through Property Taxes

This form of debt enables the City to issue general obligation bonds for capital improvements and replacement. General Obligation (G.O.) Bonds would be used for items not typically financed through the Water Revenue Bonds (for example, the purchase of water source to

ensure a sufficient water supply for the City in the future). G.O. bonds are debt instruments backed by the full faith and credit of the City which would be secured by an unconditional pledge of the City to levy assessments, charges or ad valorem taxes necessary to retire the bonds. G.O. bonds are the lowest-cost form of debt financing available to local governments and can be combined with other revenue sources such as specific fees, or special assessment charges to form a dual security through the City's revenue generating authority. These bonds are supported by the City as a whole, so the amount of debt issued for the water system is limited to a fixed percentage of the real market value for taxable property within the City. For growth related projects this type of revenue places an unfair burden on existing residents as they had previously paid for their level of service.

Revenue Bonds

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

State/Federal Grants and Loans

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

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

Impact Fees

As discussed in Section 1, an impact fee is a one-time charge to a new development for the purpose of raising funds for the construction of improvements required by the new growth and to maintain the current level of service. Impact fees in Utah are regulated by the Impact Fee Statute and substantial case law. Impact fees are a form of a development exaction that requires a fee to offset the burdens created by the development on existing municipal services. Funding the future improvements required by growth through impact fees does not place the burden on existing residents to provide funding of these new improvements.

User Fees

Similar to property taxes on existing residents, User Fees to pay for improvements related to new growth related projects places an unfair burden on existing residents as they had previously paid for their level of service.

5.4 Impact Fee Unit Calculation

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

It is recommended that the City have three components to the impact fee for culinary water system facilities-- indoor water use, fire flow capacity, and water rights. Each component is discussed separately in the following paragraphs.

Indoor Water Use Impact Fee Unit

It is recommended that the City continue to use the IPC fixture unit (wsfu) count method to calculate an Indoor Water Impact Fee Unit. It is recommended that one impact fee unit be equal to a fixture count of 40, which is the recommended maximum fixture count for a ¾ inch meter. A fixture count of 40 and a ¾ inch meter size matches the proposed level of service. It is recommended that the City continue the requirement of a ¾ inch meter being the minimum meter size allowed and a fixture count of 40 being the minimum indoor water impact fee unit for a connection. A fixture count greater than 40 would require a larger meter and an impact fee unit larger than 1. For example, a building with a fixture unit count of 87 would have an impact fee unit of 2.2 because 87 divided by 40 is 2.2.

The Indoor Water Impact Fee per unit is based on the historic cost of the available capacity in the indoor water components of the Culinary Water System and the cost of necessary future projects for the predicted development in the next 10 years. Table 5-3 is a summary of the capacity cost included in the impact fee calculation by indoor water component. The existing wsfu does not include 42,160 units attributed to existing units at the time of the Lake Mountain Mutual Water Company purchase. The system capacity for these units was already paid for by others and the City only purchased the remaining capacity. The wsfu for source under the "Next 10 Years" does not include units for all of the development anticipated. The SLR development is acquiring water through the Central Utah Water Conservancy District. It is anticipated that they will provide their own source starting in 2019. Once the SLR development is providing their own source, new development within the SLR development would not pay the source component of the impact fee. A map with the location of the SLR development can be found in Appendix C.

TABLE 5-3
INDOOR WATER CAPACITY COST

Indoor Water Component	EXISTING		NEXT 10 YEARS		BEYOND 10 YEARS		TOTAL	
	wsfu	Cost	wsfu	Cost	wsfu	Cost	wsfu	Cost
SOURCE	160,200	$7,195,095	207,160	$7,365,763	13,120	$466,494	**422,640**	**$13,528,314**
STORAGE	160,200	$2,772,608	232,720	$3,188,581	305,920	$4,191,521	**741,000**	**$9,575,060**
PIPE	160,200	$991,384	232,720	$1,140,121	305,920	$1,498,736	**741,000**	**$3,423,695**
PLANNING	0	$0	232,720	$140,000	0	$0	**232,720**	**$140,000**
TOTAL COST	**$8,675,853**		**$11,834,465**		**$6,156,750**		**$26,667,069**	

Table 5-4 is a summary of the indoor water capacity cost per wsfu using the totals presented in Table 5-3. The Cost per wsfu is $54.76.

TABLE 5-4
INDOOR WATER CAPACITY COST PER WSFU

Indoor Water Component	Cost Attributed to Component	Total wsfu Capacity	Cost per wsfu
Source	$13,528,314	422,640	$35.56
Storage	$9,575,060	741,000	$13.70
Pipe	$3,423,695	741,000	$4.90
Planning	$140,000	232,720	$0.60
TOTAL			**$54.76**

It is recommended that connections to irrigation systems not be allowed on the drinking water system. It is recommended that secondary water systems with secondary water meters be required for all new development even if the secondary water will be supplied initially by a cross-over connection maintained by the City.

Fire Flow Impact Fee Unit

It is recommended that facility capacity attributed to fire flow be based on the fire suppression requirement specified by the International Fire Code (IFC), issued by the International Code Council. The level of service is equal to 0.18 Million Gallons (1,500 gpm for 2 hours) which is the IFC fire suppression requirement for most single family homes and non-residential buildings with fire suppression systems. It is recommended that a building requiring greater than 0.18 Million Gallons (MG) of fire suppression be assigned an equitable cost of providing the additional capacity. Assigning an impact fee cost unit by ERC does not work in the case of fire flow capacity. As every home and building needs the minimum 0.18 MG for fire suppression, there is a greater distribution of the cost for the minimum storage. When a higher fire flow capacity is required, there are fewer buildings, needing that higher volume, to distribute the cost of supplying the greater capacity. A Fire Flow Impact Fee Unit was therefore calculated to represent the equitable distribution of the fire flow capacity cost. The fee is based on an analysis of the existing capacity in the storage facilities versus the existing number of buildings within each fire flow requirement. It was assumed that the excess fire flow storage capacity will be distributed by the same ratio of buildings within each fire flow category. A cost distribution unit for each IFC fire flow requirement is shown in Table 5-5.

TABLE 5-5
FIRE FLOW CAPACITY IMPACT FEE COST DISTRIBUTION UNIT

Fire Flow Requirement (gpm)	Fire Flow Duration Requirement (hours)	Fire Volume Requirement (MG)	Cost Distribution Units	Fee per Connection
1,500	2	0.18	1	$207
1,750	2	0.21	2	$516
2,000	2	0.24	5	$953
2,250	2	0.27	8	$1,603
2,500	2	0.30	13	$2,649
2,750	2	0.33	22	$4,531
3,000	3	0.54	128	$26,497
3,250	3	0.59	162	$33,557
3,500	3	0.63	208	$42,971
3,750	3	0.68	276	$57,091
4,000	4	0.96	1,140	$235,952

Also shown in Table 5-5 is a Fire Flow Impact Fee based on a cost of $6,757,244 attributed to fire flow capacity. The Fire Flow Impact Fee per unit is based on the actual municipal incurred cost of the available capacity in the fire flow components of the Culinary Water System and the cost of necessary future projects for the predicted growth in the next 10 years. A summary of the projects included in the fire flow capacity cost by time period is found in Table 5-2.

