WATER UTILITY MASTER PLAN

Sierra Lakes County Water District

January 2024

Prepared for:

Sierra Lakes County Water District
7305 Short Road
Soda Springs, CA 95728

Prepared by:

DOWL

5510 Longley Lane
Reno, NV 89511

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Water Utility Master Plan

Prepared for:

Sierra Lakes County Water District

No. C 76284
Exp. 6/30/24
CIVIL
STATE OF CALIFORNIA

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Luke Tipton, P.E.

DOWL

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EXECUTIVE SUMMARY

Sierra Lakes County Water District (SLCWD/the District) operates a community water system located approximately one mile south of Soda Springs, California, an area of approximately 2,450 acres and contains 1,068 lots. The primary source of water is surface water from Lake Serena. A secondary source from a groundwater well (Well 01) is used when needed to supplement Lake Serena. This water system master plan (Plan) documents system trends and capacity, infrastructure condition and performance, and provides a plan for near and long-term capital improvement and replacement needs. This executive summary provides a snapshot of the key findings from each section of the Plan. In total, the Plan is comprised of five sections detailing the source, disinfection, storage, and distribution components of the water system.

SECTION 1.0 – SYSTEM DEMANDS

The District currently provides service to 840 residential and commercial customers within its service area. The customers are currently not individually metered, but the District is performing a metering project that will have the entire system metered by 2025. Additionally, due to the highly transient nature of the District population, it is estimated that between 73% and 90% of the customer connections are transient and only using water for a part of the year.

Annual water demands range from 16.48 to 27.27 million gallons (MG) per year. Average day demands average 40.91 gallons per minute (gpm). Maximum day demands are 2.66 times higher than average demands, with peak hour demands approximately 4.16 times higher than average. A summary of existing demands is shown in Table ES-1.

Table ES-1 : Water Demand Summary

System Demand	2020	2021	2022	2023	Average
Average Annual Demand (MG/year)	27.27	21.51	20.73	16.48	21.50
Average Day Demand (gpm)	51.89	40.93	39.44	31.35	40.91
Max Day Demand (gpm)	128.25	107.81	98.44	101.43	108.98
Peak Hour Demand (gpm)	200.07	168.18	153.57	158.22	170.01

Per data provided by SLCWD staff, there are 181 vacant parcels that can be added to the existing demand. All 181 of the parcels are residential. If the District were to add all 181 potential customers at buildout, SLCWD system demands would increase by 21.5 percent. A comparison of the existing and projected buildout demands is shown in Table ES-2.

Table ES-2: Existing and Future System Demand Summary

System Demand	Existing System	Projected Buildout
Average Annual Demand (MG/year)	21.50	26.14
Average Day Demand (gpm)	40.91	49.73
Max Day Demand (gpm)	108.98	132.46
Peak Hour Demand (gpm)	170.01	206.64

SECTION 2.0 – WATER RESOURCES

The District is primarily served by surface water from Lake Serena and supplemented by one groundwater well. The Ice Lakes Dam was constructed in the 1940s and raises the water in Lake Serena, and the adjacent Lake Dulzura to the south. When the water surface elevation of the two lakes surpasses 6,869 feet, the narrow isthmus separating the two lakes becomes submerged, connecting the two lakes. The combined lake is commonly known as Ice Lakes or Serene Lakes. According to a bathometric survey completed in 2007, the combined volume of the two lakes is 783 acre-feet (AF).

Water from Lake Serena is extracted at the north end through a submerged intake pipe and then pumped to the Lake Serena Water Treatment Plant (WTP). From there it is treated and distributed to SLCWD customers. The District has surface water rights authorizing a direct diversion of 340 gpm and an annual diversion limit of 394 AF annually.

The District's sole groundwater well, Well 01, was previously an emergency water source only. In 2021, SLCWD installed an arsenic treatment skid and petitioned to have the well become an active primary source. The request was granted by the State Water Resources Control Board (SWRCB) under the stipulation that the well not be run for two or more consecutive days without first notifying the SWRCB.

SECTION 3.0 – WATER TREATMENT FACILITIES

Currently, the District owns and operates the Lake Serena WTP to disinfect and treat the surface water pulled from Lake Serena and brought to the WTP through the intake pump station located at the north end of Lake Serena. The WTP has a maximum treatment capacity of 350 gpm and the raw water is supplied by two pumps at the intake pump station. While the WTP is able to treat up to 350 gpm, due to the low demands in the system the pumps at the intake pump station are operated using variable frequency drives (VFDs) and are throttled down to provide 150 gpm to the WTP. The plant is adequate to meet the projected buildout peak demands.

The treatment of the surface water begins at the intake pump station where two chemicals are injected into the raw water before being pumped to the WTP. Soda ash is used for pH control and potassium permanganate is used to control odor in the raw water. The raw water is then treated at the Lake Serena WTP, which is comprised of a contact clarifier, three direct pressure filters, and chemical injection. Chlorine is injected into the treated water for disinfection, and zinc orthophosphate is also added to help mitigate corrosion in the distribution system which is comprised mostly of asbestos concrete pipe.

Well 01 has a dedicated arsenic treatment skid located within the well house. The treatment skid is comprised of four Isolux adsorption filters with a treatment capacity of 25 gpm each. While the total treatment capacity of the skid is 100 gpm, Well 01 has a pumping capacity of only 60 gpm. The skid also includes the injection of a calcium chloride solution and filtration necessary to combat the high concentration of silica in the groundwater.

The Lake Serena WTP is not fully automated and will only run when operations staff are present. This limits water production to the operations staff working days of Monday through Friday. Operations staff ensure that all system tanks are at maximum prior to the weekend to ensure adequate water supply for Saturday and Sunday.

Overall, the finished water quality from the Lake Serena WTP meets all state and federal regulatory standards. However, there has been a rise in disinfection byproducts in recent water quality samples taken.

