SKYLINE MOUNTAIN
SPECIAL SERVICE DISTRICT

WATER SYSTEM MASTER PLAN

(HAL Project No.: 299.09.100)

September 2022

HANSEN ALLEN & LUCE inc
ENGINEERS

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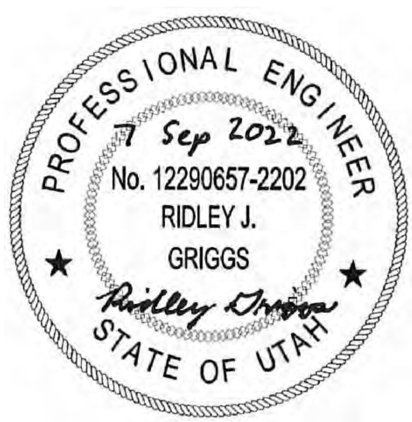

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September 2022

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GLOSSARY OF TECHNICAL TERMS

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

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

Buildout: When the development density reaches maximum allowed by planned development.

Demand: Required water flow rate or volume.

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

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

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

Fire Flow Requirements: The rate of water delivery required to extinguish a particular fire. Usually it is given in rate of flow (gallons per minute) for a specific period of time (hours).

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

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

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

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

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

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

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

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

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

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

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

Water Conservation: Planned management of water to prevent waste.

ABBREVIATIONS AND UNITS

ac	acre [area]
ac-ft	acre-foot (1 ac-ft = 325,851 gal) [volume]
CIP	Capital Improvement Plan
CFP	Capital Facilities Plan
CUWCD	Central Utah Water Conservancy District
CWP	Central Water Project
DIP	Ductile Iron Pipe
DBP	disinfection byproduct
EPA	U.S. Environmental Protection Agency
EPANET	EPA hydraulic network modeling software
ERC	Equivalent Residential Connection
ft	foot [length]
ft/s	feet per second [velocity]
gal	gallon [volume]
gpd	gallons per day [flow rate]
gpm	gallons per minute [flow rate]
HAL	Hansen, Allen & Luce, Inc.
hp	horsepower [power]
hr	hour [time]
IFA	Impact Fee Analysis
IFC	International Fire Code
IFFP	Impact Fee Facilities Plan
in.	inch [length]
kgal	thousand gallons [volume]
kW	kilowatt [power]
kWh	kilowatt hour [energy]
MG	million gallons [volume]
MGD	million gallons per day [flow rate]
mg/L	milligram per liter [concentration]
μg/L	microgram per liter [concentration]
mi	mile [length]
psi	pounds per square inch [pressure]
s	second [time]
SCADA	Supervisory Control and Data Acquisition
THM	trihalomethane
UV	ultraviolet radiation (disinfection method)
wsfu	water supply fixture unit
yr	year[time]

CHAPTER 1 INTRODUCTION

PURPOSE

The purpose of this Master Plan is to provide direction to Skyline Mountain Special Service District (SMSSD) regarding decisions that will be made to construct and maintain a functional and cost-efficient water system now and through buildout (assumed to take place within the next 20 years). The planning period for this master plan is 2022–2042.

The results of the study are limited by the accuracy of growth projections, data provided by SMSSD, and other assumptions used in preparing the study. It is expected that SMSSD will review and update this Master Plan as new trends in water use or land use emerge.

AUTHORIZATION

SMSSD selected Hansen, Allen, & Luce, Inc. (HAL), in 2021 to complete an update to the water system master plan, which was previously produced by HAL in 2007.

CHAPTER 2 SYSTEM DESCRIPTION AND MODEL

SERVICE AREA AND POPULATION

Skyline Mountain Special Service District serves a 480-acre portion of Sanpete County, Utah (Figure 2-1). Its service area includes the resort and cabins up the mountain to the east. In 2021 SMSSD reported a service population of 96 (DWR 2022). There are also five connections outside of Skyline Mountain Resort but within the SMSSD boundary.

SYSTEM DESCRIPTION

Sources

SMSSD owns three wells. The Golf Course Well and Clubhouse Well pump directly into the existing Area 1 water system. The Thad's Peak Well does not currently tie into the existing system, but fills a self-service tank at the top of Area 2. The total production for 2021 was 54.6 ac-ft among the three wells. The existing system, including the locations of the Golf Course and Clubhouse Wells, is shown in Figure 2-2.

SMSSD does not receive water from any other sources or entities or provide water to any other entities.

SMSSD's total source capacity is 138 gpm (peak day) and 222 ac-ft (average yearly).

Pump Stations

SMSSD operates one pump station that boosts water from the Booster Tank to the Upper Tank. It has two pumps, each with a pumping capacity of 120 gpm.

Network

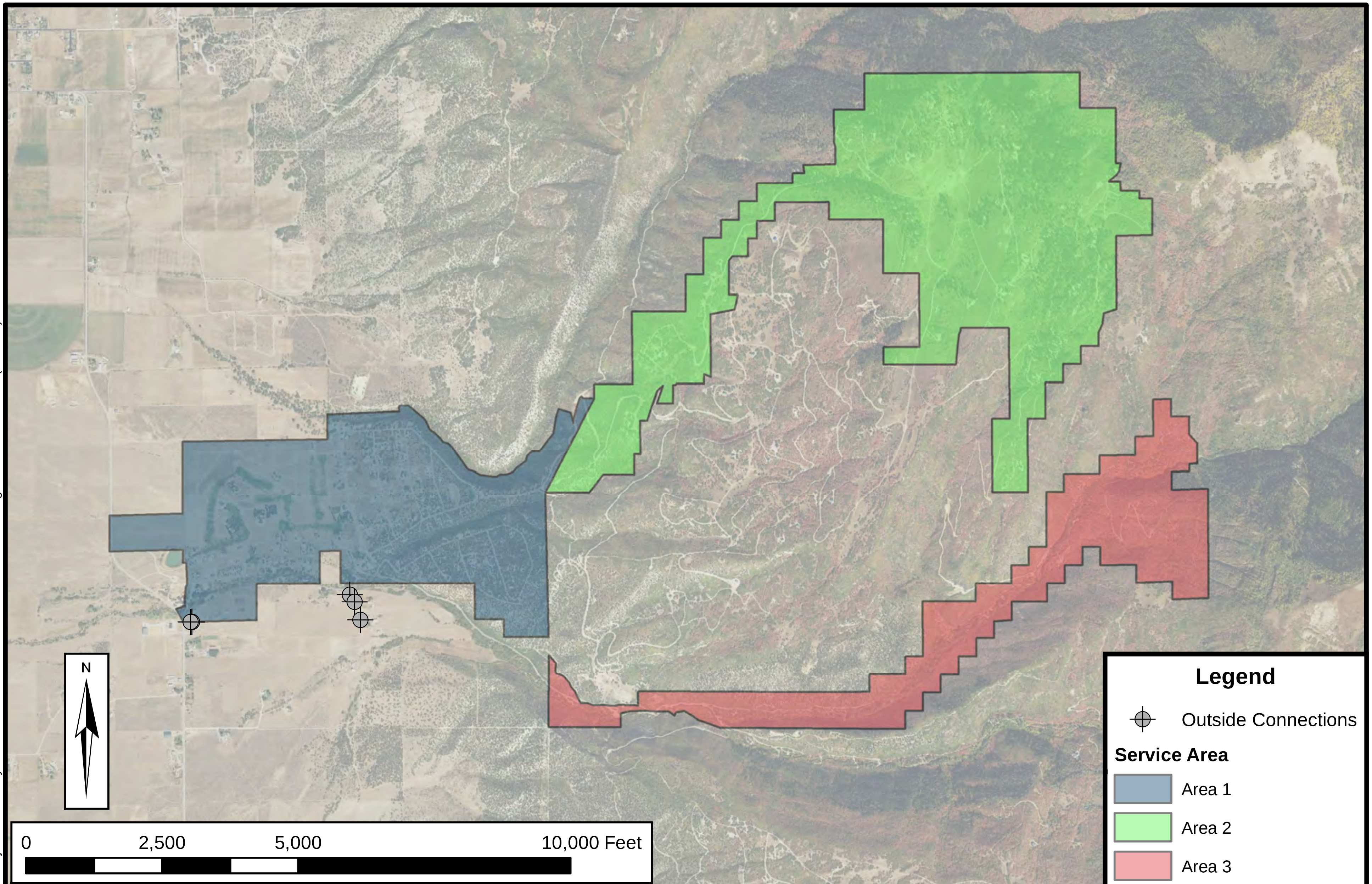
The distribution network contains approximately 8.75 miles of pipe ranging in size from 4 to 12 inches (Figure 2-2).

Storage

SMSSD maintains two storage tanks (270,000 gal and 55,000 gal) in Area 1. Their locations are shown in Figure 2-2.

Fire Flow

Fire flow tests were conducted on April 15, 2015. The hydrant tests showed that the system has a capacity of at least 480 gpm, with most of the hydrants capable of 1,000 gpm and 1,500 gpm. These fire flow tests were simulated with the model and shown in Appendix A. All new construction in the distribution system is planned to accommodate 1,500 gpm, typically requiring 8-inch diameter pipelines.



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SERVICE AREAS

FIGURE 2-1

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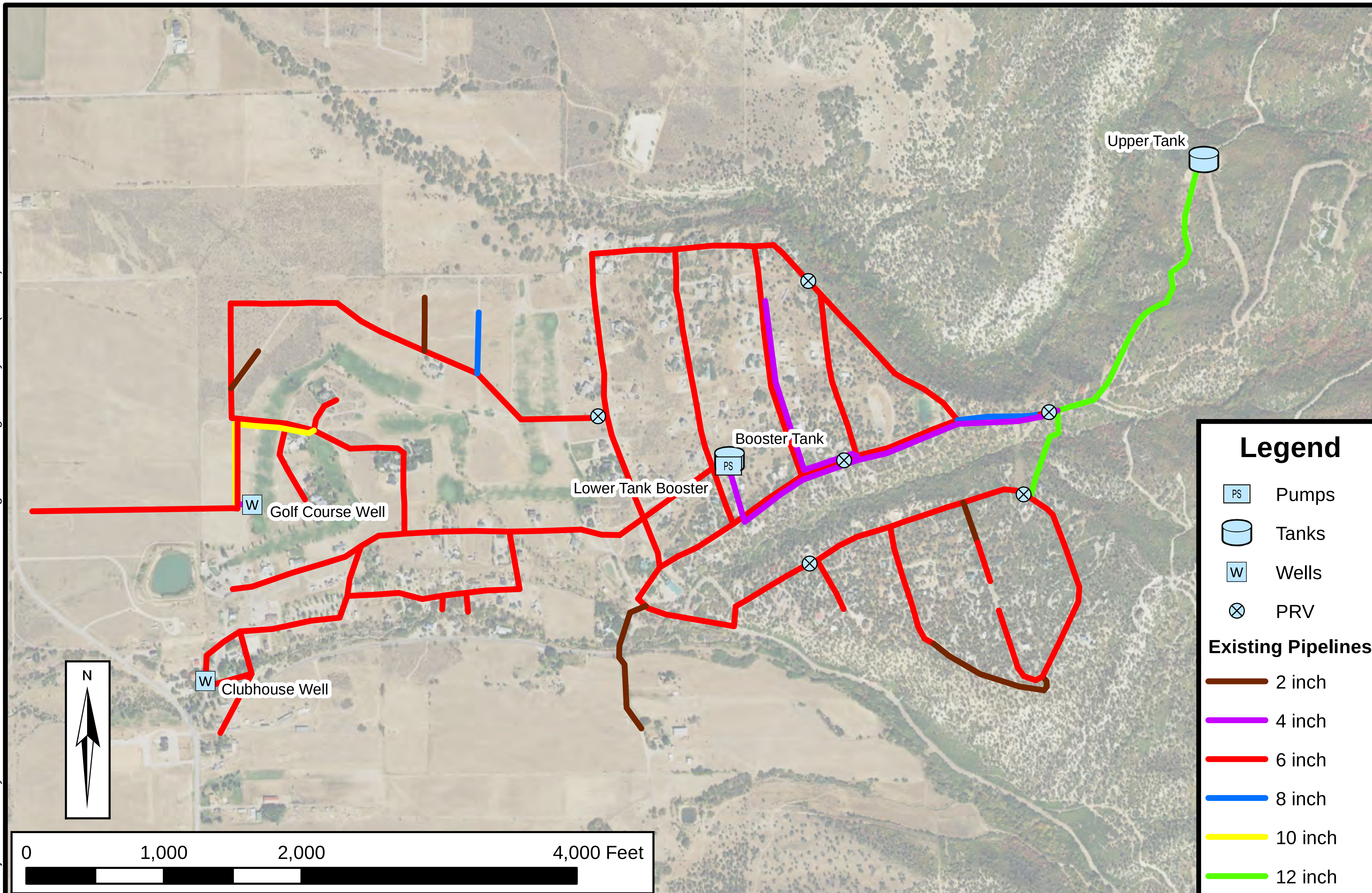

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EXISTING WATER SYSTEM

FIGURE 2-2

MODEL DEVELOPMENT AND CALIBRATION

An extended-period hydraulic model was developed with InfoWater software, which uses EPANET 2.0 as the main computational engine (EPA). The previous model was updated based on system maps SMSSD provided for this study. All pipes with diameters 2 in. or larger were included in the analysis. Hazen-Williams roughness coefficients of between 120 and 150 were used in the model. SCADA data, tank control setpoints, and measured pump flow rates were reviewed and simulated in the model.

HAL developed models for two phases of drinking water system development. The first phase was a model representing the existing system (existing model). This model was used to calibrate the model and identify deficiencies in the existing system. Calibration was performed using billing data and SCADA data for the pumps and tanks. The model was adjusted until a reasonable match to measured data was achieved. Calibration data is included in Appendix B. The second phase was a model representing future conditions and the improvements necessary to accommodate growth (future model).