Water Right Impact Fee Unit

The proposed level of service for water rights is 10 gpd per wsfu. The total demand by the year 2022 at the proposed level of service is 4,607 acre-feet. This total demand at 2022 does not include all of the development anticipated. The SLR development is acquiring water through the Central Utah Water Conservancy District. It is anticipated that they will provide their own source

starting in 2019. Once the SLR development is providing their own source, new development within the SLR development would not pay the water right component of the impact fee. A map with the location of the SLR development can be found in Appendix C. The existing culinary water right demand for the system is 3,482 acre-feet. This includes 1,206 acre-feet of water rights that were given to the City in exchange for development credit agreements for future development. It is assumed this credit will be used by 2022 for the anticipated growth. Subtracting the existing demand of 3,482 acre-feet from the total demand at 2022 of 4,607 acre-feet leaves an additional demand of **1,125 acre-feet needed by 2022** (see Table 5-6).

TABLE 5-6
WATER RIGHTS NEEDED BY 2022

	Acre-Feet
Predicted Demand in 2022 at the Proposed Level of Service	4,607
Existing Demand at the Proposed Level of Service	3,482
Additional Demand Capacity needed by 2022	**1,125**

The City owns a total of 3,872 acre-feet of water rights attributed to the Culinary Water System. Again, this includes the 1,206 acre-feet of water rights that were given to the City in exchange for development credit agreements. Subtracting the existing demand of 3,482 acre-feet from the 3,872 acre-feet of total water rights owned leaves an excess capacity of **389 acre-feet available for new development in addition to developer credits** (see Table 5-7).

TABLE 5-7
WATER RIGHTS EXCESS CAPACITY

	Acre-Feet
Water Rights Owned	3,872
Existing Demand at the Proposed Level of Service	3,482
Excess Capacity	**389**

Subtracting the excess capacity of owned water rights of 389 acre-feet from the additional demand of 1,125 acre-feet needed by 2022 leaves **736 acre-feet needing to be purchased by 2022** (see Table 5-8). The average price the City has paid for water rights is $3,012 per acre-foot. This would provide a price of **$33.88 per wsfu**.

TABLE 5-8
WATER RIGHTS TO BE PURCHASED

	Acre-Feet
Additional Demand Capacity needed by 2022	1,125
Excess Capacity	389
Total to be purchased by 2022	**736**

It is recommended that the City accept the water right impact fee in one of three ways: Payment of $33.88 per wsfu for water rights the City has available for new development, use of developer credit, or Deed the City a water right approved by the City Attorney in lieu of the water rights portion of the culinary impact fee.

5.5 Summary

Adding the proposed Culinary Water System impact fee units together, the typical single family residential connection requiring 40 wsfu or less and requiring a 1,500 gpm fire flow would have an impact fee of **$3,825** (see Table 5-9). This includes $2,190 for indoor water capacity, $280 for fire flow capacity, and $1,355 for water rights.

TABLE 5-9
TOTAL PROPOSED IMPACT FEE PER WSFU
AND TYPICAL SINGLE FAMILY RESIDENT

	Per wsfu	Per ERC
Indoor Water	$55	$2,190
Fire Flow	$7	$280
Water Rights	$34	$1,355
Total	**$96**	**$3,825**

Appendix A

Cost Estimates

City of Saratoga Springs Capital Facility Plan
Culinary Water Recommended Improvements
Preliminary Engineers Cost Estimates

Year		Item	Unit	Unit Price	Quantity	Total Price
2013	***CW 1.***	***Well #1 Improvements***				
		Well #1 Pump, Well & Pump House Reconstruction	LS	$ 350,000	1	$ 350,000
					Engineering & Admin. (10%)	$ 35,000
					Contingency (10%)	$ 35,000
					Total for Well #1 Improvements	**$ 420,000**
2014	***CW 2.***	***Zone 2 North Source Capacity***				
		PBP-7 Pump Station at U-73 (2000 gpm @ 200 HP)	Lump Sum	$ 550,000	1	$ 550,000
		PPJN 18" DIP Water Line	LF	$ 170	2700	$ 459,000
					Engineering & Admin. (10%)	$ 100,900
					Contingency (10%)	$ 100,900
					Total to Zone 2 North Source Capacity	**$ 1,211,000**
2015	***CW 3.***	***Zone 1 Redwood Road Transmission Line***				
		18" DIP from Harvest Hills Blvd to Commerce Dr.	LF	$ 170	3200	$ 544,000
					Engineering & Admin. (10%)	$ 54,400
					Contingency (10%)	$ 54,400
					Total to Zone 1 Redwood Road Transmission Line	**$ 653,000**
2016	***CW 4.***	***CWP Source***				
		Improvements at Nth Turnout & Redwood Rd	EA	$ 20,000	2	$ 40,000
		16" DIP from Nth Turnout to Redwood Road	LF	$ 160	700	$ 112,000
		Redwood Turnout Connection to Redwood Road	LS	$ 20,000	1	$ 20,000
					Engineering & Admin. (10%)	$ 17,200
					Contingency (10%)	$ 17,200
					Total to CWP Source	**$ 206,000**
2019	***CW 5.***	***CWP Source***				
		Improvements at 2300 West	EA	$ 30,000	1	$ 30,000
		14" DIP from 2300 W Turnout to Ex. 16" Line	LF	$ 150	1800	$ 270,000
					Engineering & Admin. (10%)	$ 30,000
					Contingency (10%)	$ 30,000
					Total to CWP Source	**$ 360,000**
2023	***CW 6.***	***CWP Source***				
		Improvements at Pony Express	EA	$ 30,000	1	$ 30,000
		16" DIP from Turnout to Ex. Line	LS	$ 30,000	1	$ 30,000
					Engineering & Admin. (10%)	$ 6,000
					Contingency (10%)	$ 6,000
					Total to CWP Source	**$ 72,000**
2025	***CW 7.***	***Zone 2 South - Grandview Pump Station Upgrade***				
		Upgrade Pump Station Pumps & Electrical	LS	$ 500,000	1	$ 500,000
					Engineering & Admin. (10%)	$ 50,000
					Contingency (10%)	$ 50,000
					Total to Zone 2 South - Grandview Pump Station Upgrade	**$ 600,000**
2026	***CW 8.***	***Zone 4 South - Pump Station and Tank***				
		16" DIP Transmission Line from PS to Tank	LF	$ 160	9000	$ 1,440,000
		Acquire Property	AC	$ 100,000	3	$ 300,000
		Zone 4 Pump Station (75 HP, 750 gpm)	LS	$ 450,000	1	$ 450,000
		Zone 4 Tank 4b (1.7 MG)	LS	$ 1,500,000	1	$ 1,500,000
					Engineering & Admin. (10%)	$ 369,000
					Contingency (10%)	$ 369,000
					Total to Zone 4 South - Pump Station and Tank	**$ 4,428,000**
2027	***CW 9.***	***Zone 3 North - Pump Station Project***				
		12" DIP Transmission Line	LF	$ 120	12000	$ 1,440,000
		Zone 3 North Pump Station (900 gpm, 100 HP)	LS	$ 475,000	1	$ 475,000
		Acquire Property	AC	$ 100,000	0.5	$ 50,000
					Engineering & Admin. (10%)	$ 196,500
					Contingency (10%)	$ 196,500
					Total to Zone 3 North - Pump Station Project	**$ 2,358,000**