SECTION 4.0 – SYSTEM OVERVIEW AND CAPACITY ANALYSIS

The system operates by pulling source water from Lake Serena, treating it at the WTP, and then moving the treated water to the Office Tank. Water is then pumped from the Office Tank to the Hill Tank. Water is then distributed by gravity to the entire system from the Hill Tank.

System capacity for both the existing system demand and projected buildout demand scenarios of the water system was determined using two different methodologies. First, a storage and supply analysis of the system was used to verify that capacity was available to serve the system connections. Second, water pressure, pipe velocity, and system fire flow analyses were used to determine if the distribution infrastructure was sufficient to convey the necessary water to meet the system demands. Per the calculations performed the system has adequate storage and supply capacity for both Maximum Day and Peak Hourly demand scenarios. Table ES-3 shows the remaining capacity for all scenarios calculated.

Table ES-3: Existing and Buildout System Storage and Supply Capacity Summary

Demand Scenario	MDD Remaining Capacity (gal)	PHD Remaining Capacity (gal)
Existing	661,071	573,189
Buildout	604,416	497,598

Water pressure within the system was greater than 20 psi for both existing and buildout demands during the various demand scenarios modeled (i.e., average day, max day, and peak hour). The fire flow analysis performed showed that several hydrants throughout the system have fire flows less than 1,000 gpm. Table ES-4 summarizes the available fire flow distribution during the existing and buildout scenarios.

Table ES-4: Existing and Buildout System Fire Flow Summary

Fire Flow Range (gpm)	Number of Hydrants at Existing	Number of Hydrants at Buildout
Less than 500	1	1
500 to 1,000	6	7
1,000 to 1,500	18	17
1,500 to 2,000	32	33
Greater than 2,000	23	22

The main issue of the SLCWD distribution system is not capacity related. The system is comprised of aging asbestos concrete pipe that is failing. District staff report that leaks and bursts of the water mains have become more frequent. Additionally, many of the older service saddles on these mains have begun to fail as well.

SECTION 5.0 – CAPITAL IMPROVEMENT PROGRAM

In general, the water system is in need of several capital improvement projects in order to address the system deficiencies. Primarily the replacement of the aging asbestos concrete mains to safeguard the system from costly emergency repairs and water loss. The findings and recommendations of the Plan have been compiled into ten improvement projects or programs which will provide the District with a robust and resilient water system. The 10-year capital improvement program can be found in Table ES-5. The 10-year program totals $33,134,000.

It is recommended that this master plan be updated at least once every ten years so that the capital improvement program is representative of system needs.

Table ES-5: 10-Year Capital Improvement Program:

Project	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Water Main Replacement PER	$104,000									
Intake Pipe Extension	$332,000									
Utility Rate Study	$26,000									
System GIS	$9,000									
Water Main Replacement Phase 1		$2,987,000								
Water Age and WTP Process Analysis		$76,000								
Water Main Replacement Phase 2			$3,101,000							
Well 01 Treatment Relocation & Discharge Line			$694,000							
Raw Water Line Leak Detection & Investigation			$56,000							
Water Main Replacement Phase 3				$3,218,000						
WTP SCADA Improvements				$29,000						
KMNO4 Titration Unit Replacement				$29,000						
Hill Tank Flow Meter				$239,000						
Water Main Replacement Phase 4					$3,341,000					
Water Main Replacement Phase 5						$3,468,000				
Water Main Replacement Phase 6							$3,599,000			
Water Main Replacement Phase 7								$3,736,000		
Water Main Replacement Phase 8									$3,878,000	
Water Main Replacement Phase 9										$4,026,000
Water System Master Plan Update										$290,000
Total Annual Capital Cost	**$471,000**	**$3,063,000**	**$3,851,000**	**$3,515,000**	**$3,341,000**	**$3,468,000**	**$3,599,000**	**$3,736,000**	**$3,878,000**	**$4,316,000**

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1.0 SYSTEM DEMANDS

1.1 Customer Profile

The Sierra Lakes County Water District (SLCWD/the District) operates a community water system located approximately one mile south of Soda Springs, California (CA). The District service area is 2,450 acres and contains 1,068 lots (Plan area). The SLCWD system is classified as a community water system, but the population is highly transient. The percentage of transient connections within the system is estimated to be between 76 percent (per CA Drinking Water Watch) and 90 percent (per SLCWD staff). The system is only partially metered as of January 2024, so no accurate estimates of the number of transient connections can be made at this time.

Of the 1,068 total lots within the District, 840 are developed and connected to the District water system. Other lots in the District service area include vacant parcels, and land designated as “Other” or “Restricted” by SLCWD staff. These lots are primarily land owned by SLCWD, a maintenance yard owned by Placer County, land preserved by the Truckee Donner Land Trust, or other private parties. Table gives a summary of the lot types and the number of each.

Table 1: District Lot Type Summary

Lot Type	# Of Lots
Connected Property	840
Other	11
Restricted	36
Vacant	181
Total	**1,068**

For the purposes of this Plan, it is assumed that SLCWD has 840 water customers, with the potential to increase by a count of 181. Of the existing water customers, two customer types are defined by the District: residential and commercial. The vast majority of existing water customers are residential, with only 4 of the 840 being commercial.

1.2 Customer Usage and System Supply

SLCWD maintains and operates two water production sources, one surface water and one groundwater, to provide the community with water. The primary source of water is surface water pulled from Lake Serena by two intake pumps located in a building on the north side of the lake. This surface water is then treated by the system water treatment plant (WTP) prior to distribution.

The secondary water source is a groundwater production well located near the WTP. Until recently, the well was designated as an emergency standby source, and could only be operated at a maximum of 15 days per year. As of September 2021, the well has been designated an active permanent source. However, water from the well may be corrosive to metal pipes, so it is subject to increased chemical monitoring and cannot be operated more than two consecutive days as the SLCWD sole source without first notifying the State Water Resources Control Board (SWRCB).