CHAPTER 3 EXISTING WATER SYSTEM

CONNECTIONS

Analysis of SMSSD's metered water use in 2021 indicated 247 residential connections or equivalent residential connections (ERCs). A summary of ERCs by Area is shown in Table 3-1.

Outdoor water use is minimal in most areas although some residential lots have irrigated lawns.

Table 3-1
Existing ERCs by Area

Area	ERCs
1	247
2	0
3	0
Total	**247**

DEMANDS

The level of service (LOS) is the water volume and pressure standards that the drinking water system is designed to meet. Level of service is regulated by Utah Administrative Rule 309, which is administered by the Utah Division of Drinking Water (DDW). In the past, the DDW set standard sizing requirements which each water utility was required to meet, based on equivalent residential connections or ERCs. In 2018, the DDW revised this approach to set system-specific sizing requirements.

The level of service for this master plan is based on production and meter data collected and reported by SMSSD over several years. It incorporates appropriate safety factors and is intended to produce a design which is responsible without being unnecessarily expensive. It considers both indoor use and areas which are irrigated using the water system.

Existing demands were found based on an evaluation of billing and production data. The monthly usage for these full-time residents was evaluated to determine an acceptable level of service for existing indoor demands. This level of service recommended for indoor use is 270 gpd/ERC which is approximately 0.3 ac-ft per year. See Table 3-2.

Table 3-2
SMSSD Indoor Water Demands

ERCs	Demand (gpd/ERC)	Peak Day Demand (gpm)	Average Yearly Demand (ac-ft/yr)
247	270	46.3	74.7

Outdoor water demands were evaluated based on a review of aerial imagery and billing data for properties with irrigated landscape. Presently, irrigated acreage in SMSSD is confined mostly to the clubhouse area, a few properties near the golf course, and some other properties scattered throughout Area 1. It is estimated that roughly 8 acres of landscape are irrigated by the drinking water system, and that peak day demand for outdoor use is about 7.5 gpm. Average Annual Demand is estimated at 3.0 ac-ft/irr-ac, which is consistent with the water rights irrigation duty value for the area. See Table 3-3.

Table 3-3
SMSSD Outdoor Water Demands

Irrigated Acreage	Peak Day Demand (gpm/irr-ac)	Peak Day Demand (gpm)	Average Yearly Demand (ac-ft/irr-ac)	Average Yearly Demand (ac-ft/yr)
8.0	7.5	60.0	3.0	24.0

Because it is rare for all seasonal residents to be present on the same day, the peak day demands shown in Tables 3-2 and 3-3 are higher than historically observed peaks. However, because it is possible that most residents may be present and using water during holiday weekends or other peak times, peak demands for all existing ERCs were considered in the evaluation of the system.

SOURCES

SMSSD owns and operates three wells. The capacity of these wells is shown in Table 3-4. Both the Golf Course and Clubhouse Well are in Area 1 and supply the existing water system. Thad's Peak Well fills a self-service water tank for users in Area 2. Locations of the Golf Course and Clubhouse Wells are shown in Figure 2-2.

Table 3-4
SMSSD Sources

Source	Peak Day Capacity (gpm)	Average Yearly Capacity (ac-ft)[1]	2021 Peak Month Production (gpm)	2021 Annual Production (ac-ft)
Golf Course Well	65	-	45.9	32.8
Clubhouse Well	55	-	27.7	20.8
Thad's Peak Well[2]	38	-	-	0.98
Total	**158**	**254.86**	**73.6**	**54.6**

1. Average yearly capacity is limited to water rights held by the District
2. Production of the Thad's Peak Well is recorded on an annual basis

The capacity of each well was determined based on information in previous master plans, SCADA flow records, well logs, and other available information. Production data for the Golf Course and Clubhouse Wells was recorded in the SCADA system. Data for the Thad's Peak well is recorded on a totalizing meter and is read on an annual basis.

The Golf Course and Clubhouse Wells have sufficient capacity to meet the proposed level of service for existing users in Area 1.

DISTRIBUTION

SMSSD's water distribution system consists of all pipelines, valves, fittings, and other appurtenances used to convey water from sources and storage tanks to water users. The existing water system contains approximately 8.75 miles of pipe with diameters of 4 inches to 12 inches. A summary of length of pipe by diameter is given in Figure 3-1.

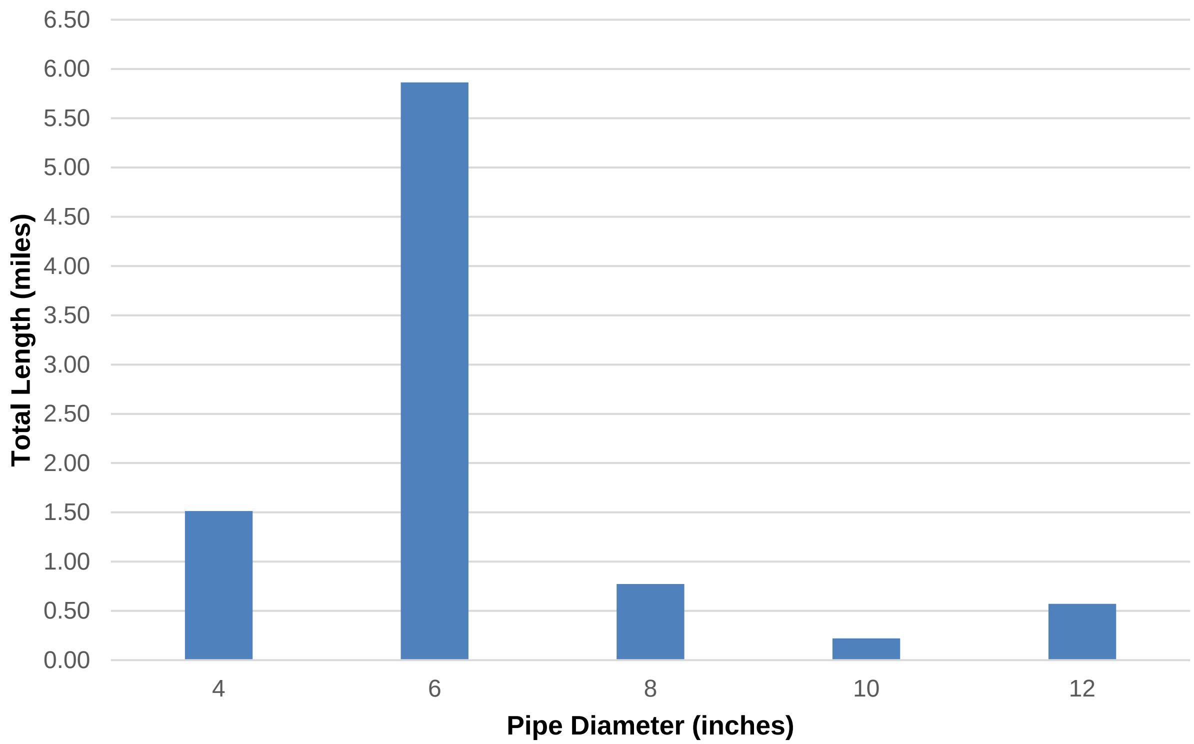


Figure 3-1: Summary of Pipe Length by Diameter

Performance of the drinking water system was evaluated according to the requirements listed in Table 3-5. The Fairview Fire Chief was consulted for recommended fire flow under existing conditions. The Fire Chief expressed an intent to follow requirements as stated in the International Fire Code. Flow requirements of up to 1,750 gpm are expected in Area 1. The contact information of the Fairview Fire Chief is as follows:

Fire Chief:	Nathan Miner
Phone:	435-262-1189
Address:	165 N State St. Fairview, Utah 84629

The system was originally designed to provide a fire flow capacity of 1,000 gpm, which was compliant with fire codes in effect at the time of construction. Locations in the Area 1 system where 1,000 gpm of fire flow capacity can be provided will not be subject to retroactive fire flow requirements and will be considered code compliant as long as they are maintained properly and new construction does not alter the fire flow requirement. As infrastructure is replaced over time, it will be sized appropriately to meet requirements according to current code.

Table 3-5
Compliance of Existing
Distribution System with Utah Rule

Condition	Requirement[1]	System Design Flow[2]	Compliance Status
Peak Day	Minimum 40 psi service pressure	106 gpm	All connections comply.
Peak Instantaneous	Minimum 30 psi service pressure	213 gpm	All connections comply.
Peak Day plus Fire Flow[3]	Minimum 20 psi service pressure	106 gpm (system) Plus 1,000 gpm fire	All areas comply as shown on Figure 3-2.

1. Requirements are as stated in Utah Code R309-105-9(2). The requirement for connections prior to 2007 is a minimum of 20 psi under all conditions.
2. Peak day system flows are shown in Tables 3-2 and 3-3. Peak day flow was multiplied by a factor of 2.0 to produce peak instantaneous flow.
3. Fire flow is discussed in Appendix C. The maximum fire flow requirement in SMSSD is 1,000 gpm under existing conditions.

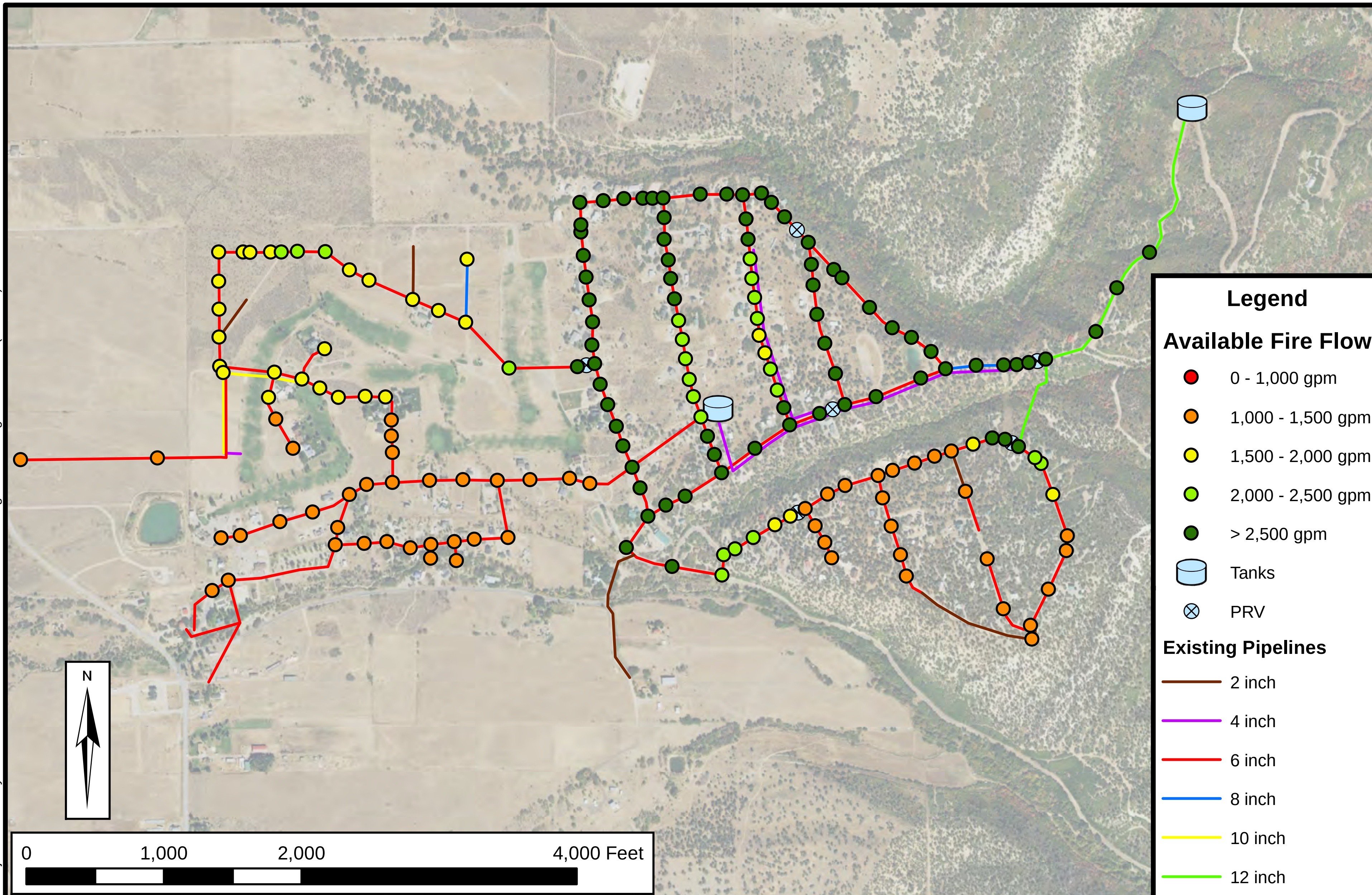
Figure 3-2 shows the available fire flow throughout the existing system based on model output.

STORAGE

The existing water system is served by two storage tanks located in Area 1. Their locations are shown in Figure 2-1 and their respective dimensions shown in Table 3-6. SCADA data for each tank showed that the Booster Tank typically operates at a level between 6 and 8 feet and the Upper Tank typically operates at a level between 17 and 19 feet.

Table 3-6
Existing Tanks

Tank	Existing Capacity (gallons)	Material	Dimensions	Outlet Elevation (ft)	Emergency/Fire Volume (gal)
Booster	55,000	Concrete	25' diam. x 15' deep	6,365	0
Upper	270,000	Concrete	48' diam. x 20' deep	6,834.5	210,000
Total	**325,000**	-	-	-	



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SKYLINE MOUNTAIN SPECIAL SERVICE DISTRICT	EXISTING AVAILABLE FIRE FLOW	FIGURE 3-2

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As specified in Utah R309-510-8, storage sizing requirements are composed of three parameters:

- Equalization Storage
- Emergency Storage
- Fire Storage

It is proposed that a combined equalization and emergency storage requirement of 270 gal/ERC be used for the indoor storage requirement. This amount is equivalent to peak day usage and contains sufficient capacity beyond equalization needs to provide a buffer to the District in the event of a power outage or other service interruption.