City of Saratoga Springs Capital Facility Plan
Culinary Water Recommended Improvements
Preliminary Engineers Cost Estimates

Year	Item	Unit	Unit Price	Quantity	Total Price
2028	***CW 10. Zone 4 North Project***				
	12" DIP Transmission Line from PS to Tank	LF	$ 120	2500	$ 300,000
	Acquire Property	AC	$ 100,000	2.5	$ 250,000
	Zone 4 Pump Station (80 HP, 800 gpm)	LS	$ 450,000	1	$ 450,000
	Zone 4 Tank (1.2 MG)	LS	$ 1,100,000	1	$ 1,100,000
				Engineering & Admin. (10%)	$ 210,000
				Contingency (10%)	$ 210,000
				Total to Zone 4 North Project	**$ 2,520,000**
2030	***CW 11. Zone 5 South Project***				
	12" DIP Transmission Line from PS to Tank	LF	$ 120	4500	$ 540,000
	Acquire Property	AC	$ 100,000	2	$ 200,000
	Zone 5 Pump Station (50 HP, 450 gpm)	LS	$ 400,000	1	$ 400,000
	Zone 5 Tank (1.0 MG)	LS	$ 1,000,000	1	$ 1,000,000
				Engineering & Admin. (10%)	$ 214,000
				Contingency (10%)	$ 214,000
				Total to Zone 5 South Project	**$ 2,568,000**
				Subtotal for Short-Term Improvements	**$ 15,396,000**

CULINARY WATER SYSTEM COST

1 Lake Mountain Mutual Purchase

Source	Wells 1,2,4,6 (7,8), 2 Boosters, and pipe	$11,000,000		Wells	$1,000,000
Storage	Tank 1,3,4 and pipelines	$4,710,000		Transmission for wells and boosters	$500,000
Fire	Tank 1,3,4 and pipelines	$2,240,000		Booster station	$500,000
Distribution	Miscellaneous Piping	$1,916,000		Storage per gallon	$1
Water Rights	378 acre-feet	$1,134,000		Water rights per ac-ft	$3,000
TOTAL		**$21,000,000**		Total	$21,000,000

2 Lake Mountain Development Purchase (2005 Bond)

Source	Well 3, Booster and pipelines	$914,578		Well 3	$417,014
Storage	Tank 2 and Pipelines	$639,500		Tank 2	$519,828
Fire	Tank 2 and Pipelines	$755,047		Booster 1	$180,966
Distribution	Pipe C	$765,057		Pipeline B & D	$132,294
TOTAL		**$3,074,183**		Pipeline C	$907,975
				2005 Bond Interest	$916,106
				Total	$3,074,183

3 Tank 5 and Waterline - 2006 Bond

Storage	Tank 5 and pipeline	$2,645,796		Tank 5 and Pipeline	$3,500,000
Fire	Tank 5 and pipeline	$2,236,090		2006 Bond Interest	$1,381,886
TOTAL		**$4,881,886**		Total	$4,881,886

4 Zone 2 South SID (2009 Bond)

Storage	Tank 6 and pipeline	$1,579,763		Tank 6	$1,588,650
Fire	Tank 6 and pipeline	$547,938		Pipeline	$539,051
TOTAL		**$2,127,701**		Total	**$2,127,701**

5 Water Right Purchases

Water Right	150 acre-feet from L&V Properties	**$450,000**
Water Right	75 acre-feet from L&V Properties	**$225,000**
Water Right	225 acre-feet from L&V Properties	**$675,000**
Water Right	225 acre-feet from Jeff Neilson	**$350,000**
Water Right	225 acre-feet from Jeff Neilson	**$275,000**
Water Right	225 acre-feet from Jeff Neilson	**$113,825**
TOTAL		**$2,088,825**

6 400 North Pipeline

Distribution	Pipeline	$186,278		400 North 14" Pipeline	$497,087
Fire	Pipeline	$310,809		Total	$497,087
TOTAL		**$497,087**			

7 Saratoga Road Pipeline

Source	Pipeline	$575,780		Saratoga Road Pipeline	$575,780
TOTAL		**$575,780**			

8 Booster Pump Station 1 Upgrade

Source	Booster Upgrade	$99,995		Booster Pump Station 1 Upgrade	$99,995
TOTAL		**$99,995**			

9 1200 North Pipeline

Distribution	Pipeline	$26,659		1200 North 12" Pipeline	$91,681
Fire	Pipeline	$65,022		Total	$91,681
TOTAL		**$91,681**			

10 Fox Hollow Zone 3

Source	Booster	$1,189,127		Tank 7	$1,596,844
Storage	Tank 7 and pipelines	$1,405,223		Fox Hollow Booster	$1,189,127
Fire	Tank 7 and pipelines	$191,621		Total	$2,785,971
TOTAL		**$2,785,971**			

11 Master Planning, CFP, IFFP, IFFA

Planning	2 Updates	$140,000		Master Planning, CFP, IFFP, IFFA	$70,000
TOTAL		**$140,000**			

12 IFFP Project - Zone 2 North Source

Source	Booster Station and Pipeline	$937,961		Booster Station	$660,200
Fireflow	18" U-73 Pipeline	$273,039		18" U-73 Pipeline	$550,800
TOTAL		**$1,211,000**		Total	$1,211,000

13 IFFP Project - Redwood Rd Transmission Line

Disribution	Redwood Rd Transmission Line	$323,701		Redwood Rd Transmission Line	$653,000
Fireflow	Redwood Rd Transmission Line	$329,299		Total	$653,000
TOTAL		**$653,000**			

14 IFFP Project - Transmission Lines to Connect CWP Turnouts

Disribution	Transmission Lines	$206,000		Transmission Lines	$206,000
TOTAL		**$206,000**		Total	$206,000