1.2.1 Water Production

Water production is the volume of water measured at the water source (e.g., water pumped from Lake Serena or the groundwater well). Since production data was not explicitly provided, it was assumed that the volume of water treated at the WTP was equal to water production (i.e., no water is lost along the transmission main from the lake intake and groundwater well to the WTP). Table 2 presents the monthly water production, in millions of gallons (MG), for the system. Data from December 2020 was removed from the analysis due to unknown errors within the recorded data.

Table 2: Monthly Water Production (MG), 2020-2023

Month	2020	2021	2022	2023	Average
January	2.14	2.20	1.99	1.68	2.00
February	1.95	1.93	1.90	1.73	1.88
March	1.84	2.00	1.70	1.61	1.79
April	1.78	1.51	1.33	1.82	1.61
May	1.92	1.37	1.45	1.28	1.51
June	2.87	2.60	2.07	1.60	2.28
July	4.69	3.32	2.45	2.48	3.23
August	4.30	2.39	2.53	2.15	2.84
September	3.15	1.64	2.20	1.22	2.05
October	2.41	1.20	1.92	1.03	1.64
November	1.93	1.32	1.13	0.98	1.34
December	n/a	1.75	1.68	1.17	1.70
Total	**28.98**	**23.23**	**22.35**	**18.75**	**23.87**

The overall trend of water usage throughout the year is fairly common when compared to other potable water systems in the area. Figure 1 shows the average monthly water production from Lake Serena for the period of 2020 to 2023. Like most utility systems in the area, peak usage months occur in the warmer summer months. However, water usage within the District for warmer months is driven by seasonal population changes due to recreation, rather than an increase in irrigation as seen in most typical water systems. This results in lower water usage numbers for April and May than might be typically seen for systems that utilize high irrigation usage.

Due to the transient nature of the SLCWD populations, a spike in water usage is seen during the months of December and January, with usage tailing off until the warmer months. This can again be attributed to the high number of transient residents utilizing their properties during winter holidays. Overall, the peak average month (July) sees approximately 2.4 times the production as the lowest average month (November).

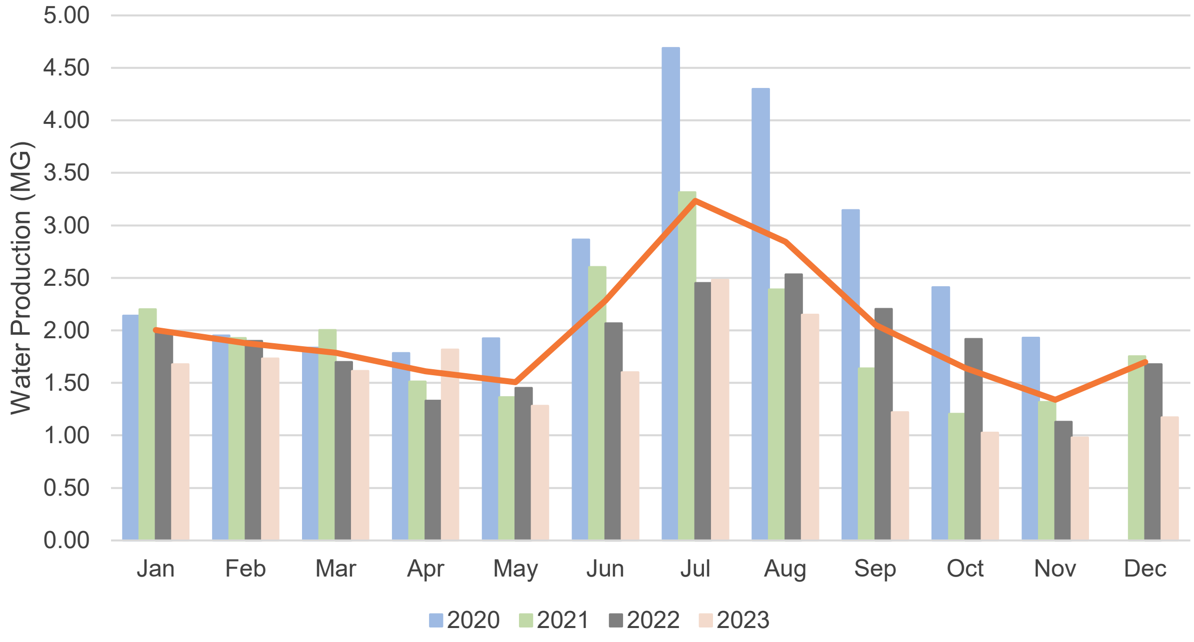

Figure 1: Average Monthly Water Production (MG), 2020-2023

1.2.2 Customer Usage

Currently, the SLCWD is undergoing a project to install water meters on all customer services to begin metering water usage and adjust water rates accordingly. As such, water service is billed at a flat rate per year as of the writing of this Plan. Given that individual water meter data was not available to calculate customer demands, an estimation was made in order to determine how much water was consumed by the District customers for each month.

SLCWD operations staff utilize potable water to backwash the water treatment filters. This volume of water is recorded daily, along with the total water volume treated, and the change in volume of the SLCWD system tank. The following equation was then used to estimate customer usage:

Customer Usage (gal)= Treated Water-Change in Tank Volume-Backwash Water

Table 3 presents the monthly customer water usage for the system. Data from December 2020 was removed from the analysis due to unknown errors within the recorded data.

Table 3: Monthly Customer Water Usage (MG), 2020-2023

Month	2020	2021	2022	2023	Average
January	1.85	2.14	1.79	1.49	1.82
February	1.80	1.79	1.80	1.53	1.73
March	1.72	1.74	1.54	1.27	1.57
April	1.66	1.29	1.27	1.27	1.37
May	1.96	1.34	1.34	1.05	1.42
June	2.77	2.36	1.76	1.39	2.07
July	4.41	3.23	2.54	2.39	3.14
August	4.21	2.09	2.32	1.89	2.63
September	2.86	1.50	2.04	1.27	1.92
October	2.29	1.19	1.70	0.98	1.54
November	1.75	1.19	1.02	0.81	1.19
December	n/a	1.65	1.61	1.14	1.11
Total	**27.28**	**21.51**	**20.73**	**16.48**	**21.50**

1.2.3 Non-Revenue Water

Non-revenue water (NRW) is the difference between the quantity of water produced and the quantity of water delivered to customers or billed. NRW is not the same as water loss, as losses are only a component of NRW. Revenue water is the inverse of NRW and is the percentage of pumped water read at the meter.