The recommended storage requirement for outdoor uses is 2,680 gal/irr-ac. This is approximately equal to average daily use and will provide adequate equalization and emergency storage for outdoor uses.

The Fire Chief for Fairview, Utah was consulted to determine required fire storage. It was determined that required fire storage is equal to the volume required to provide the maximum fire flow of 1,750 gpm for 2 hours (210,000 gallons total). More information can be found in Appendix C. This is consistent with the 2007 master plan. Table 3-7 summarizes the storage requirements and a determination of remaining capacity.

Table 3-7
Existing Storage Requirements

Component	Unit Requirement	Service	Total Requirement (gal)
Indoor Equalization and Emergency	270 gal/ERC	247 ERCs	66,690
Outdoor Equalization	2,680 gal/irr-ac	8.0 irr-ac	21,440
Fire	1,750 gpm for 2 hours	Area 1	210,000
		Total	**298,130**
		Existing Capacity	325,000
		Surplus (+) / Deficit (-)	**+26,870**

There is sufficient storage capacity for existing users.

CHAPTER 4 FUTURE WATER SYSTEM

The planning horizon for future conditions in this master plan is 2042. It is assumed that nearly all properties within the SMSSD service area will be improved and using water by this time.

Future source and storage requirements were estimated based on a projection of future connections to the SMSSD water system. A summary of these findings is shown in Table 4-1. Development of these requirements is discussed further in this chapter. The existing system does not have the capacity to meet the demands expected at buildout.

Table 4-1
Summary of Future Demand and Capacity

Requirement	Existing Capacity	Future Requirement	Surplus (+) / Deficit (-)
Peak Day Source	158 gpm	385 gpm	-227 gpm
Average Yearly Source	222.35 ac-ft/yr	274 ac-ft/yr	-52 ac-ft/yr
Storage	325,000 gal	690,740 gal	-365,740 gal

CONNECTIONS

Connections to the existing system presently exist only in Area 1. Areas 2 and 3 currently consist of a mixture of improved and unimproved lots with no water service. Information about these lots was provided by SMSSD and was evaluated to categorize these lots as either improved or unimproved. This information was used to form the basis for growth projections and projected future connections to the water system.

A growth rate has historically been difficult to develop in the SMSSD service area due to historically variable growth. An arbitrary, but reasonable growth rate of 5 percent was assumed to occur in each area through buildout. Table 4-2 shows the existing number of occupied lots and the estimated growth in each service area.

Table 4-2
Anticipated Growth in ERCs

Year	Estimated Total ERCs		
	Area 1	Area 2	Area 3
2022	247	216	95
2023	260	227	100
2024	273	239	105
2025	287	251	110
2026	302	264	116
2027	317	277	122
2028	321	292	128
2029	321	307	135
2030	321	322	142
2031	321	339	149
2032	321	356	157
2033	321	374	160
2034	321	394	160
2035	321	414	160
2036	321	435	160
2037	321	457	160
2038	321	471	160

Table 4-3 shows the existing number of ERCs and the estimated number at buildout. These ERC values assume that all available lots in the district are improved and connected to the water system.

Table 4-3
Existing and Projected Number of ERCs at Buildout

Area	Existing ERCs	Buildout ERCs
1	247	321
2	0	471
3	0	160
Total	**247**	**952**

Both Areas 2 and 3 are anticipated to see the most growth over the next few years given the higher percentage of lots that are not yet improved.

DEMANDS

Planning for the expected number of ERCs shown in Table 4-2 and following the same methodology described in the previous chapter, SMSSD's expected buildout demands are shown in Table 4-4. It is assumed that Areas 2 and 3 will not have any irrigated acreage due to their natural mountain setting. It is recommended that irrigation from the water system in Areas 2 and 3 be prohibited to help the District make best use of limited water resources.

Future irrigated acreage in Area 1 was forecasted by reviewing irrigated area on existing lots. It was assumed that of the 321 ERCs at buildout, 57 would contain an average of 0.25 acres of irrigated land each (those properties generally located near the golf course), and the remaining 264 ERCs would have an average of 0.05 acres of irrigated land each. These estimates are consistent with existing land use patterns. In total, Area 1 is expected to have 27.5 acres of irrigated land at buildout. These values were used in the hydraulic model to simulate future conditions.

Table 4-4
SMSSD Buildout Source Demand

Area	ERCs	Irrigated Area (acres)	Peak Day Source Requirement (gpm)	Average Yearly Source Requirement (ac-ft)
1	321	27.5	266.4	179.6
2	471	0	88.3	70.7
3	160	0	30.0	24.0
Total	**952**	**27.5**	**384.8**	**274.2**

The proposed demands exceed the existing source capacity in the water system. These values are summarized in Table 4-1 and show that there is a deficit for the peak day demand and average yearly demand of 227 gpm and 52 ac-ft, respectively.

SOURCES

To meet projected future demands, it is proposed to use the Thad's Peak well to supply the Future Zone 2 distribution system, develop and connect into the Cottonwood Springs to serve Area 1, drill a new well to serve Area 2 and purchase the existing Colledge well located in Area 3. A summary of demands by area as compared to existing capacity is shown in Table 4-5.

Water rights are likely to be sufficient for the foreseeable future to buildout given the seasonal use. It is anticipated that less than the expected 274.2 ac-ft will be used annually given that most of the residents in Areas 2 and 3 are seasonal. The numbers shown are a conservative estimate assuming that all of Area 1 residents are full time users and Areas 2 and 3 residents are using water six months of the year.

Table 4-5
SMSSD Buildout Demand and Existing Capacity

Area	Capacity (gpm)	Buildout Peak Day Demand (gpm)	Surplus (+) / Deficit (-)
1	120	266.4	-146
2	38	88.3	-50
3	0	30.0	-30
Total	**158**	**384.8**	**-226.8**

An additional capacity of 226.8 gpm is required to meet expected future peak day demands. To meet these demands, the following source projects are proposed and shown in Table 4-6.

Table 4-6
Proposed Source Projects

Description	Notes
Area 1 Springs	Develop and utilize the existing Cottonwood Springs to provide approximately 100 gpm of source to Area 1.
Area 2 Well	Drill and equip an additional well in Area 2 to provide at least 50 gpm.
Purchase Existing Colledge Well for Area 3	Purchase and re-equip the existing Colledge Well to provide approximately 75 gpm of source capacity to Area 3.

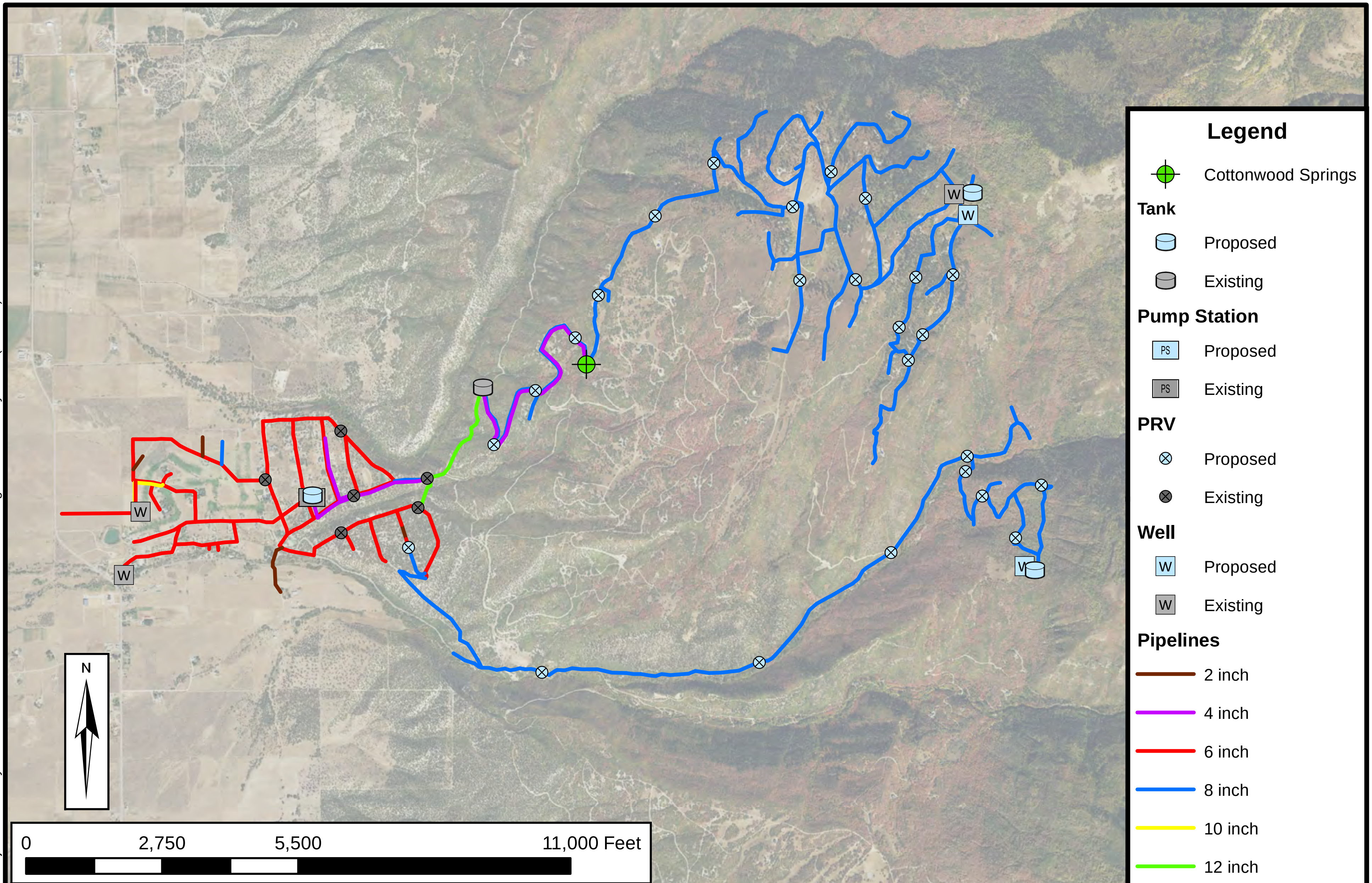
The locations of these proposed facilities are shown in Figure 4-1. The existing Colledge Well drilling log specified that it can provide 15 gpm; however, SMSSD personnel reported that it was equipped at 15 gpm but is physically capable of producing up to 75 gpm. Re-equipping it to provide 75 gpm will meet expected buildout demands. The location of Cottonwood Springs is also shown on Figure 4-1. It would require a dedicated 4-inch line to connect into the Area 1 distribution system. This project would provide capacity for growth in Area 1, delaying the need of for a new well.

DISTRIBUTION

Areas 2 and 3 have no existing distribution infrastructure and will require installation of a complete system in order to be served. Figure 4-1 shows the proposed pipelines and their recommended minimum diameters. An estimated 17.9 miles of pipeline are required to serve Areas 2 and 3.

The minimum required size as specified by Utah R309-550-5 is 8 inches for all pipes that supply fire flow. Pipes were then evaluated using the hydraulic model to determine if pipes larger than 8-inch diameter were required to maintain reasonable pipe velocity or service pressure.

To manage pressures associated with the change in elevation throughout the system, approximately twenty-four 6-inch diameter PRVs are required along with the new pipelines. Their



SKYLINE MOUNTAIN SPECIAL SERVICE DISTRICT

BUILDOUT WATER SYSTEM

FIGURE 4-1

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approximate locations are shown in Figure 4-1. Locations of each PRV should be more precisely determined as part of the design for the Areas 2 and 3 water system.

DDW minimum water pressure requirements for distribution systems (R309-105-9) are 20 psi during peak day plus fire flow demand, 30 psi during peak instantaneous demand, and 40 psi during peak day demand.

New construction will require minimum 8 in. diameter pipelines per R309-550-5(5)(a) and fire flow capacity of 1,500 gpm as per the local fire authority. Locations in the Area 1 system where 1,000 gpm of fire flow capacity can be provided will not be subject to retroactive fire flow requirements and will be considered code compliant as long as they are maintained properly and new construction does not alter the fire flow requirement. Figure 4-2 shows the available fire flow for the buildout scenario. Table 4-7 shows the compliance with the Utah Rule based on each condition.