15 IFFP Project - Water Rights

Water Rights	736 acre-feet	$2,208,000		Water Rights	$2,208,000
TOTAL		**$2,208,000**		Total	$2,208,000

Type	Cost	ERC	wsfu	Cost per ERC	Cost per wsfu
Source	$13,528,314	9512	380480	$1,422.24	$35.56
Storage	$9,575,060	17471	698840	$548.05	$13.70
Distribution	$3,423,695	17471	698840	$195.96	$4.90
Fire Suppression	$6,757,244	24112	NA	$280.24	$7.01
Water Rights	$5,430,825	4007	160289	$1,355.26	$33.88
Planning	$140,000	5818	232720	$24.06	$0.60
Total	$38,855,138			$3,825.82	$95.65

SARATOGA SPRINGS FIRE FLOW UNITS CALCULATION

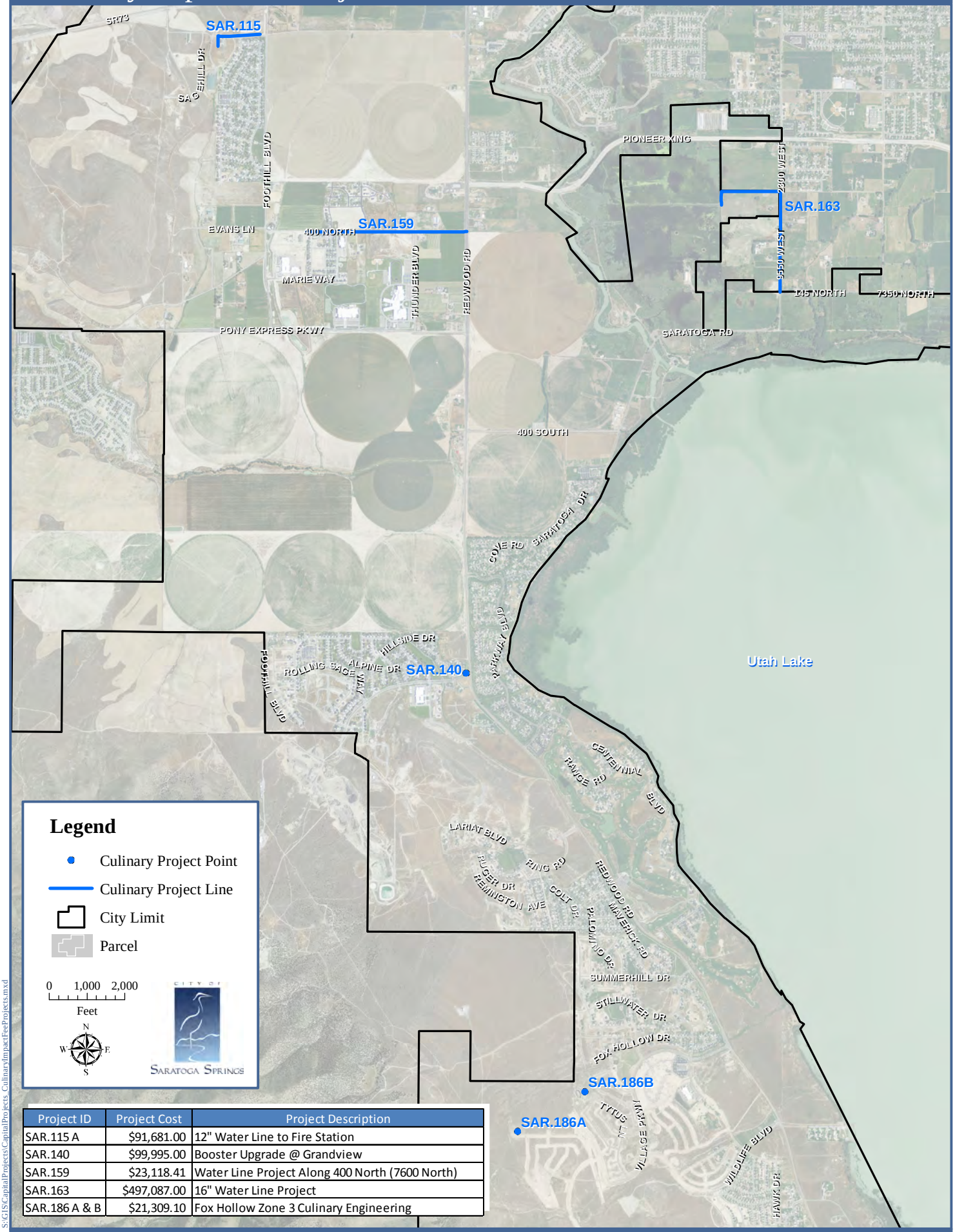
Fire Flow Requirement (gpm)	Fire Flow Duration (hours)	Fire Flow Volume (gallons)	Fire Flow Volume (MG)	Additional Fire Flow Volume per Requirement (MG)	Existing Connections per Fire Flow	Total Existing Connections per Fire Flow	Total Storage Capacity per Fire Flow (ERC)	Total Storage Capacity per Fire Flow (Connections)	Fire Flow Volume per Connection per Fire Flow (gallons)	Total Fire Flow Volume per Connection (gallons)	Fire Flow Impact Fee Units per Connection
1500	2	180000	0.18	0	3246	3307	17471.000	14893	84.6	84.6	1.0
1750	2	210000	0.21	30000	18	61	322.265	322	93.2	177.8	2.1
2000	2	240000	0.24	30000	14	43	227.171	227	132.2	309.9	3.7
2250	2	270000	0.27	30000	11	29	153.208	153	196.1	506.0	6.0
2500	2	300000	0.3	30000	8	18	95.095	95	315.8	821.8	9.7
2750	2	330000	0.33	30000	4	10	52.830	53	566.0	1387.8	16.4
3000	3	540000	0.54	210000	2	6	31.698	32	6562.5	7950.3	94.0
3250	3	585000	0.585	45000	1	4	21.132	21	2142.9	10093.2	119.3
3500	3	630000	0.63	45000	1	3	15.849	16	2812.5	12905.7	152.5
3750	3	675000	0.675	45000	1	2	10.566	11	4090.9	16996.6	200.9
4000	4	960000	0.96	285000	1	1	5.283	5	57000.0	73996.6	874.6
						3368		15215			