Due to the SLCWD system currently being unmetered, customer demand cannot be determined at the point of usage by a meter. As NRW cannot be calculated due to the lack of data, water losses through leaks were estimated using the most recent water leak detection project from 2017, attached in Appendix A. Approximately 12 miles or 63,360 feet of pipe (approximately 92 percent of the systems total pipe) within the distribution system were surveyed. Three total leaks were pinpointed and the data from the leak detection survey is summarized in Table 4 below.

Table 4: 2017 Leak Detection Summary

Location	Leak Type	Leak Classification*	Estimated Water Loss (gpm)
9349 Pahatsi Rd	Service Line	II	5.00
5409 Hillside Dr	Service Line	II	2.00
6134 Cascade Rd	Service Line	II	2.00

**All identified leaks were classified as a leak repair priority classification II. As stated within the leak detection report, classification II leaks include "All leaks that display water losses significant enough to be monitored on a regular repair schedule".*

After discussion with SLCWD operations staff, it was confirmed that the leak at 9349 Pahatsi Rd was repaired. However, it is unknown if the other two leaks were repaired. It was assumed that these two leaks have not been repaired. Based on these assumptions, the leaks are causing 5,760 gallons of water lost per day, which is 9.8 percent of the average daily water usage.

Typical NRW nationally has been estimated between 14 to 18 percent by the American Water Works Association (AWWA) and the Environmental Protection Agency (EPA). While the estimated water losses for SLCWD are well below that, the 8.8 percent estimated does not encompass the full breadth of NRW for the system. Additionally, the two leaks identified were located on service lines, not the main distribution system. Once the system is fully metered, NRW should be fully calculated, and this Plan updated to reflect the results.

1.3 System Demand and Peaking Factors

The average customer water usage from 2020 through 2023 was 21.50 MG/year, which is equal to an average flow rate of 40.91 gallons per minute (gpm). Figure 2 shows the monthly average flow rate in the system during this time period. The monthly average flow rate provides the seasonal demand curve. This seasonal demand curve is typical and shows increased system demand during warmer months and reduced demand during cooler months, primarily due to seasonal visitation and the transient nature of the SLCWD population. The maximum average customer water usage in July is 2.6 times greater than the minimum average wintertime production in November.

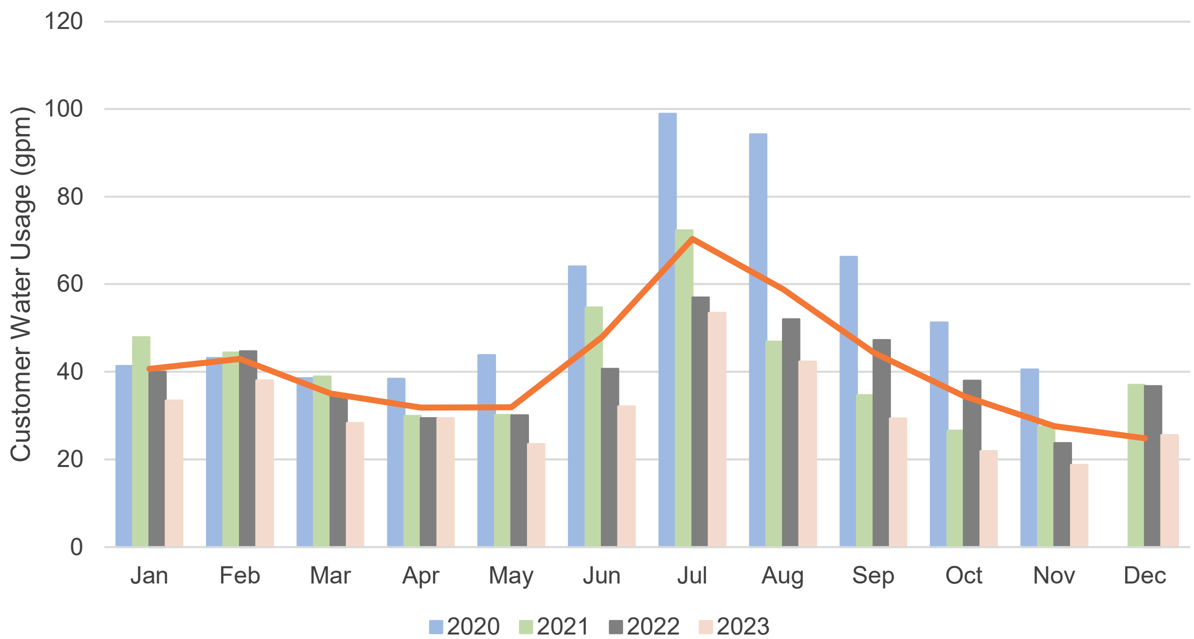

Figure 2: Average Monthly Customer Water Usage (gpm), 2020-2023

Water demands for a system are typically presented in five ways:

- Average Annual Demand (AAD)
- Average Day Demand (ADD)
- Maximum Month Demand (MMD)

- Maximum Day Demand (MDD)
- Peak Hour Demand (PHD)

For the purposes of this Plan, water demand factors are based on the customer water usage data summarized above. The AAD, stated above, was 21.50 MG per year. Therefore, the ADD for the Plan was 40.91 gpm. The MDD for the Plan was calculated by averaging the four largest daily customer water usages, one for each year. Due to a water main break on June 20, 2022, data recorded during that day was removed from the analysis.