Table 4-7
Compliance of Buildout
Distribution System with Utah Rule

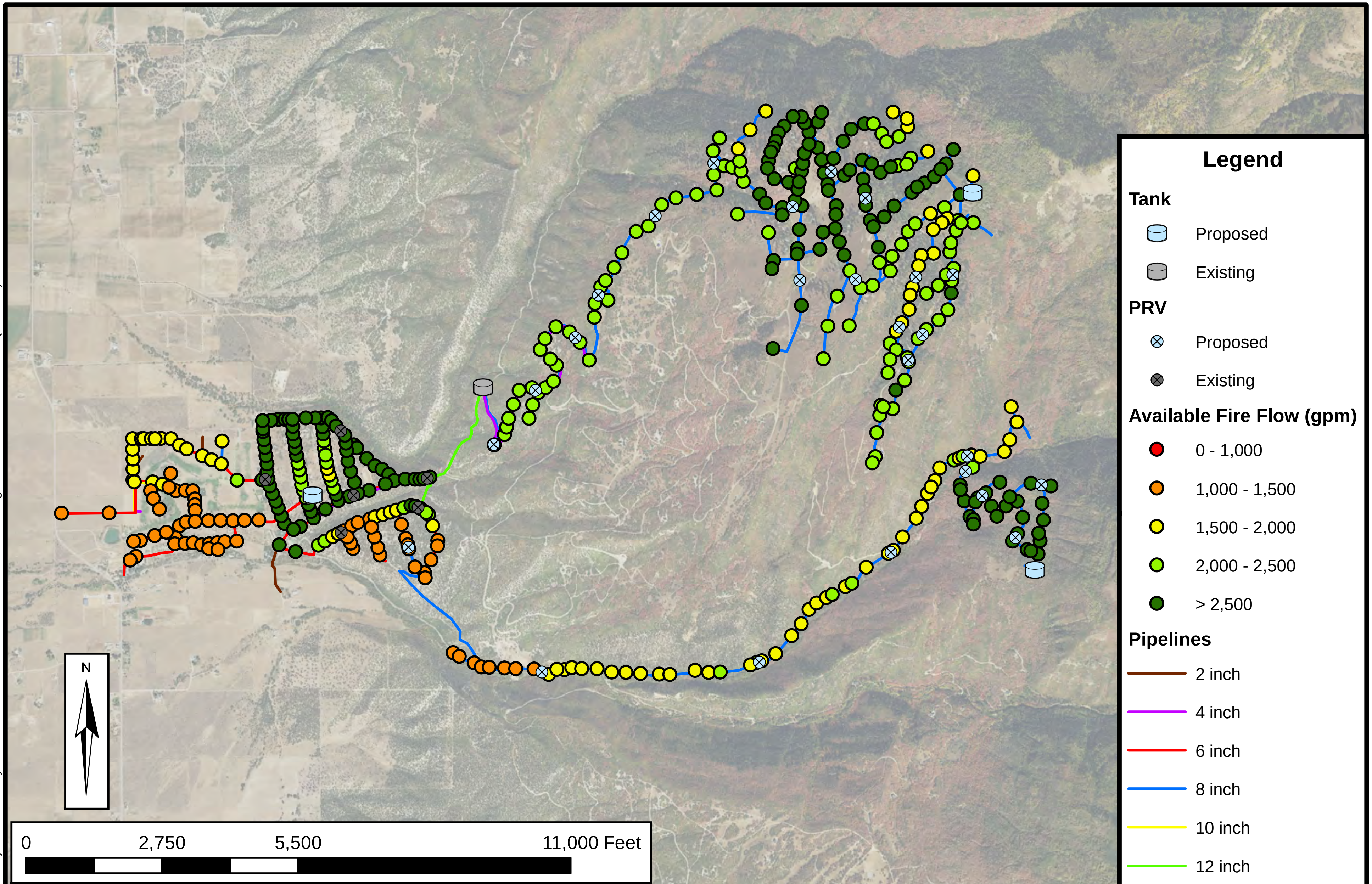
Condition	Requirement[1]	System Design Flow[2]	Compliance Status
Peak Day	Minimum 40 psi service pressure	385 gpm	All connections comply.
Peak Instantaneous	Minimum 30 psi service pressure	770 gpm	All connections comply.
Peak Day plus Fire Flow[3]	Minimum 20 psi service pressure	385 gpm (system) Plus 1,000/ 1,500 gpm fire	All areas comply as shown on Figure 4-2

1. Requirements are as stated in Utah Code R309-105-9(2). The requirement for connections prior to 2007 is a minimum of 20 psi under all conditions.
2. Peak day system flows are shown in Tables 4-4. Peak day flow was multiplied by a factor of 2.0 to produce peak instantaneous flow.
3. Fire flow is discussed in Appendix C. The minimum fire flow requirement in SMSSD is 1,000 gpm for existing infrastructure and 1,500 gpm for all new construction.

The proposed system satisfies the future peak instantaneous minimum pressure requirement of 30 psi and the future peak day requirement of 40 psi. The simulated minimum pressure in the future system is 40 psi (just downstream of system PRVs). The proposed system also provides adequate fire flow for each respective area while maintaining a minimum service pressure of 20 psi.

STORAGE

Future storage requirements were calculated with similar methodology mentioned in Chapter 3. Emergency storage is to be determined by level of risk and desired system reliability. It is proposed to have a combined equalization and emergency storage requirement of 270 gal/ERC be used for the indoor storage requirement. The proposed outdoor storage requirement is 2,680 gal/irr-ac. A maximum fire flow requirement of 1,750 gpm for two hours is expected for Area 1. Areas 2 and 3 will have a fire flow requirement of 1,500 gpm for two hours. These requirements were determined based on conversations with the District and the Fairview Fire Department. Table 4-8 shows the storage requirements for each area.



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BUILDOUT AVAILABLE FIRE FLOW

FIGURE 4-2

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Table 4-8
SMSSD Buildout Storage Requirements

Area	ERCs	Irrigated Area (acres)	Fire Requirement (gal)[1]	Equalization Storage Requirement (gal)	Storage Requirement (gal)	Existing Storage (gal)	Surplus (+) / Deficit (-)
1	321	27.5	0	160,370	160,370	325,000	164,630
2	471	0	180,000	127,170	307,170	0	-307,170
3	160	0	180,000	43,200	223,200	0	-223,200
Total	**952**	**27.5**	**360,000**	**330,740**	**690,740**	**325,000**	**-365,740**

1. Fire storage will be shared between zones with Areas 2 and 3 providing fire storage for Area 1.

The existing system does not have the storage capacity necessary for projected buildout requirements. The projects in Table 4-9 are proposed to be included in the buildout system to provide the required storage. Fire storage will be held in Areas 2 and 3 and fed down to Area 1 through PRVs if needed. The existing 55,000 gallon tank in Area 1 will need to be replaced as it is 50 years old and reaching the end of its service life.

Table 4-9
Proposed Storage Projects

Description	Notes
Area 1 Storage Tank	Construct a new storage tank with a capacity of at least 250,000 gallons to replace the existing 55,000 gallon tank in Area 1.
Area 2 Storage Tank	Construct a storage tank with a capacity of at least 310,000 gallons to serve Area 2 and provide fire storage to Areas 1 and 2.
Area 3 Storage Tank	Construct a storage tank that with a capacity of at least 225,000 gallons to serve Area 3 and provide fire storage to Areas 1 and 3.

CHAPTER 5 CAPITAL FACILITY PLAN

The purpose of this section is to identify the drinking water facilities that are required, for the 20-year planning period, to meet the demands placed on the system by future development. Proposed facilities were sized to meet master plan requirements and located to accommodate 20-year growth projections. Each capital facility plan project will require a detailed design analysis before construction to more precisely define the locations of tanks, wells, hydrants, and other key infrastructure. Specific projects with estimated costs are presented at the end of this chapter.

Projects necessary to support growth over the next 20 years are identified and described in the Capital Facility Plan. Conceptual-level cost estimates were prepared for each project. These costs are attributable to new growth for the system.

Table 5-1 briefly summarizes the estimated costs of projects by service area. Figure 4-1 shows the proposed projects and their approximate locations.

Table 5-1
Capital Projects by Area

Area	Estimated Cost
1	$1,830,000
2	$14,730,000
3	$6,280,000
Total	**$22,840,000**

Each Area has capital projects that will help facilitate future growth. These projects have an estimated cost of **$22,840,000** (see Table 5-1 and Appendix D). These costs are eligible to be paid for by impact fees from incoming users and connection fees and rates for existing users.

Table 5-2
System Growth-Related Capital Projects (0 – 20 Years)

Type	Area	Recommended Project	Estimated Cost
Storage	1	Replace the existing 55,000 gallon tank in Area 1 with a new 250,000 gallon tank.	$530,000
Source	1	Develop Cottonwood Springs and construct approximately 5,800 feet of 4-inch pipe to convey spring water to Area 1.	$1,300,000
Transmission	2	Construct new water pipelines necessary to provide water to lots in Area 2.	$13,340,000
Source	2	Drill an additional well that can provide at least 50 gpm to help meet the expected future demands in Area 2.	$710,000
Storage	2	Construct a tank with a minimum capacity of 310,000 gallons.	$680,000
Transmission	3	Construct new water pipelines necessary to provide water to lots in Area 3.	$5,700,000
Source	3	Purchase the existing Colledge Well Located in Area 3.	$110,000
Storage	3	Construct a tank with a minimum capacity of 225,000 gallons.	$470,000
Total			**$22,840,000**

OFFICE AND MAINTENANCE BUILDING

As part of this effort, a preliminary site plan for an office and maintenance building was developed. A planning-level estimated cost for this building is $310,000 or more depending on options chosen. See Appendix E for the site plan and cost estimate.

FUNDING OPTIONS

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

General Obligation Bonds

This form of debt enables SMSSD 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 SSMD in the future). G.O. bonds are debt instruments backed by the full faith and credit of SMSSD which would be secured by an unconditional pledge of SMSSD 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 SMSSD's revenue-generating authority. These bonds are supported by SMSSD 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 SMSSD. G.O. bonds must be approved by a members vote.

Revenue Bonds

This form of debt financing is also available to SMSSD for utility-related capital improvements. Unlike G.O. bonds, revenue bonds are not backed by SMSSD 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 lender 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 current interest rates are quite low. This type of debt also has very specific coverage requirements in the form of a reserve fund specifying an amount, usually expressed in terms of average or maximum debt service due in any future year. This debt service is required to be held as a cash reserve for annual debt service payment to the benefit of bondholders. Typically, voter approval is not required when issuing revenue bonds.

State or 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 are clear indicators that local government may be left to its own devices regarding infrastructure finance in general. However, state or 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 state or federal 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 District.

Impact Fees

The Utah Impact Fees Act, codified in Title 11, Chapter 36a, of the Utah Code, authorizes municipalities to collect impact fees to fund public facilities. An impact fee is "a payment of money imposed upon new development activity . . . to mitigate the impact of the new development on public infrastructure" (Subsection 11-36a-102(8)). Impact fees enable local governments to finance infrastructure improvements without burdening existing development with costs that are exclusively attributable to growth.

Impact fees can be applied to water-related facilities under the Utah Impact Fees Act. The Act is designed to provide a logical and clear framework for establishing new development assessments. It is also designed to establish the basis for the fee calculation which SMSSD must follow in order to comply with the statute. The fundamental objective for the fee structure is the imposition on new development of only those costs associated with providing or expanding water infrastructure to meet the capacity needs created by that specific new development. Impact fees cannot be applied retroactively.

An impact fee analysis is provided in a separate document.

CHAPTER 6 MASTER PLAN SUMMARY

SOURCES

The existing sources are sufficient for the current conditions and demands for the water system. The following recommendations are suggested for the sources to ensure that the demands can be met in future conditions:

- Drill and equip a new well in Area 1 that is capable of supplying at least 100 gpm.
- Develop the existing Cottonwood Springs to supply water to Area 1.
- Drill and equip a new well in Area 2 that is capable of supplying at least 65 gpm.
- Purchasing the existing Colledge Well located in Area 3.

These projects will provide adequate peak day source for the estimated buildout demands of Areas 1, 2, and 3. Additional water rights may need to be secured if seasonal use in Areas 2 and 3 amounts to 0.15 ac-ft per ERC as was estimated in this report. However, this is a conservative estimate, and it is likely that existing water rights will be adequate many years into the future. In the future, reviewing annual water use records in Areas 2 and 3 is recommended to more accurately quantify usage in these areas.

DISTRIBUTION

Under existing conditions, SMSSD's existing distribution system satisfies the minimum pressure requirements of R309-510-9 and R309-105-9, including 20 psi during peak day fire flow, 30 psi during peak instantaneous demand, and 40 psi during peak day demand. There are no existing deficiencies. The existing system is also able to meet the fire flow requirements of at least 1,000 gpm while maintaining a service pressure of 20 psi.

To serve Areas 2 and 3, approximately 17.9 miles of new pipe and approximately 24 PRVs must be installed. A map of proposed infrastructure for these areas is shown in Figure 4-1. The proposed infrastructure will satisfy the minimum pressure requirements of R309-510-9 and R309-105-9, including 20 psi during peak day fire flow, 30 psi during peak instantaneous demand, and 40 psi during peak day demand.

STORAGE

SMSSD has sufficient water storage capacity to meet existing requirements. Future growth and aging infrastructure will require the construction of the following projects:

- Replace the existing 55,000 gallon storage tank with a new storage tank with a capacity of 250,000 gallons in Area 1.
- Construct a storage tank that with a capacity of at least 310,000 gallons to serve Area 2
- Construct a storage tank that with a capacity of at least 225,000 gallons to serve Area 3

OPERATIONAL RECOMMENDATIONS

Operational expenses and projects were not covered in detail as part of this master plan. However, over the course of the study, SMSSD personnel suggested several potential improvements to increase redundancy and help with system operation. These suggestions are listed below and recommended for further study.

- Consider drilling or purchasing another Well in Area 3 to provide redundancy.
- Ensure that all meters are functioning properly and installed for every connection.
- Identify all the sizes and locations of pipes and identify what that was not replaced in 2013. Develop a detailed map documenting this information.
- Investigate the peak capacity of Thad's Peak Well to see if its capacity could be increased.

REFERENCES

DWR (Utah Division of Water Rights). 2022. Public Water Supplier Information, Skyline Mountain SSD. Accessed May 16, 2022 https://www.waterrights.utah.gov/asp_apps/viewEditPWS/pwsView.asp?SYSTEM_ID=10891.

EPA (U.S. Environmental Protection Agency). 2019. “EPANET: Application for Modeling Drinking Water Distribution Systems.” EPA. Accessed May 16, 2022 http://www.epa.gov/nrmrl/wswrd/dw/epanet.html.

State of Utah. 2019a. Utah Administrative Code, Section R309-105: Administration: General Responsibilities of Public Water Systems. In effect Mar. 1. Accessed May 16, 2022 https://rules.utah.gov/publicat/code/r309/r309-105.htm.

———. 2019b. Utah Administrative Code, Section R309-510: Facility Design and Operation: Minimum Sizing Requirements. In effect Mar. 1. Accessed May 16, 2022 https://rules.utah.gov/publicat/code/r309/r309-510.htm.

———. 2014c. Utah Code Annotated, Section 11-36: Impact Fees Act. Accessed May 16, 2022 https://le.utah.gov/xcode/Title11/Chapter36A/11-36a.html?v=C11-36a_1800010118000101.