Fire Flow Requirement (gpm)	Storage Capacity (Connections)	Total Fire Flow Impact Fee Units	Total Fee Distribution	Fee per Connection	Existing Units	Existing Cost	Next 10 Years Connections	Next 10 Years Units	Beyond 10 Years Units	Beyond 10 Years Cost
1500	14571.0	14571.0	$4,083,355	$280.24	3,246.0	$909,654	4,715	4,715.0	6,610.0	$1,852,377
1750	95.0	199.6	$55,940	$588.84	37.8	$10,599	26	54.6	107.2	$30,031
2000	74.0	271.1	$75,969	$1,026.60	51.3	$14,372	20	73.3	146.5	$41,064
2250	58.0	346.9	$97,213	$1,676.09	65.8	$18,437	16	95.7	185.4	$51,959
2500	42.0	408.0	$114,328	$2,722.10	77.7	$21,777	12	116.6	213.7	$59,886
2750	21.0	344.5	$96,538	$4,597.03	65.6	$18,388	6	98.4	180.4	$50,567
3000	11.0	1033.7	$289,679	$26,334.49	187.9	$52,669	3	281.9	563.8	$158,007
3250	5.0	596.5	$167,162	$33,432.43	119.3	$33,432	1	119.3	357.9	$100,297
3500	5.0	762.7	$213,742	$42,748.49	152.5	$42,748	1	152.5	457.6	$128,245
3750	6.0	1205.4	$337,795	$56,299.11	200.9	$56,299	1	200.9	803.6	$225,196
4000	5.0	4373.1	$1,225,522	$245,104.47	874.6	$245,104	1	874.6	2,623.9	$735,313
	14893.0	24112.5	$6,757,244		5,079.5	$1,423,481	4,802	6,782.9	12,250.1	$3,432,944

WR Number	Amount Purchased (Acre-Ft)	Amount Paid	Cost per AF	Purchase Date	Use	Seller
CULINARY PURCHASES						
53-1686	150	$450,000.00	$3,000.00	4/22/2010	Culinary	L & V Properties
53-1686	75	$225,000.00	$3,000.00	6/2/2010	Culinary	L & V Properties
53-1686	225	$675,000.00	$3,000.00	5/12/2011	Culinary	L & V Properties
54-623	100	$350,000.00	$3,500.00	2007	Culinary	Jeff Neilson
54-623	100	$275,000.00	$2,750.00	2/17/2010	Culinary	Jeff Neilson
54-623	39.25	$113,825.00	$2,900.00	12/20/2011	Culinary	Jeff Neilson
Total	**689.25**	**$2,088,825.00**	**$3,030.58**			

WR Number	Amount Purchased (Acre-Ft)	Amount Paid	Cost per AF	Purchase Date	Use	Seller
SECONDARY PURCHASES						
54-1088	15.488	$54,208.00	$3,500.00	9/13/2007	Secondary	Darrell & Chris Wendel
59-5851	4.59	$8,000.00	$1,742.92	3/6/2008	Secondary	Delvin & Ren Wells
59-5851	18.36	$32,000.00	$1,742.92	3/6/2008	Secondary	Gwenda W. Arnold
59-5851	41.31	$72,000.00	$1,742.92	3/6/2008	Secondary	Mervyn and De Arnold
55-1849	112.59	$337,770.00	$3,000.00	7/29/2009	Secondary	Hal J. Scott Family Trust
55-1849	37.53	$112,590.00	$3,000.00	7/28/2009	Secondary	Summit Exchange Service
54-1227	3.672	$12,852.00	$3,500.00	7/28/2009	Secondary	Idona Christensen
54-1227	3.672	$12,852.00	$3,500.00	7/28/2009	Secondary	Kerkman Fmaily Trust
54-1227	36.72	$128,852.00	$3,500.00	7/5/2012	Secondary	Kerkman Fmaily Trust
54-1227	7.344	$25,204.00	$3,500.00	7/5/2012	Secondary	Steadman Family Trust
54-1227	3.672	$12,852.00	$3,500.00	7/5/2012	Secondary	Bernell Kerkman
54-1227	3.672	$12,852.00	$3,500.00	7/5/2012	Secondary	Craig Kerkman
54-1227	3.672	$12,852.00	$3,500.00	7/5/2012	Secondary	Julia Kerkman
54-1227	3.672	$12,852.00	$3,500.00	7/5/2012	Secondary	Hazelann Griffiths

Culinary Impact Fee Projects



Project ID	Project Cost	Project Description
SAR.115 A	$91,681.00	12" Water Line to Fire Station
SAR.140	$99,995.00	Booster Upgrade @ Grandview
SAR.159	$23,118.41	Water Line Project Along 400 North (7600 North)
SAR.163	$497,087.00	16" Water Line Project
SAR.186 A & B	$21,309.10	Fox Hollow Zone 3 Culinary Engineering

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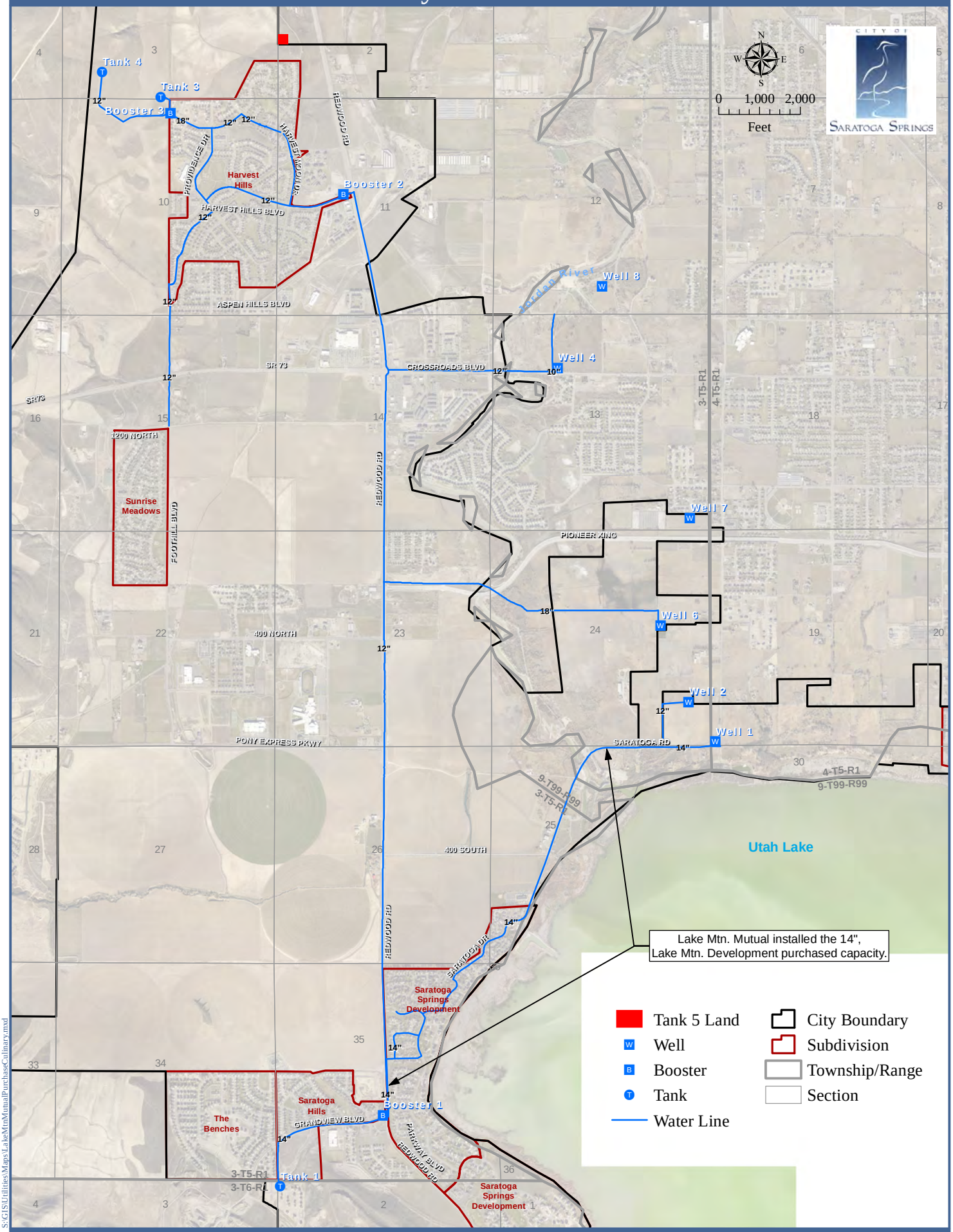
19 February 2014