PHD was calculated using Supervisory Control and Data Acquisition (SCADA) data provided by SLCWD for October 2021 to July 2022. The data was used to determine the average hourly peaking factor and average diurnal curve for the system. The largest hourly peaking factor from the average daily diurnal was then multiplied by the MDD to ADD peaking factor to determine the PHD peaking factor for each year and the average. For example, the largest hourly peaking factor for the average day across all three years is 1.56. This peaking factor multiplied by the 2020 MDD to ADD peaking factor of 2.47 gives a PHD to ADD peaking factor of 3.86. Table 5 summarizes the system demands and peaking factors that will be used in this Plan.

Table 5: Water Demand Summary

System Demand	2020	2021	2022	2023	Average
AAD (MG/year)	27.27	21.51	20.73	16.48	21.50
ADD (gpm)	51.89	40.93	39.44	31.35	40.91
MDD (gpm)	128.25	107.81	98.44	101.43	108.98
MMD (gpm)	105.04	74.28	56.73	55.61	72.92
PHD (gpm)	200.07	168.18	153.57	158.22	170.01
MDD:ADD PF	2.47	2.63	2.50	3.24	2.66
MMD:ADD PF	2.02	1.82	1.44	1.77	1.78
PHD:ADD PF	3.86	4.11	3.89	5.05	4.16

Additionally, the average diurnal curve for the system is shown in Figure 3. The average curve for the system is unique in that it does not have two periods of peak usage that is normally seen for residential communities. Rather, the District sees its highest period of water usage only in the morning, before slowly tailing off as the day moves on. This is another indication of the transient nature of the population, in that homes are being occupied and water being used during recreational periods, rather than long term residents that may leave homes during the day and return in the evening.

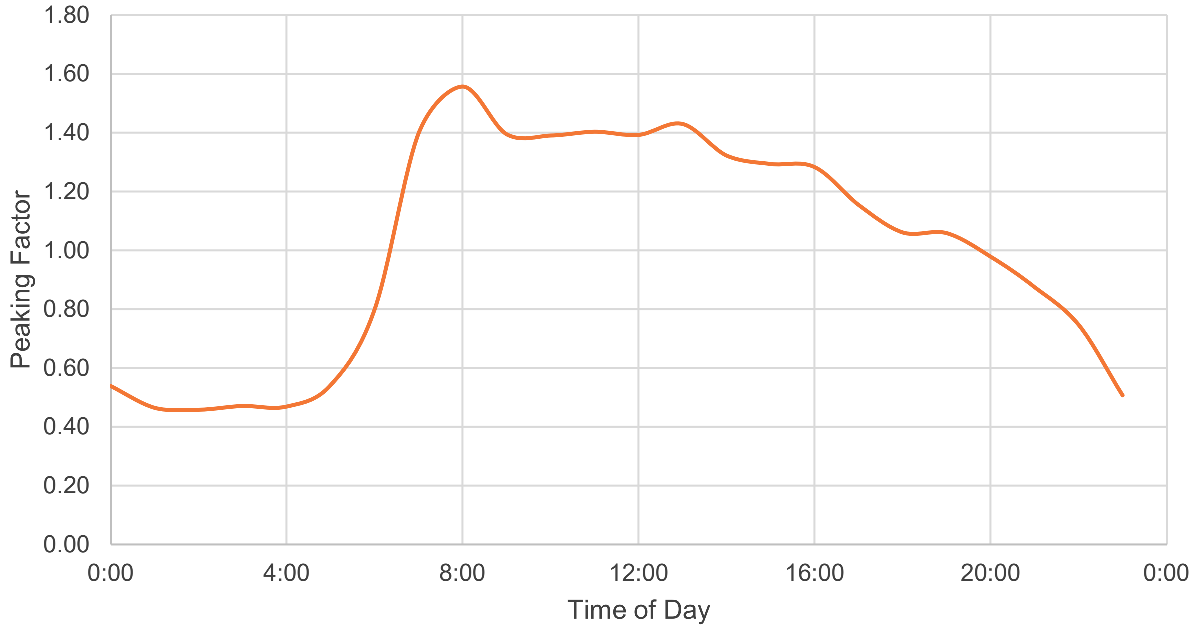

Figure 3: Average Diurnal Curve

Additional analysis was performed to determine the effects of the transient population on water demand. Calculated water demands were categorized by the day of the week, and water usage during the weekend was compared to water usage the rest of the week. The weekend to weekday peaking factors for all months analyzed can be found in Table 6. Diurnal curves for average weekday usage and average weekend usage were also calculated and are shown in Figure 4.

As shown, the two diurnal curves are somewhat similar, but weekday usage sees a larger spike initially and a more rapid decline in usage throughout the day. Weekend usage stays more consistent and has a profile that more closely mirrors the dual peaks seen in typical residential communities.

Table 6: Weekend to Weekday Peaking Factors

Month	2020	2021	2022	2023	Average
January	1.48	1.49	1.43	1.18	1.42
February	1.66	1.54	1.49	1.26	1.52
March	1.37	1.43	1.19	0.88	1.24
April	1.18	1.08	0.95	0.92	1.04
May	1.34	0.96	0.94	0.67	1.01
June	2.04	1.72	1.12	0.92	1.48
July	2.94	2.20	1.71	1.64	2.14
August	2.85	1.38	1.56	1.30	1.86
September	2.25	1.10	1.33	0.96	1.42
October	1.59	0.80	1.03	0.64	1.03
November	1.25	0.84	0.73	0.59	0.88
December	n/a	0.91	0.95	0.78	0.92