———. 2019d. Utah State Legislature, House Bill 31: Water Supply and Surplus Water Amendments. Accessed May 16, 2022. https://le.utah.gov/~2019/bills/static/HB0031.html.

———. 2019e. Utah State Legislature, House Joint Resolution 1: Proposal to Amend Utah Constitution – Municipal Water Resources. Accessed May 16, 2022. https://le.utah.gov/~2019/bills/static/HJR001.html.

Utah Division of Drinking Water, “General Guidance for Water Use Data Reporting and Setting System-Specific Source and Storage Sizing Requirements,” DDW-ENG-0048 (Oct. 15, 2018), https://documents.deq.utah.gov/drinking-water/engineering/DDW-2018-009165.pdf.

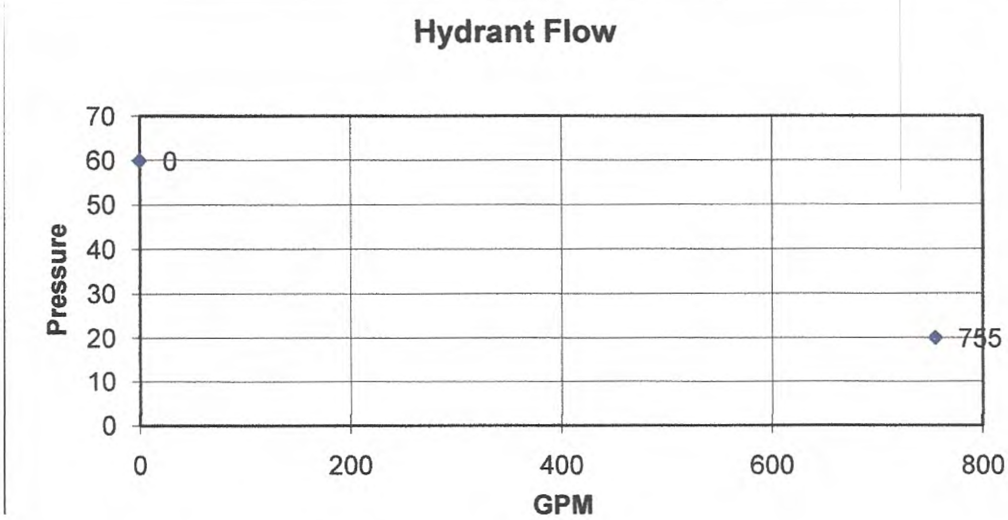
Utah Division of Drinking Water, “Detailed Guidance for Water Use Data Reporting and Setting System-Specific Source and Storage Sizing Requirements,” DDW-ENG-0047 (Oct. 18, 2018), https://documents.deq.utah.gov/drinking-water/engineering/DDW-2018-011527.pdf.

APPENDIX A

Fire Flow and Hydrant Tests

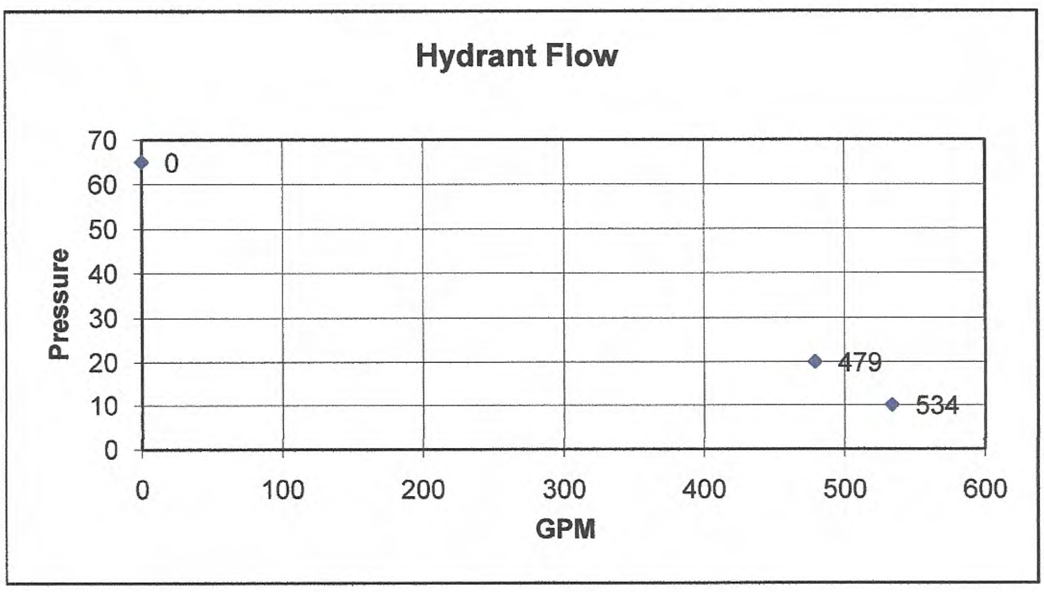
Hydrant Information Sheet

Hydrant Number	A14
Hydrant Location	Skyline Mountain Resort 12135 East Fairview Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	20
Residual Pressure	20
Static Pressure	60
Flow, gpm =	755
Flow, gpm at 20 psi=	755



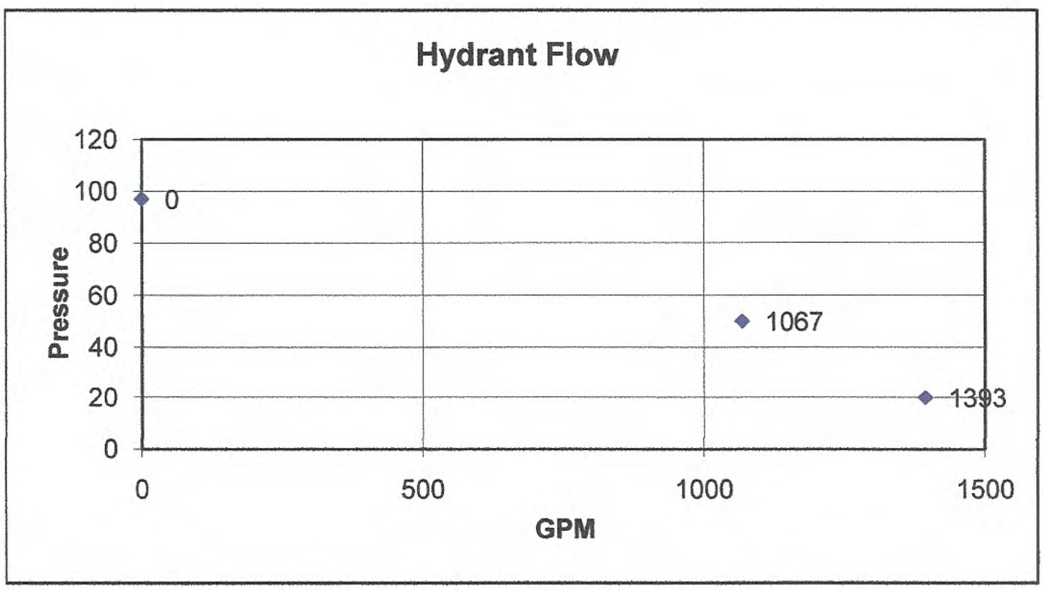
Hydrant Information Sheet

Hydrant Number	A41
Hydrant Location	Skyline Mountain Resort 12125 East Sports Haven Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	10
Residual Pressure	10
Static Pressure	65
Flow, gpm =	534
Flow, gpm at 20 psi=	479



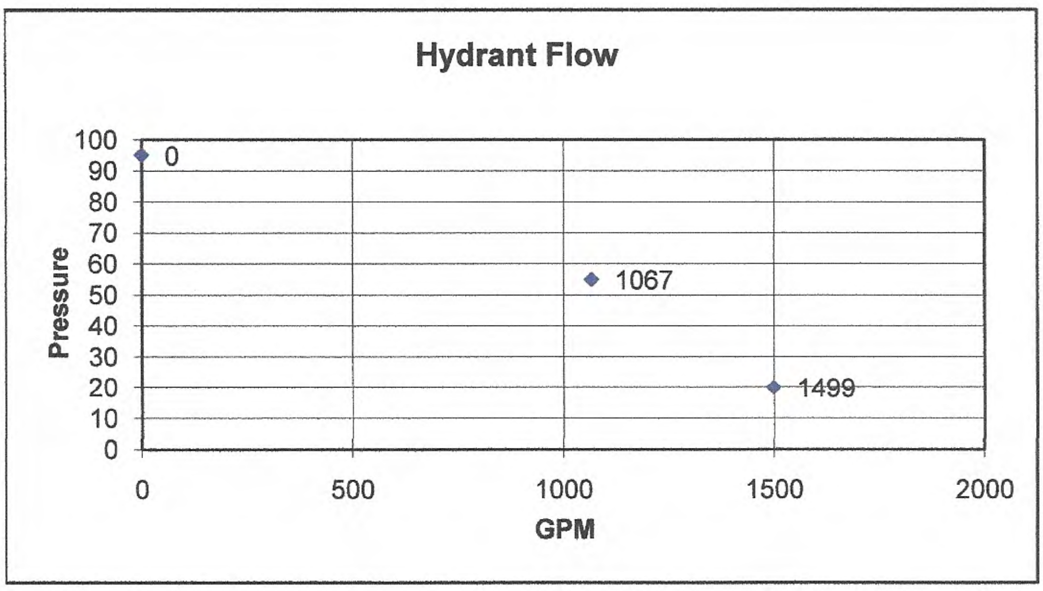
Hydrant Information Sheet

Hydrant Number	B56
Hydrant Location	Skyline Mountain Resort 22440 North Spring Creek Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	40
Residual Pressure	50
Static Pressure	97
Flow, gpm =	1067
Flow, gpm at 20 psi=	1393



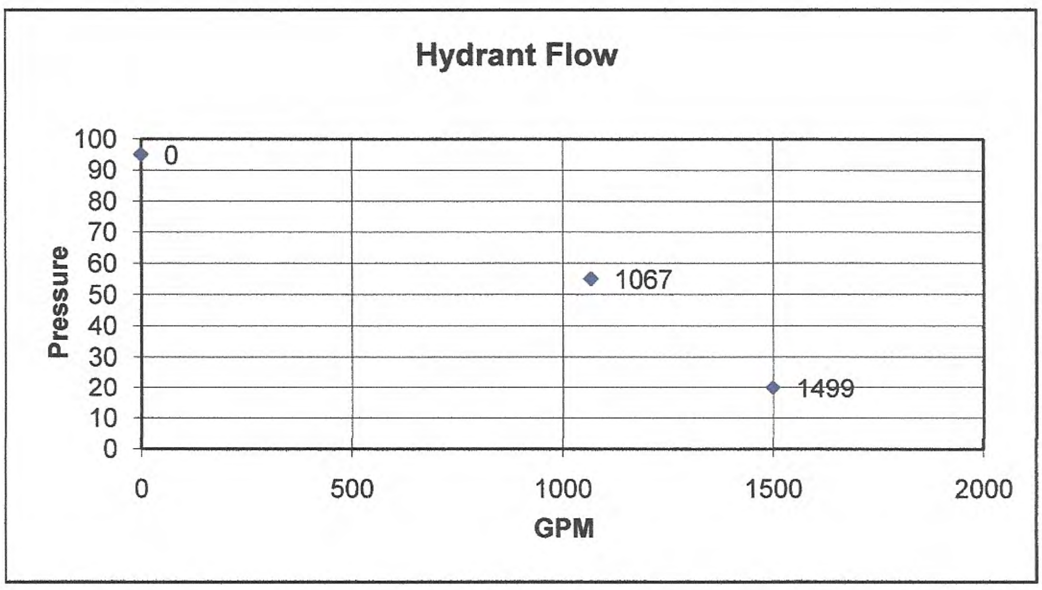
Hydrant Information Sheet

Hydrant Number	GC37
Hydrant Location	Skyline Mountain Resort 11985 East Long Drive Road Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	40
Residual Pressure	55
Static Pressure	95
Flow, gpm =	1067
Flow, gpm at 20 psi=	1499



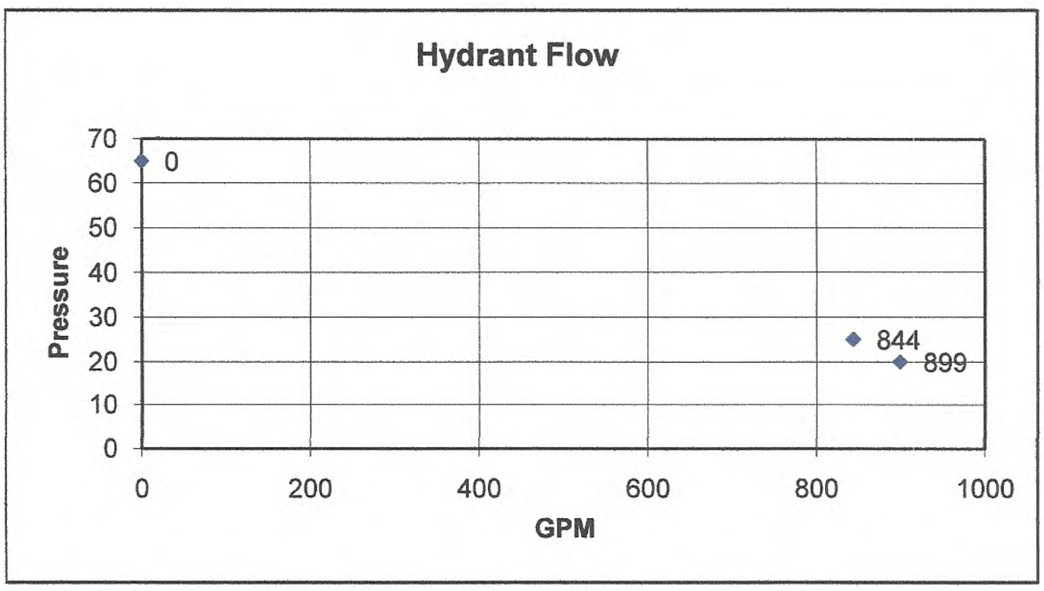
Hydrant Information Sheet

Hydrant Number	B67
Hydrant Location	Skyline Mountain Resort 22760 North Spring Creek Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	40
Residual Pressure	55
Static Pressure	95
Flow, gpm =	1067
Flow, gpm at 20 psi=	1499