Lake Mountain Mutual Culinary Asset Phurchase



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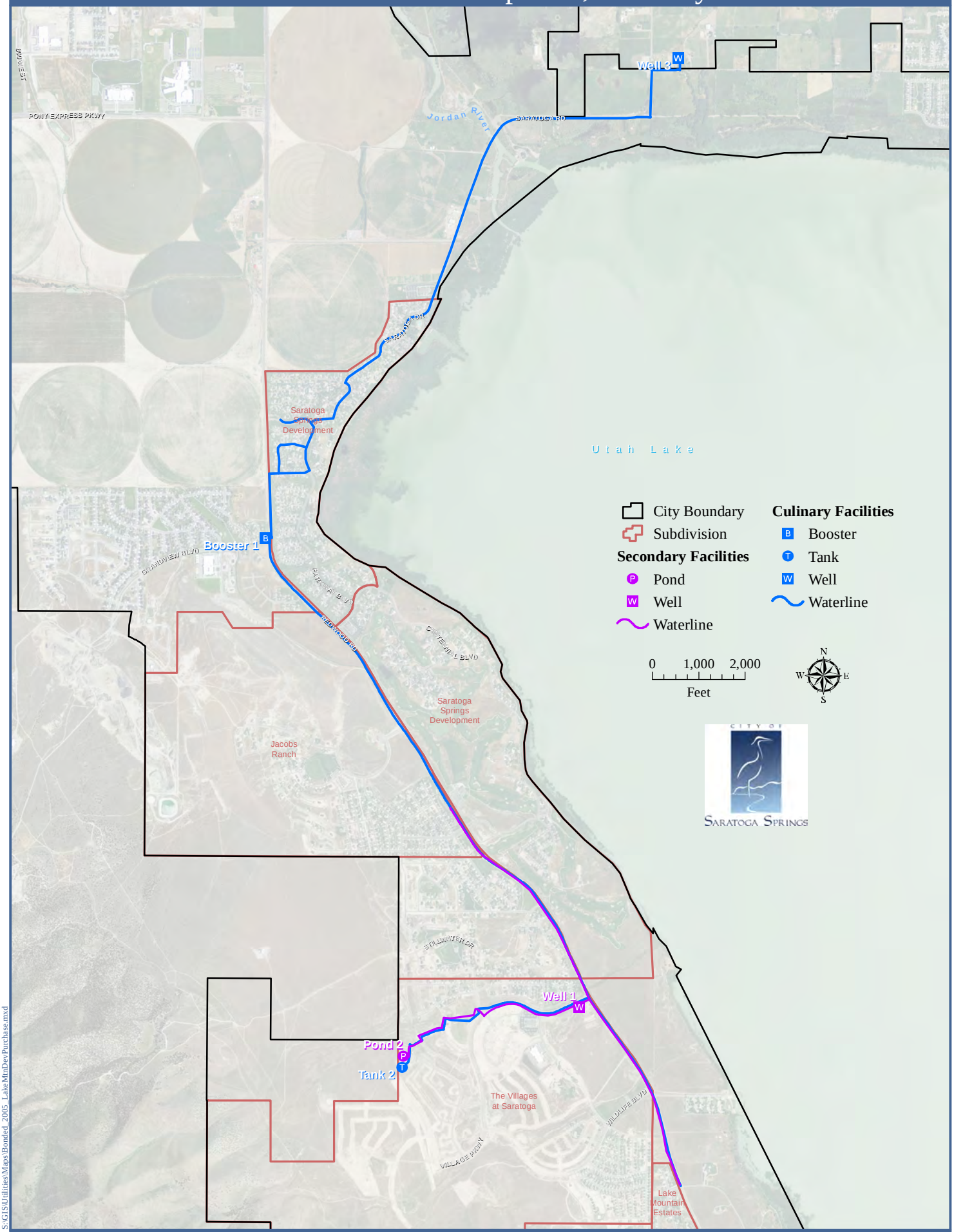
4 February 2014