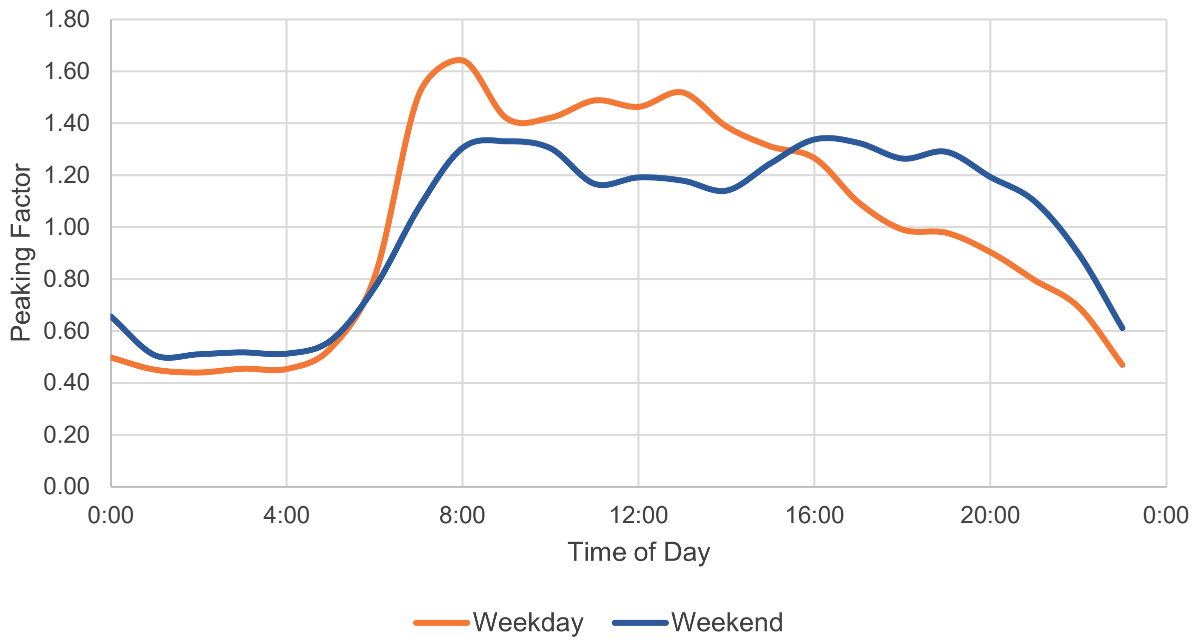

Figure 4: Weekday and Weekend Diurnal Curves

1.4 Water Demand Characterization

Land use types were analyzed to determine an average flow per Equivalent Dwelling Unit (EDU) for the Plan area. An EDU is a unit of measurement used to assess system size for planning purposes. This approach provides a normalization of system demands to the volume of water used by a single-family home or dwelling unit.

The current 2023 property list was joined with the Geographic Information System (GIS) parcel database using the assessor's parcel number (APN). Due to imperfect matching of the data, 1,064 out of 1,068 properties matched to the parcel data. However, it was determined that this match was sufficient to calculate a representative water demand profile for the Plan area. Table 7 summarizes the current land use associated with each parcel listed within SLCWD's property list.

Table 7: Service Area Land Use

Property Type	Residential Count	Area (ac)	Commercial Count	Area (ac)	Unknown Count	Area (ac)
Connected Customers	828	192.5	4	7.1	8	1.9
Vacant Land	180	39.9	0	0.0	1	0.8
Trust Land	0	0.0	1	5.7	10	2,067.5
Restricted Land[1]	14	2.5	19	98.1	0	0.0
Unbuildable Land	0	0.0	0	0.0	3[2]	Unk

[1]Restricted land require additional assessments, as identified by SLCWD, before being built.
[2]Three out of the four properties that did not match within GIS were classified as Unbuildable Land. The remaining property was classified as a Restricted Residential Land.

Given that over 95 percent of the existing customers, by area, and over 98 percent, by customer count, have a single-family residential land use; it was justified to apply an average flow per EDU to all existing customers within the Plan area. Table 8 presents the average flow per EDU calculation. The calculated EDU of 0.049 gpm also equates to 70 gpd per customer.

Table 8: Average Flow per EDU

ADD (gpm)	# Of Customers	Average Flow per EDU (gpm/EDU)
40.91	840	0.049

1.5 Future Water Demands

The buildout condition for the District was created by assuming that all lots in the District service area marked as "Vacant" would be developed at buildout. Future buildout demands were calculated by multiplying the vacant lot counts by the EDU of 70 gpd. All lots marked as vacant in the service area are residential. Table 9 gives the expected average demand to be added to the system by buildout.

Table 9: Additional Demands at Buildout

Vacant Lots	Additional Average Demand (gpd)
181	12,695

1.6 Water Demand Summary

The SLCWD service area water usage is expected to grow by 21.5 percent on average from existing to buildout. The water demands that will be utilized in this Plan for capacity analysis and hydraulic modeling are summarized in Table 10.

Table 10: Existing and Buildout Demand Summary

Demand Scenario	ADD (gpm)	MDD (gpm)	PHD (gpm)
Existing	40.91	108.98	170.01
Buildout	49.73	132.46	206.64

2.0 WATER RESOURCES

This section serves as a valuable guide for SLCWD, providing insights into its water systems water resources and water rights. The main purpose of this section is to outline the compliance criteria and regulatory standards that SLCWD must adhere to. Furthermore, it presents a detailed overview of SLCWD's water resources and provides an understanding of its water rights.

2.1 Water Resources

As the overseeing utility authority, SLCWD is responsible for managing water resources, which includes the acquisition, treatment, and distribution of water to consumers. The District operates as a CA Special District under the provisions outlined in CA Water Code Sections 30000-33901. Lake Serena serves as the primary drinking water source for the community, supplemented by one groundwater well.

Ice Lakes Dam was constructed in the 1940s on Serena Creek to raise the water level of the two natural lakes situated behind it. Over time, the dam has undergone several retrofitting efforts to enhance its structural integrity and increase its height for additional water storage capacity. Lake Serena, located to the north, and Lake Dulzura, situated to the south, both overflow into Serena Creek, eventually merging with the North Fork of the American River. The two lakes are separated by a narrow isthmus, which becomes submerged and unites the lakes when water levels exceed an elevation of 6,869 feet. This combined lake is commonly referred to as Ice Lakes or Serene Lakes. Throughout history, the water levels have typically remained high enough to keep the isthmus inundated. The combined capacity of the two lakes, as documented in a June 2007 bathymetric survey, is 783 acre-feet (AF). Ownership and operation of Ice Lakes Dam lies with the District, subject to annual inspections conducted by the CA Division of Dams.