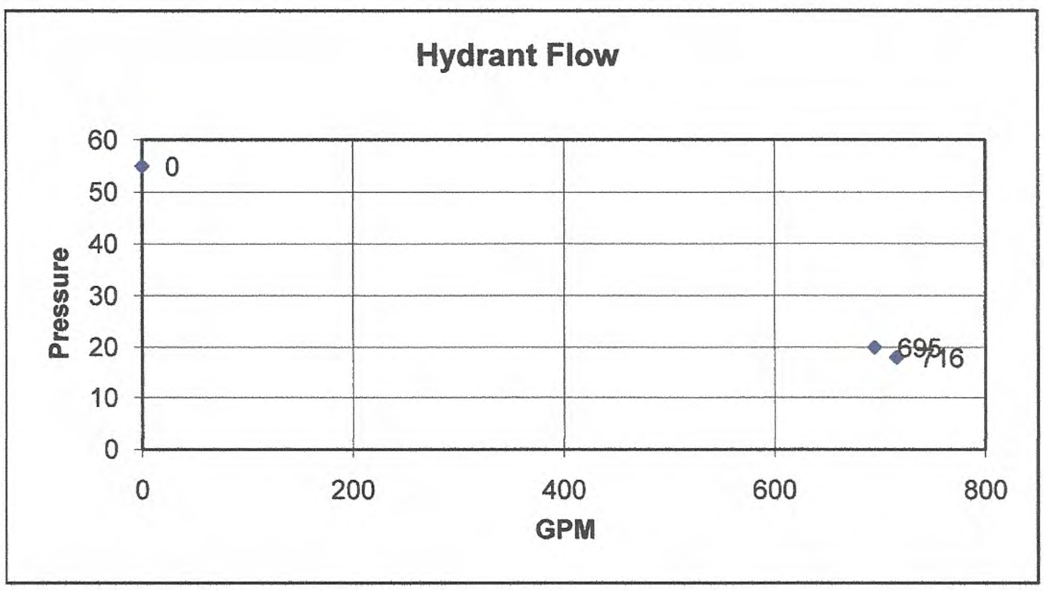
Hydrant Information Sheet

Hydrant Number	B48
Hydrant Location	Skyline Mountain Resort 12510 East Juniper Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	25
Residual Pressure	25
Static Pressure	65
Flow, gpm =	844
Flow, gpm at 20 psi=	899



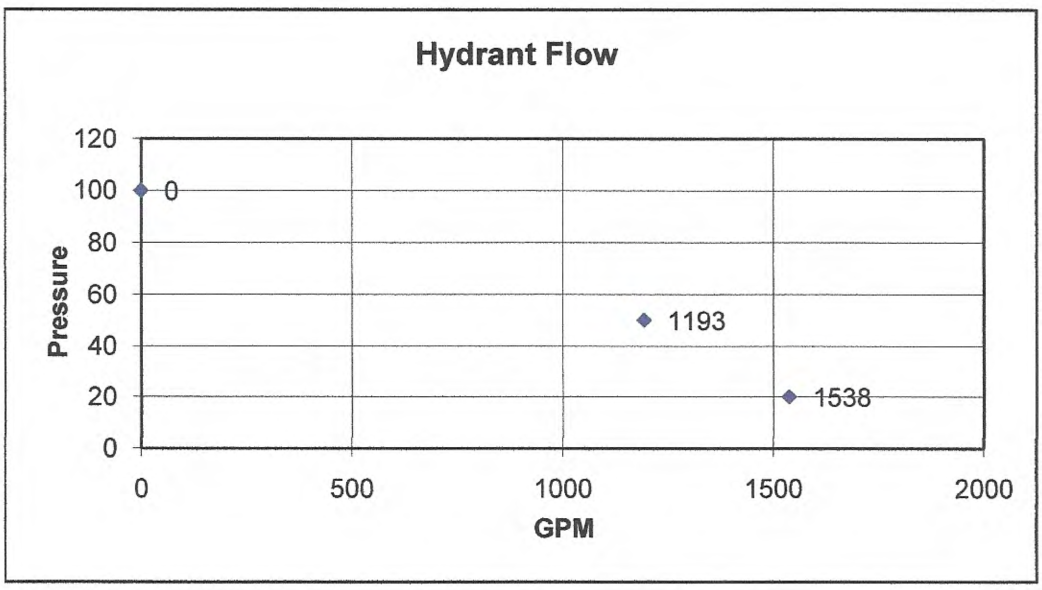
Hydrant Information Sheet

Hydrant Number	B102
Hydrant Location	Skyline Mountain Resort 22565 North Juniper View Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	18
Residual Pressure	18
Static Pressure	55
Flow, gpm =	716
Flow, gpm at 20 psi=	695



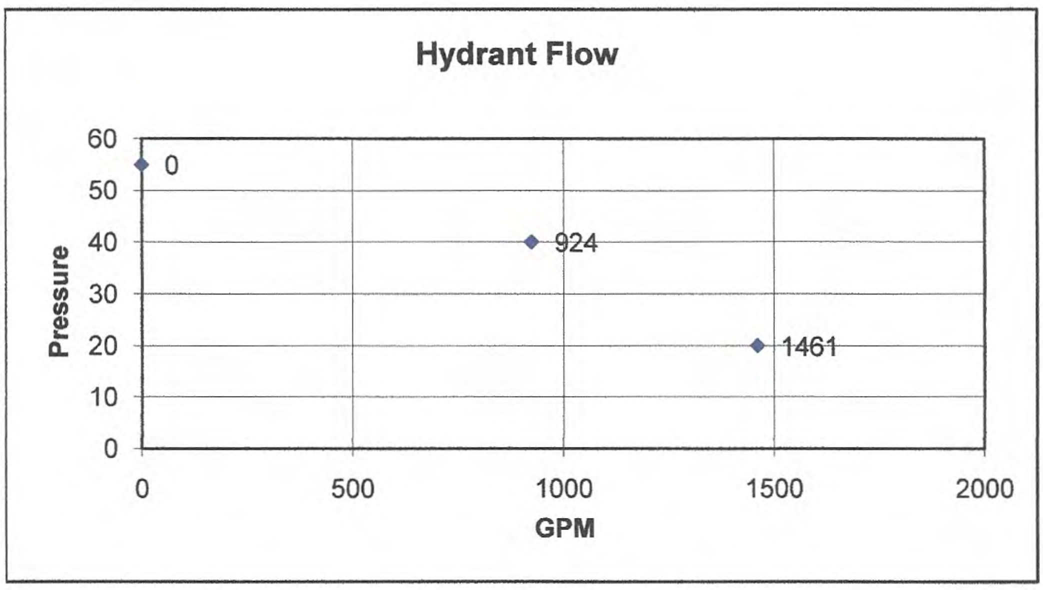
Hydrant Information Sheet

Hydrant Number	B121
Hydrant Location	Skyline Mountain Resort 22760 North Juniper View Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	50
Residual Pressure	50
Static Pressure	100
Flow, gpm =	1193
Flow, gpm at 20 psi=	1538



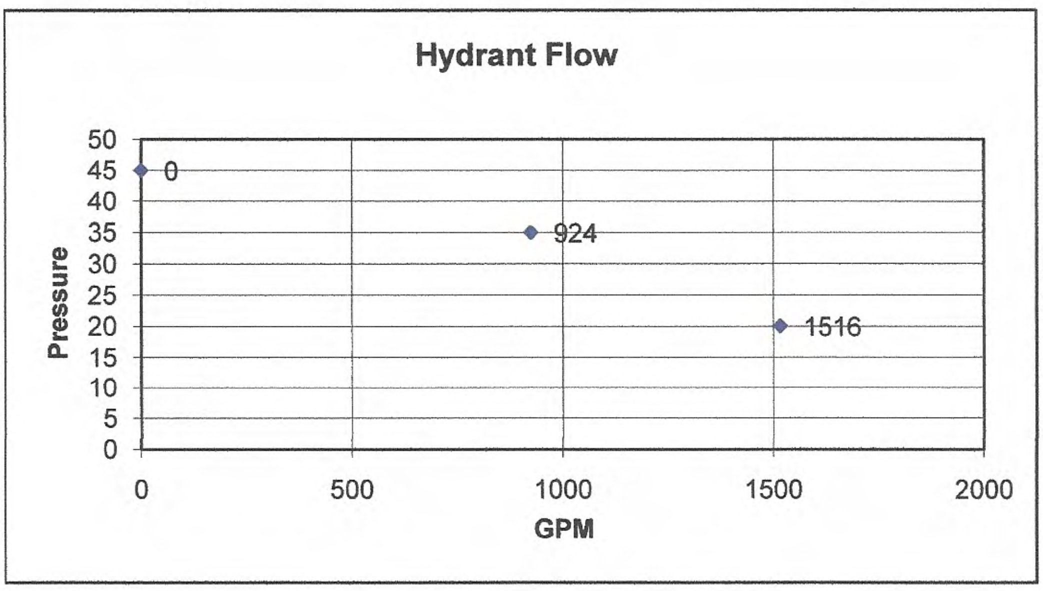
Hydrant Information Sheet

Hydrant Number	B33
Hydrant Location	Skyline Mountain Resort 12785 East Spring Creek Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	30
Residual Pressure	40
Static Pressure	55
Flow, gpm =	924
Flow, gpm at 20 psi=	1461



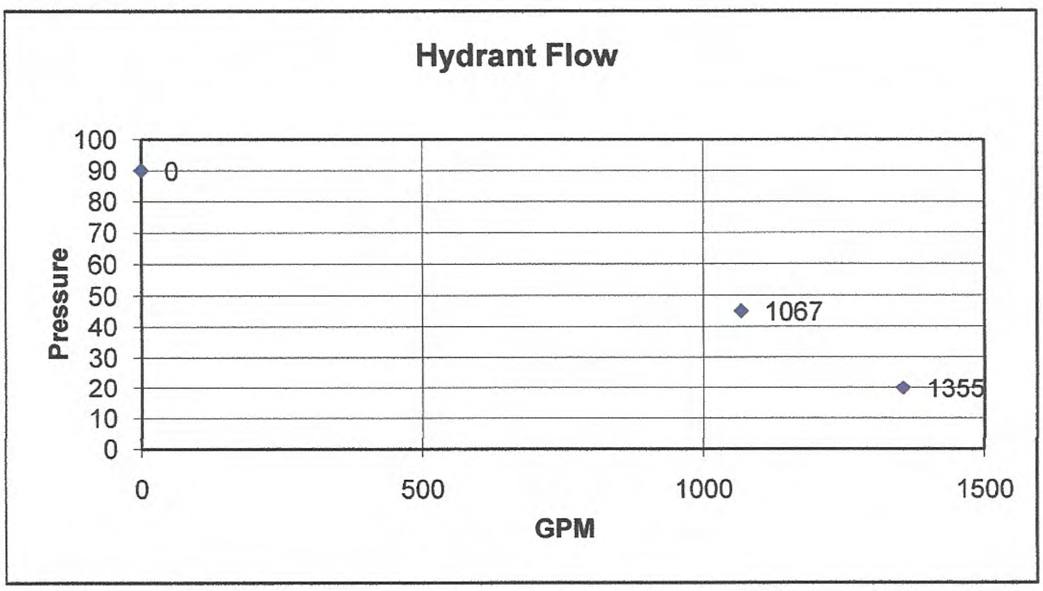
Hydrant Information Sheet

Hydrant Number	M92
Hydrant Location	Skyline Mountain Resort 23740 North Pine Canyon Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	30
Residual Pressure	35
Static Pressure	45
Flow, gpm =	924
Flow, gpm at 20 psi=	1516



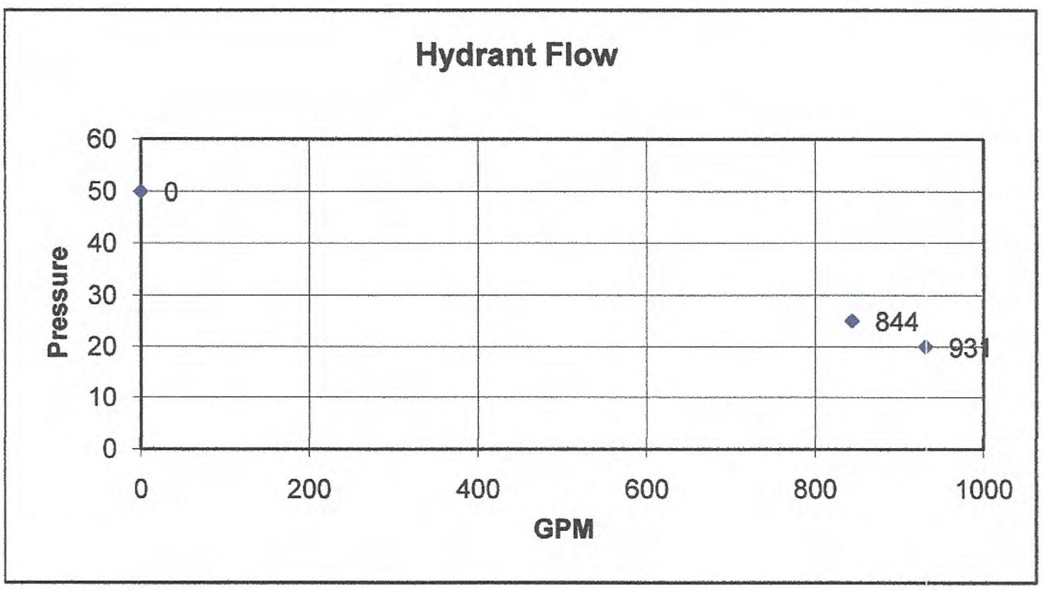
Hydrant Information Sheet

Hydrant Number	C1
Hydrant Location	Skyline Mountain Resort 12450 East Cedar Ridge Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	40
Residual Pressure	45
Static Pressure	90
Flow, gpm =	1067
Flow, gpm at 20 psi=	1355