2005 Bond Series - Lake Mtn. Development, Water System Purchase



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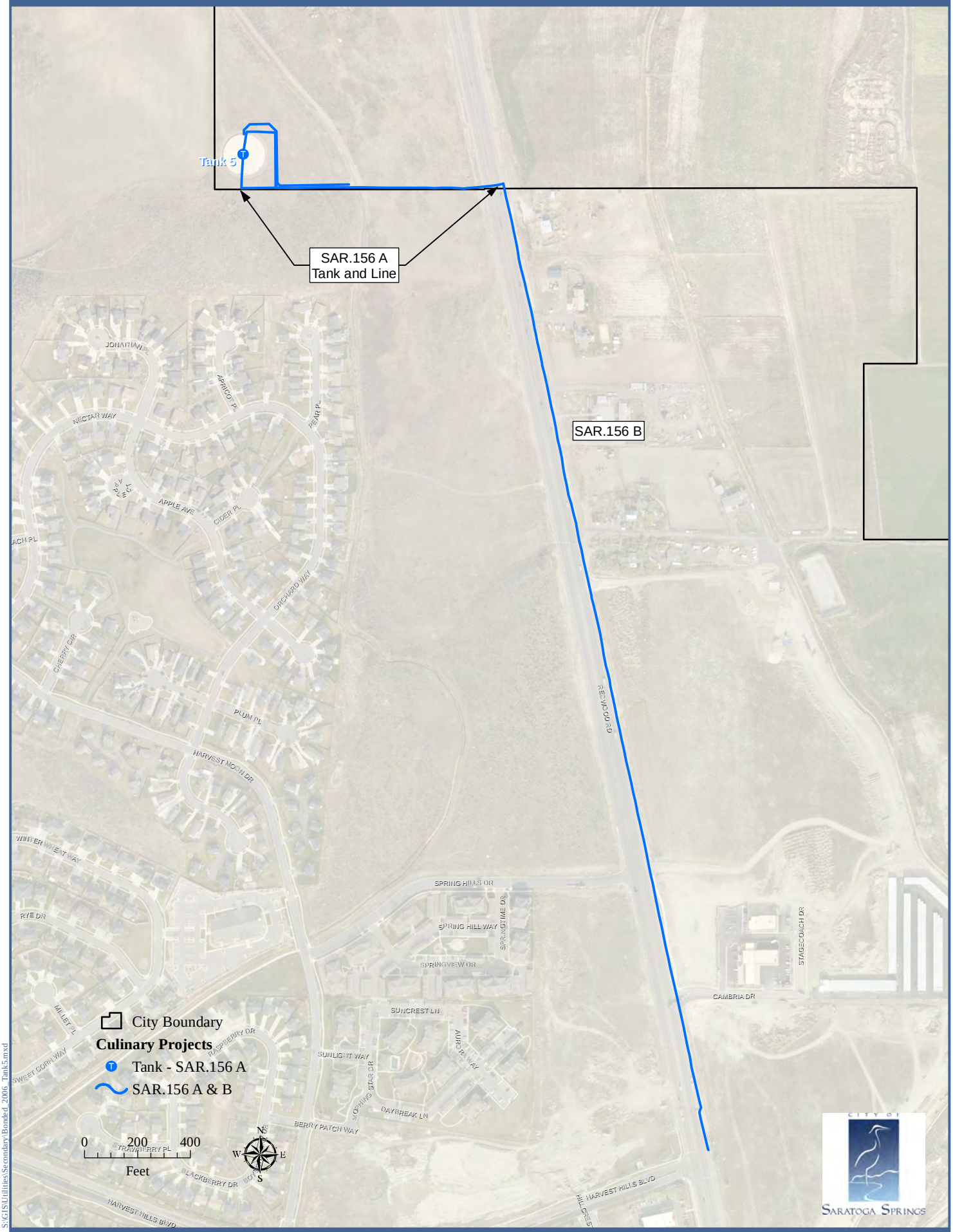
27 August 2012

2006 Bond Series - Zone 1: Tank 5 and Waterline Connections



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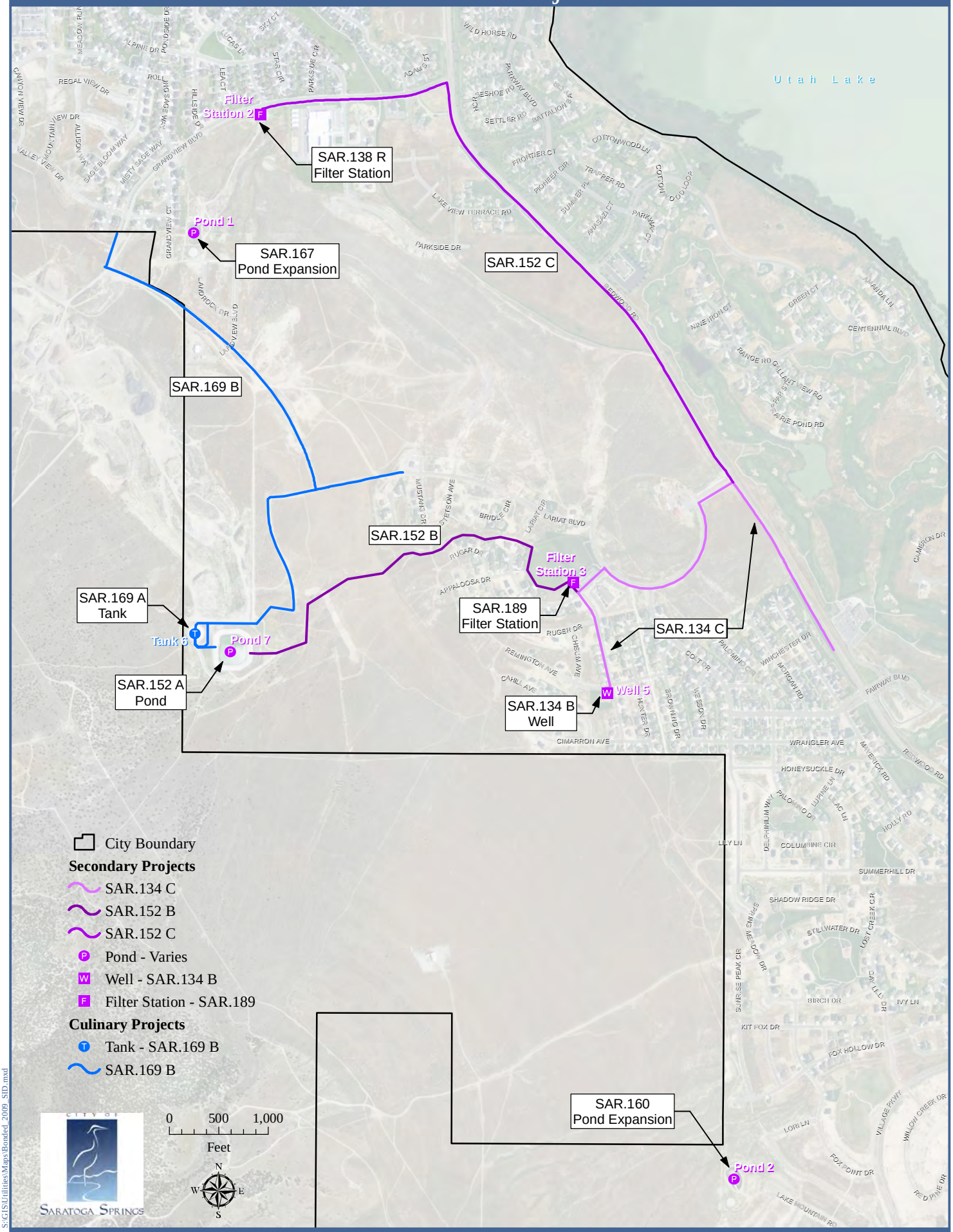
27 August 2012

2009 Bond Series - South Zone 2 SID Projects



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27 August 2012

Appendix B

Well Operation and Maintenance Memorandum

HANSEN ALLEN & LUCE inc
ENGINEERS

Memorandum

DATE: August 20, 2012
TO: Jeremy Lapin, P.E.
Saratoga Springs City
FROM: William Bigelow, P.E.
PROJECT: Wells Evaluation
SUBJECT: Operations and Maintenance Recommendations

The purpose of this memo is to provide recommended O&M activities that Saratoga Springs City may consider as a general guideline for all of the City's wells. The underlying assumption of these recommendations is that preventative maintenance is less costly in the long run than emergency maintenance. The following outline shows the typical problems that the City has been having over the past several years, followed by general O&M recommendations.