The District pumps raw water from the lakes using a pump station located at the northern end of Serene Lakes. At the raw water pump station, pH adjustment and odor control through chemical adjustment occurs. The raw water pump station provides flow through the District water filtration plant located at the District office. While the treatment plant has a design capacity of 350 gpm, it is only operated at 150 gpm. Once the water has passed through the filtration plant, it is deposited into a tank adjacent to the plant (Office Tank), and subsequently pumped to an underground reservoir (Hill Tank) on the backside of the Soda Springs Ski Hill. The Hill Tank provides service and pressure via gravity to the District's customers. A more in-depth discussion on the characteristics and operations of the District treatment facility and distribution can be found in Sections 3.0 and 4.0.

In addition to the surface water pulled from Serene Lakes, the District utilizes a groundwater well located approximately 200 yards to the south of the District office. Prior to 2021, this groundwater well functioned entirely as an emergency water source for the District. Recent improvements to the well, including an arsenic treatment skid, have allowed the District to convert the well to a primary source. However, due to the corrosivity of the groundwater, the well is under stricter chemical monitoring, and the District may not operate the well more than two consecutive days as the sole source of the District without first notifying the SWRCB.

2.2 Water Rights

2.2.1 Surface Water

On January 3, 1964, the SWRCBs Division of Water Rights issued Permit 14248 to the District based on Application 20601. The permit stipulated that construction work must be completed by June 1, 1964, and the authorized use of water should commence by December 1, 1966. The permit granted SLCWD the ability to store up to 1,177 acre-feet annually (AFA) for municipal, industrial, fish culture, and recreational purposes. In an order dated May 15, 1991, the Division of Water Rights added industrial use for snowmaking purposes, allowing a daily allocation of 9,000 gallons per day (GPD) at the Royal Gorge Cross-Country Ski area between November 15 and December 31.

On December 27, 2005, SLCWD submitted a petition for a 10-year extension to complete construction work or apply water to beneficial use. Additionally, SLCWD sought to change a portion of its storage right to a direct diversion right for 220 gpm due to the Division's reservoir accounting rules. While the operational and diversion practices remained the same, the change was necessary to align with Water Code section 1605, which required the measurement of water diverted under the permit.

On October 4, 2011, the District revised its petitions for extension and change. SLCWD requested to modify the petitioned direct diversion rate from 200 gpm to 340 gpm. As a part of this petition, the District prepared a Negative Declaration (ND), SCH #2011102026. The ND describes the lake storage as follows:

> *Lake Serena and Lake Dulzura are natural lakes that overflow into Serena Creek. An isthmus separates the two lakes, and when water levels rise above an elevation of 6,869.0 feet, the isthmus becomes submerged, resulting in the merging of the two lakes into a single lake known as Ice Lakes and Serene Lakes. Ice Lakes Dam was initially constructed in the mid-20th century to raise the water level in the two natural lakes and has since undergone various retrofits to increase its height. Throughout history, the lake level has consistently remained high enough to keep the isthmus inundated, thereby combining the lakes. According to a June 2007 bathymetric survey, the combined capacity of the two lakes is 783 AF.*

Additionally, the ND stated that between 2000 and 2009, the District on average used 117.7 AFA, and that future water use is estimated to be 365 AFA. Review of the ND did not identify any terms for inclusion in the amended permit. After filing a Notice of Determination in December of 2011 and review by the State Water Board, the District was granted an amended permit authorizing direct diversion of 340 gpm, with the annual limit on direct diversion being 394 AFA.

2.2.2 Groundwater

CA does not have a permit process for regulation of groundwater use, and wells can be used to extract groundwater for beneficial use for overlying land without approval from the State Board or a court. As such, the District does not require specific water rights for the use of their groundwater. Additionally, the District is not located in defined groundwater basin per the State, and therefore is not subject to any regulation that may exist adjudicating the groundwater rights within the basin.

Utilizing groundwater to supplement the District water supply was first explored in 1981 with test drillings. The District then applied to amend their permit for domestic water supply to include a groundwater well as a secondary water supply source in 1982. The plans and specifications for Well 01 were approved in that same year. The well was drilled and installed in the early 1990’s and has received several updates since. Ultimately, the well-produced high levels of arsenic and the State limited usage of the well to 15 days per year as a supplementary source.

In 2021, the District applied to amend its permit to reclassify Well 01 from standby to an active source and provide arsenic treatment for the water produced by the well. The State approved this reclassification that same year. However, due to the corrosive nature of the water, SLCWD may not operate the well as the sole source for the system more than two days consecutively. Well 01 discharges into the 450,000-gallon office storage tank, which serves as a short-term buffer against the potentially corrosive water.

2.3 Water Quality

CA has implemented comprehensive water quality standards to safeguard public health and the environment, enforced by regulatory bodies such as the SWRCB and Regional Water Quality Control Boards. The CA Department of Public Health establishes primary drinking water standards, known as Maximum Contaminant Levels (MCLs), which define the maximum allowable levels of various contaminants in drinking water, including bacteria, chemicals, heavy metals, and other substances. These MCLs are regularly updated based on scientific research to ensure public health protection.

Public water systems relying on surface water must comply with the Surface Water Treatment Rule, which mandates filtration and disinfection of the source water and sets MCLs. At SLCWD's WTP, the water undergoes filtration and disinfection before entering the distribution system. Additionally, the raw water extracted from the lake undergoes pH adjustment and odor control measures at the intake pump station before reaching the WTP. Additional information on the SLCWD treatment plant can be found in Section 3.0. SLCWD's consumer confidence reports confirm that the District's water meets all drinking water standards set by the EPA and the state of CA.

On March 10, 2021, SLCWD submitted plans to the SWRCB for the installation of four adsorption filters on a treatment skid at Well 01 to remove arsenic from the groundwater supply in order to reclassify the well as an active water source. The Well 01 treatment skid is comprised of four Isolux filters, each capable of treating up to 25 gpm, for a total treatment capacity of 100 gpm. Additional information on the Well 01 treatment skid can be found in Section 3.0.