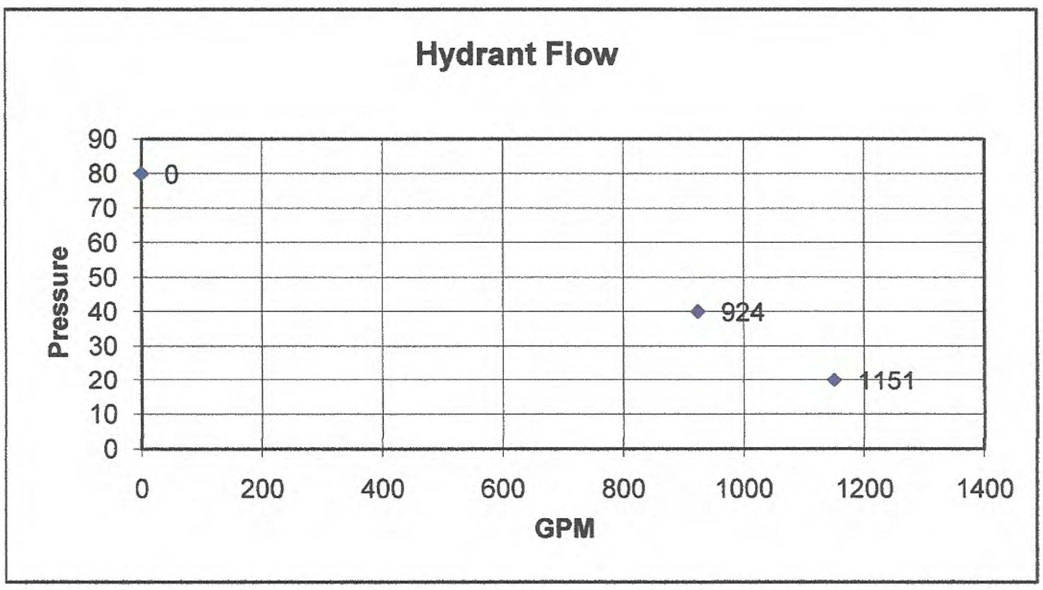
Hydrant Information Sheet

Hydrant Number	C22
Hydrant Location	Skyline Mountain Resort 22285 North Cedar Ridge Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	25
Residual Pressure	25
Static Pressure	50
Flow, gpm =	844
Flow, gpm at 20 psi=	931



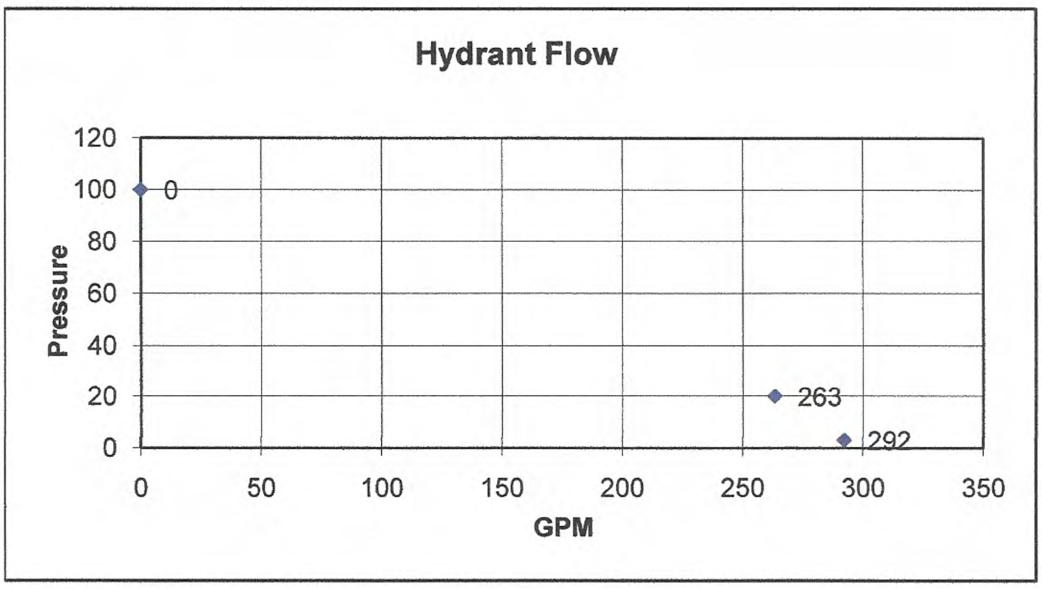
Hydrant Information Sheet

Hydrant Number	C49
Hydrant Location	Skyline Mountain Resort 22345 North Cedar Ridge Drive Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	30
Residual Pressure	40
Static Pressure	80
Flow, gpm =	924
Flow, gpm at 20 psi=	1151



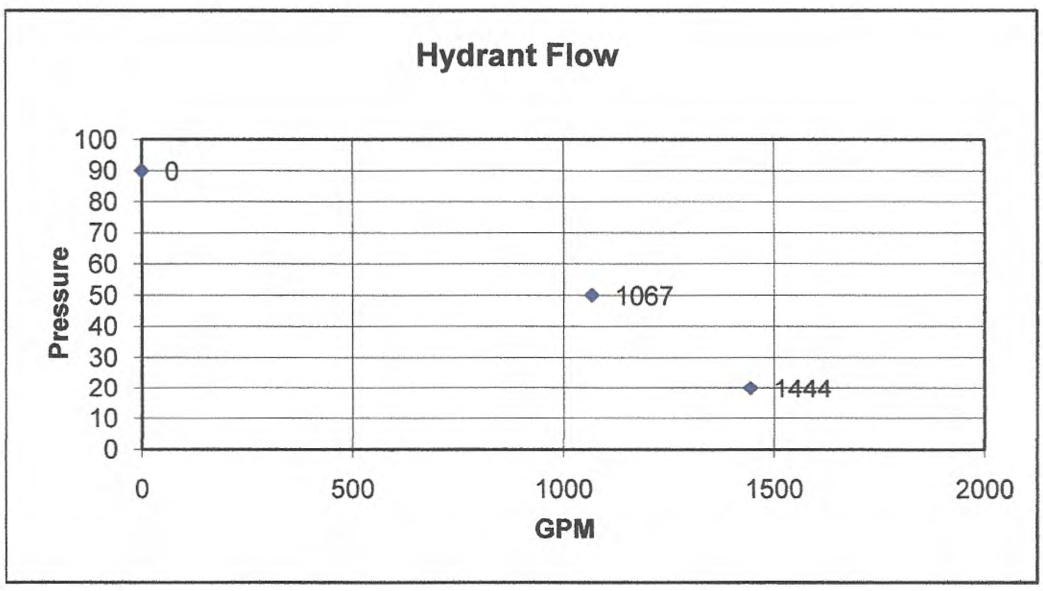
Hydrant Information Sheet

Hydrant Number	E21
Hydrant Location	Skyline Mountain Resort 2213 North Owen Thomas Drive by Old Managers House Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	3
Residual Pressure	3
Static Pressure	100
Flow, gpm =	292
Flow, gpm at 20 psi=	263



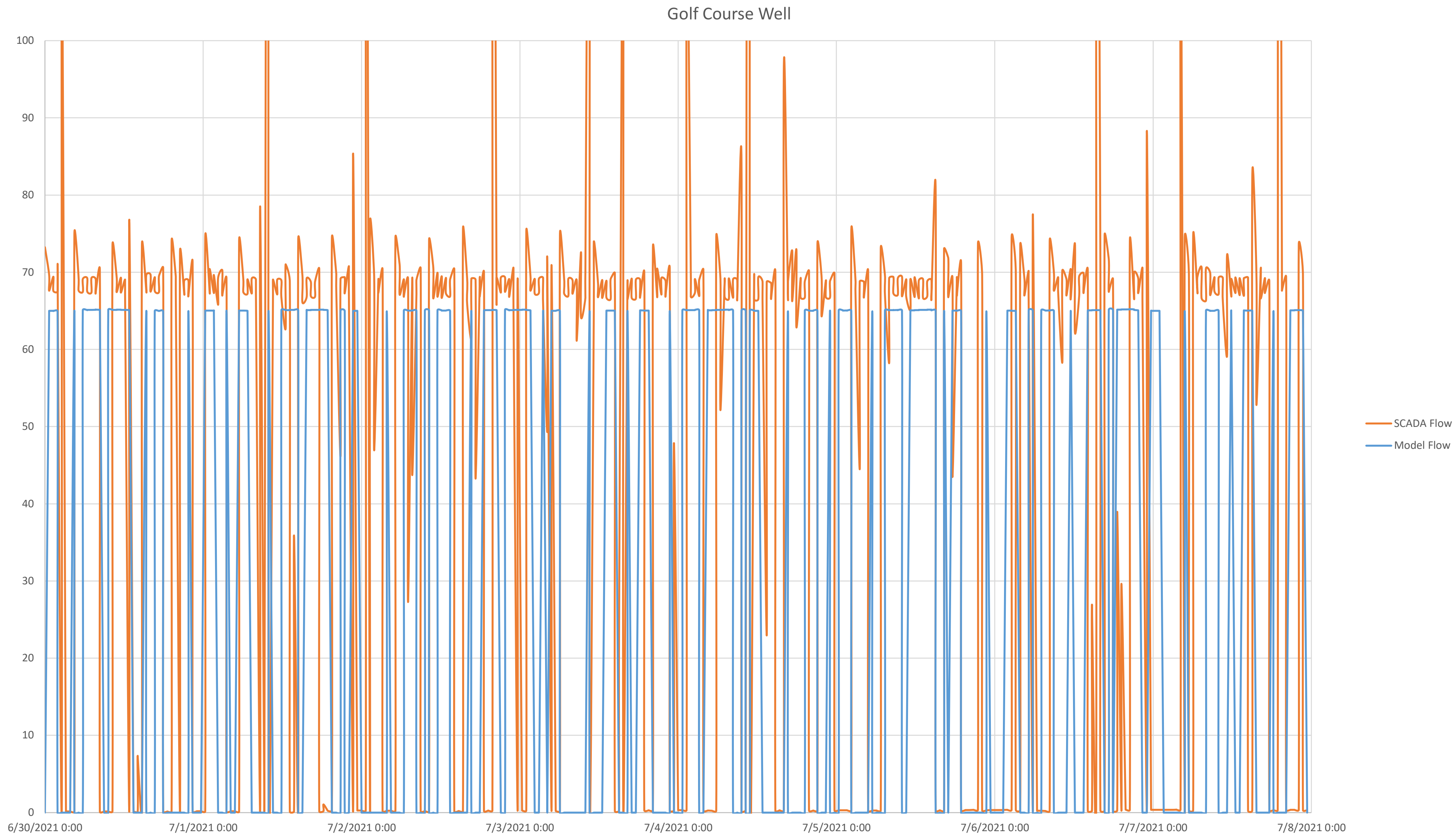
Hydrant Information Sheet

Hydrant Number	Pavilion
Hydrant Location	Skyline Mountain Resort 22130 North 11750 East by New Club House Fairview, Utah 84629
Nozzle Coefficient	0.90
Nozzle I.D., inches	2.50
Pitot Pressure	40
Residual Pressure	50
Static Pressure	90
Flow, gpm =	1067
Flow, gpm at 20 psi=	1444