FREQUENT PROBLEMS

Well Problems

1. Well casings and screens are developing holes from sanding and corrosion problems.
2. Wells are experiencing well screen collapse due to subsidence.
3. Biofouling is showing up in some wells, and it causes decreased well yields.

Pumping System Problems

1. Pumps are failing early due to heavy sand production.
2. Pumps are wearing out due to heavy usage and short life expectancy (3450 RPM vs 1750 RPM pumps)

RECOMMENDED SCHEDULED MAINTENANCE TASKS

Well Maintenance

1. Collecting well data is the first step to maintaining wells.
2. Calculate the specific capacity of each well at least once each month.
3. Collect water level data for each well routinely even when the well is not in service.
4. At least annually, evaluate the specific capacity data for evidence of trends. If specific capacity has dropped more than 15%, investigate the cause.
5. Every time that the pump is pulled for maintenance, do the following:
    a. Video the well and look for evidence of holes, screens/perforations plugging or biofouling.

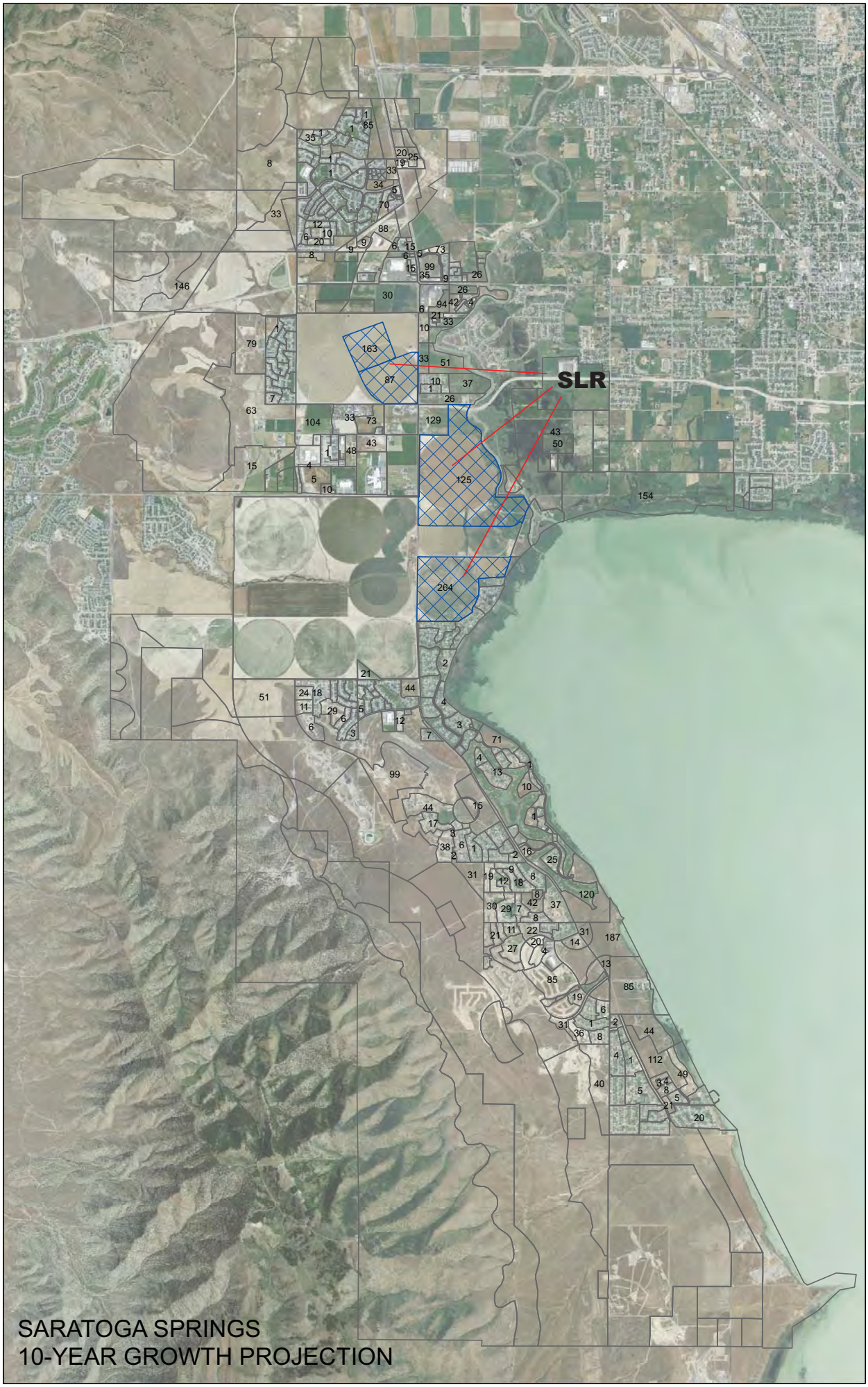
b. If the well casing needs it, perform scrubbing or brushing to remove rust, scale and biofouling or clogging.
c. If specific capacity has dropped more than 15%, evaluate whether well re-development or chemical treatment is needed.
d. If sanding has been an issue, perform aggressive well re-development and gravel pack replenishment to reduce or eliminate sanding. This may take a considerable effort in some wells.
e. If biofouling is an issue, consider performing chemical treatment to restore the original specific capacity.
f. If water quality is excessively poor, consider investigating drilling deeper for better water quality or abandoning the well and planning to drill another well where the water quality is better.

Pump Maintenance

1. Collecting pump performance is the first step to maintaining pumps.
2. Record as a minimum the following parameters every day when the well is in operation: flow rate, system pressure, amps, and water level.
3. Listen and feel for a change in the pumping system's sound or vibration.
4. Pull every well pump for preventive maintenance every 8 – 10 years if the pump has not been pulled prior to this time. Have the pump disassembled and checked for problems and clearances. If recommended, rebuild or replace the pump.
5. When ordering a new pump, perform a life cycle cost analysis to select the lowest cost pump over the long run.
6. Compare current operating data with previous operating data for evidence of trends.
    a. If flow is decreasing and amperage is increasing, this could indicate that the pump bearings may be starting to fail.
    b. If flow is decreasing and amperage is also decreasing, the pump impellers may be worn.
    c. If water level and flow are decreasing, the well screen/perforations may be clogged or biofouled or the aquifer water level may be dropping.

Appendix C

Misc. Documents


SLR
SARATOGA SPRINGS
10-YEAR GROWTH PROJECTION