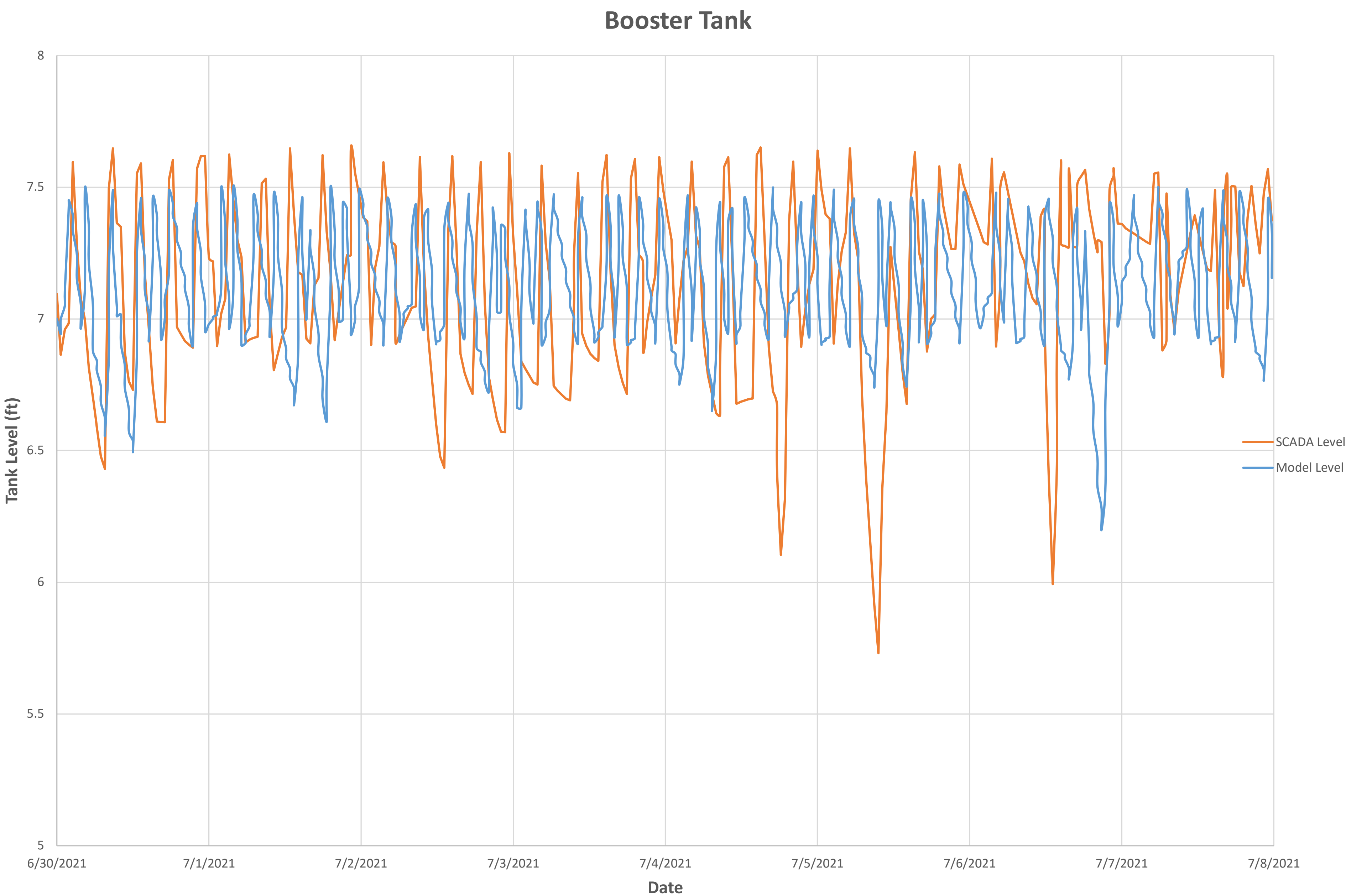


APPENDIX B

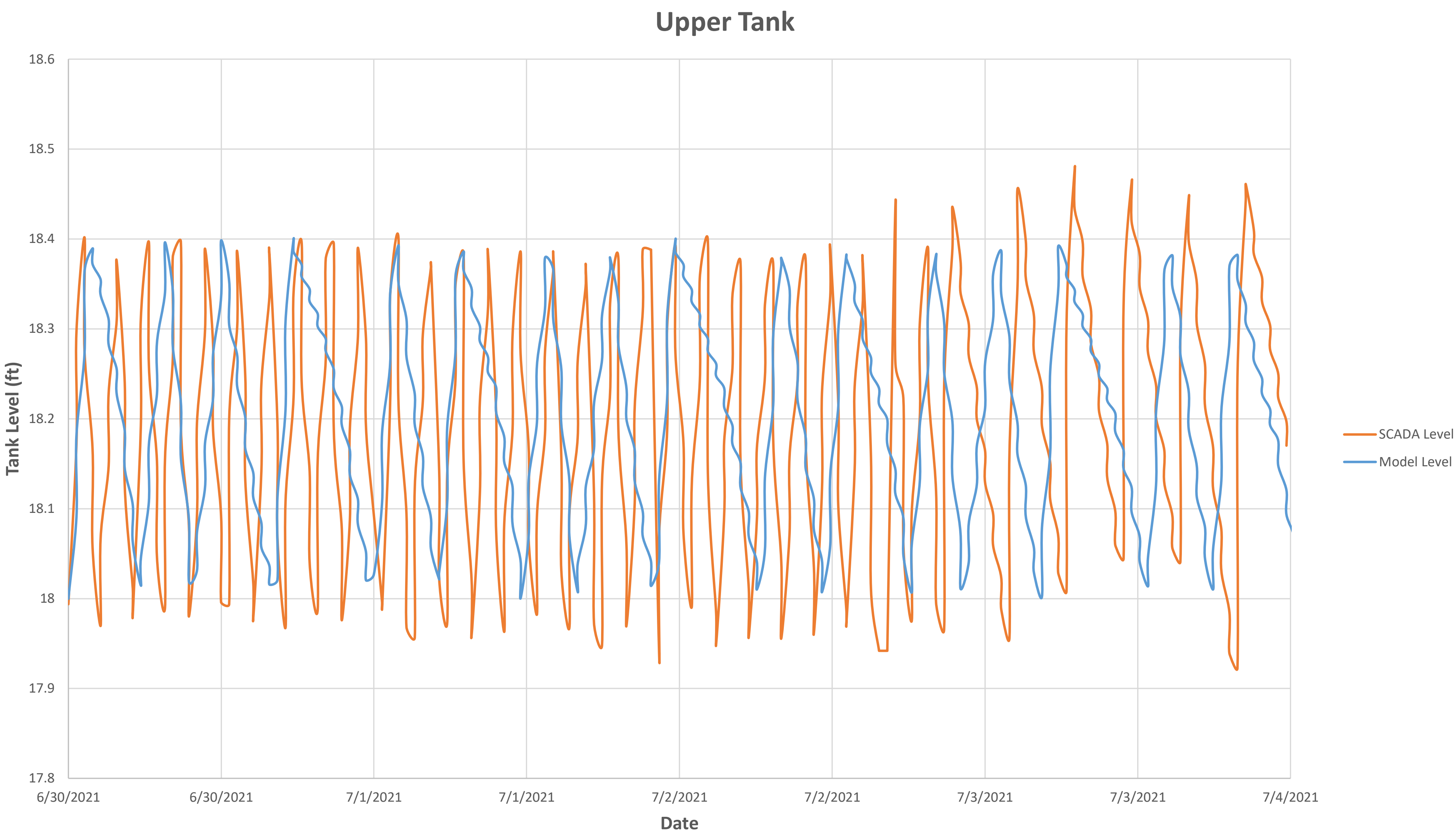
Hydraulic Model Calibration Data



Golf Course Well
100
90
80
70
60
50
40
30
20
10
0
6/30/2021 0:00
7/1/2021 0:00
7/2/2021 0:00
7/3/2021 0:00
7/4/2021 0:00
7/5/2021 0:00
7/6/2021 0:00
7/7/2021 0:00
7/8/2021 0:00
SCADA Flow
Model Flow



Booster Tank
Tank Level (ft)
8
7.5
7
6.5
6
5.5
5
6/30/2021
7/1/2021
7/2/2021
7/3/2021
7/4/2021
7/5/2021
7/6/2021
7/7/2021
7/8/2021
Date
SCADA Level
Model Level


Upper Tank
Tank Level (ft)
18.6
18.5
18.4
18.3
18.2
18.1
18
17.9
17.8
6/30/2021
6/30/2021
7/1/2021
7/1/2021
7/2/2021
7/2/2021
7/3/2021
7/3/2021
7/4/2021
Date
SCADA Level
Model Level

APPENDIX C

Estimated Project Costs

SMSSD Drinking Water Projects
Water Recommended Improvements
Preliminary Engineers Cost Estimates

	Item	Unit	Unit Price	Quantity	Total Price
1-1	***Area 1 Storage Capacity Upgrade***				
	Tank	GAL	$ 1.75	250000	$ 437,500
				Engineering & Admin. (10%)	$ 43,750
				Contingency (10%)	$ 43,750
				Total to Area 1 Storage Capacity Upgrade	**$ 530,000**
1-2	***Equip Cottonwood Springs for Use***				
	4" Water Line	LF	$ 135	5800	$ 784,648
	Develop Springs and Construct Connection	LS	$ 300,000	1	$ 300,000
				Engineering & Admin. (10%)	$ 108,465
				Contingency (10%)	$ 108,465
				Total to Equip Cottonwood Springs for Use	**$ 1,300,000**
				Total Costs for Area 1	**$ 1,830,000**
2-1	***Area 2 Transmission Upgrades***				
	8" Water Line	LF	$ 170	62500	$ 10,640,188
	6" PRV	EA	$ 30,000	16	$ 480,000
				Engineering & Admin. (10%)	$ 1,112,019
				Contingency (10%)	$ 1,112,019
				Total to Area 2 Transmission Upgrades	**$ 13,340,000**
2-2	***Area 2 Source Capacity Upgrade***				
	Well Drilling and Development (50 gpm)	EA	$ 192,000	1	$ 192,000
	Well Equipment and Well House	EA	$ 400,000	1	$ 400,000
				Engineering & Admin. (10%)	$ 59,200
				Contingency (10%)	$ 59,200
				Total to Area 2 Source Capacity Upgrade	**$ 710,000**
2-3	***Area 2 Storage Capacity Upgrade***				
	Tank	GAL	$ 1.75	325000	$ 568,750
				Engineering & Admin. (10%)	$ 56,875
				Contingency (10%)	$ 56,875
				Total to Area 2 Storage Capacity Upgrade	**$ 680,000**
				Total Costs for Area 2	**$ 14,730,000**
3-1	***Area 3 Transmission Upgrades***				
	8" Water Line	LF	$ 170	26500	$ 4,511,440
	6" PRV	EA	$ 30,000	8	$ 240,000
				Engineering & Admin. (10%)	$ 475,144
				Contingency (10%)	$ 475,144
				Total to Area 3 Transmission Upgrades	**$ 5,700,000**
3-2	***Area 3 Source Capacity Upgrade***				
	Purchase of Colledge Well, upgrade to public drinking water source and re-equip to provide 75 gpm	EA	$ 95,000	1	$ 95,000
				Engineering & Admin. (10%)	$ 9,500
				Contingency (10%)	$ 9,500
				Total to Area 3 Source Capacity Upgrade	**$ 110,000**
3-3	***Area 3 Storage Capacity Upgrade***				
	Tank	GAL	$ 1.75	225000	$ 393,750
				Engineering & Admin. (10%)	$ 39,375
				Contingency (10%)	$ 39,375
				Total to Area 3 Storage Capacity Upgrade	**$ 470,000**
				Total Costs for Area 3	**$ 6,280,000**
				Total Costs	**$ 22,840,000**

APPENDIX D

Checklist for Hydraulic Modeling Design Elements Report

APPENDIX

CHECKLIST FOR HYDRAULIC MODEL DESIGN ELEMENTS REPORT

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

Skyline Mountain Special Service District Master Plan

(Project Name or Description)

20043

(Water System Number)

Skyline Mountain SSD Drinking Water System

(Water System Name)

September 7, 2022

(Date)

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

1. The Report contains:

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

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

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

(d) A listing of the various pipeline sizes within the distribution system with their associated pipe materials and, if readily available, the approximate length of pipe in each size and material category. A schematic of the distribution piping showing node points, elevations, length and size of lines, pressure zones, demands, and coefficients used for the hydraulic analysis required by (h) below will suffice. *[R309-110-4 "Master Plan" definition]* ☒ ______

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

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

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

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

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

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

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

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

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

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

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

8. Any control valves or other system features that could significantly affect the flow of water through the distribution system (i.e. interconnections with other systems, pressure reducing valves between pressure zones) for various operating conditions are included in the model. *[R309-511-5(7)]* ☒ ______

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

10. The hydraulic model incorporates the appropriate demand requirements as specified in *R309-510, Minimum Sizing Requirements*, and *R309-511, Hydraulic Modeling Requirements*, in the evaluation of various operating conditions of the public drinking water system. The Report includes:
    - the methodology used for calculating demand and allocating it to the model;
    - a summary of pipe length by diameter;

- a hydraulic schematic of the distribution piping showing pressure zones, general pipe connectivity between facilities and pressure zones, storage, elevation, and sources; and
- a list or ranges of values of friction coefficient used in the hydraulic model according to pipe material and condition in the system. In accordance with Rule stipulation, all coefficients of friction used in the hydraulic analysis are consistent with standard practices.

  [R309-511-7(4)] ☒ ______

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

12. The Hydraulic Model Design Elements Report includes a statement regarding whether fire hydrants exist within the system. Where fire hydrants are connected to the distribution system, the model incorporates required fire suppression flow standards. The statement that appears in the Report also identifies the local fire authority's name, address, and contact information, as well as the standards for fire flow and duration explicitly adopted from *R309-510-9(4), Fireflow,* or alternatively established by the local fire suppression agency, pursuant to *R309-510-9(4), Fireflow.* The Hydraulic Model Design Elements Report explains if a steady-state model was deemed sufficient for residential fire suppression demand, or acknowledges that significant fire suppression demand warrants extended model simulations and explains the run time used in the simulations for the period of the anticipated fire event. *[R309-511-5(10) & R309-511-7(5)]* ☒ ______

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

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

    ☒ ______

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

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

17. The Hydraulic Model Design Elements Report identifies the hydraulic modeling method, and if computer software was used, the Report identifies the software name and version used. *[R309-511-6(1)(f)]* ☒ ______

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

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

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

21. The velocities in the model are not excessive and are within industry standards. ☒ ______

APPENDIX E

Preliminary Office Building Site Plan

FILE NAME: PROJECTS\299 – SKYLINE MOUNTAIN SSD\09.100 MASTER PLAN\CAD\G-1 SITE PLAN.DWG
FILE DATE: 9.8.2022 09:44:52 (DCL)

10/07

HANSEN ALLEN & LUCE INC
ENGINEERS

PROJECT ENGINEER

DESIGNED RJG	3				
DRAFTED DCL	2				
CHECKED RJG	1				
DATE SEPTEMBER 2022	NO.	DATE	REVISIONS	BY	APVD.

SCALE
AS SHOWN

SKYLINE MOUNTAIN SSD
2201 SMR
FAIRVIEW, UTAH 84629

SKYLINE MOUNTAIN SSD
SITE PLAN
OFFICE BUILDING & FILL STATION

SHEET
1
299.09.100

SMSSD
Office Building
Preliminary Engineers Cost Estimates

	Item	Unit	Unit Price	Quantity	Total Price
O-1	***Office Building - Low Range***				
	Office Building	SF	$ 150.00	1728	$ 259,200
				Engineering & Admin. (10%)	$ 25,920
				Contingency (10%)	$ 25,920
				Total to Office Building - Low Range	**$ 310,000**
O-1	***Office Building - High Range***				
	Office Building	SF	$ 500.00	1728	$ 864,000
				Engineering & Admin. (10%)	$ 86,400
				Contingency (10%)	$ 86,400
				Total to Office Building - High Range	**$ 1,040,000**