Water quality within the District has been more than adequate in the last several years. Per the SWRCB Drinking Water Watch database, SLCWD currently shows no group or individual violations. The SLCWD 2022 Consumer Confidence Report also shows that the District meets both primary and secondary drinking water standards. A copy of the 2022 Report can be found in Appendix B.

2.4 Source Water Reliability

SLCWD conducted a comprehensive water availability analysis to assess the total flow within the watershed. The study revealed that an average of 4,765 AFA of water originates from the headwaters, flows through Ice Lakes, and down the American River. Of this flow, approximately 8 percent can be diverted by the SLCWD, although historically, the District has utilized a much smaller portion to meet the needs of its customers.

Currently, the District treats and distributes water to approximately 840 connections within its service area boundaries. The anticipated future development within the SLCWD consists of infill residential development on the remaining 181 undeveloped lots. Per Section 1.5, at buildout the undeveloped lots would add 14,118 gpd or 15.8 AFA. Taking into account the current average water use of 73.2 AFA for the District, the projected new development would increase the total water use to 89 AFA. Importantly, this projected demand is significantly lower than the District's permitted water use of 394 AFA, indicating that the District's raw water supply is expected to be more than sufficient to meet the future buildout.

Due to the transient nature of the District population, it is not expected that existing annual demands will see large increases due to population increase. The vast majority of residences within SLCWD are either second homes, or short-term rental properties. SLCWD saw its highest water production year in 2020 due to more of the population utilizing their second properties as a result of the COVID-19 pandemic quarantine restrictions. Since 2020, SLCWD has seen a decrease in water production every year. This indicates that Serene Lakes will continue to be a reliable water source in the future.

While the lakes themselves prove to be a reliable source, infrastructure issues have been the limiting factor in water source reliability. The raw water intake line has been susceptible to freezing during the winter, forcing the District to rely on Well 01 for short periods of time. Due to the restrictions placed on Well 01 because of water quality issues, it is not considered a long-term source without putting the distribution system at risk of corrosion. Section 3.0 of this Plan provides a more in-depth explanation of these issues, as well as recommended solutions to improve the water source infrastructure reliability.

In the past, SLCWD informally explored the possibility of partnering with DSPUD and other service providers in the area for service provision. However, structural differences, such as voting requirements, have made the retention of these service providers as independent agencies more viable. SLCWD allows out-of-town property owners to vote on District issues, while DSPUD requires voters to be full-time residents of the District. These differences in voting structure have influenced the decision to maintain separate service providers.

2.5 Water Management Strategies

Currently, the District does not utilize individual customer water meters, but is actively installing water meters on customer lines. SLCWD has installed approximately 681 meters as of January 2024, with plans to have the system fully metered by 2025. This will allow the District to perform more advanced methods for calculating water loss and determining proper water conservation efforts. Given the multiyear drought affecting the state of CA, enacting water conservation measures will become more of a priority for the District in the coming years. However, until more useful water consumption data is produced, it is recommended that SLCWD continue to push forward with installing individual customer meters.

3.0 WATER TREATMENT FACILITIES

SLCWD currently operates two separate treatment trains for its two separate sources. The largest, and primary source for the system, is the Lake Serena WTP located at the District office on Short Road. The WTP treats surface water pumped from the lake via the Lake Serena intake pump station.

The second treatment train is an arsenic treatment skid installed at Well 01. Well 01 is also considered a primary source for the system, however it is rarely utilized due to the corrosive nature of the groundwater. SLCWD is restricted from running Well 01 as the sole source for their system for more than two consecutive days.

3.1 Lake Serena Water Treatment Plant

3.1.1 Intake Pump Station

Starting at Lake Serena, water is pumped out of the lake through the Lake Serena intake pump station. The intake pump station is comprised of two 350 gpm pumps utilizing variable frequency drives. Due to the low demands within the system, the pumps at the intake pump station are throttled down to provide only 150 gpm to the WTP.

The water treatment process begins within the intake pump station. Soda ash and potassium permanganate ($KMnO_4$) are injected into the raw water before being pumped to the WTP. Both chemicals provide different benefits to the raw water treatment process. Soda ash is used for pH control purposes by raising the pH levels of the water. The soda ash is titrated into the raw water to maintain a pH level of 7.5. The $KMnO_4$ is used to control odor in the raw water by oxidizing dissolved iron, manganese, and hydrogen sulfide.

The injection rate of the $KMnO_4$ cannot be monitored on a continuous basis. Previously, the titration rate for the chemical was monitored and controlled by an older Wallace & Tiernan Titrator located at the District operations office. However, the unit has been broken and inoperable for some time. District staff utilize the “Styrofoam cup” method on a daily basis to monitor the injection rate. Staff will fill up a white cup with water just downstream of the injection point and observe the water. If the water has a hint of pink to its color, it is considered to be injecting at a proper rate. However, as this can only be done when District staff is onsite, issues may arise. SLCWD has received complaints from a single customer located near the water system distribution tank that the water has left pink rings in their toilet. It is recommended that SLCWD replace the old titration unit with newer monitoring and control unit located in the

District office. Constant monitoring and control will be able to prevent over or under injection of $KMnO_4$ into the water supply.

3.1.1.1 Intake Pipe

A crucial part of the intake pump station is the intake pipe. The intake pipe extends approximately 320 feet from the intake pump station. This length covers the distance from the wet well in the pump house to the lake shore, to the end of the intake approximately 110 feet off the shoreline. The intake pipe is at an approximate depth of 9.5 feet, with the end of the pipe elevated approximately 2 feet from the bottom of the lake. This gives the actual water intake a depth of approximately 7.5 feet. The pipe material is assumed to be Polyvinyl Chloride (PVC), however tar coating on the pipe suggests two different materials have been joined together. The pipe size is either 10-inch or 12-inch depending on the source of information.

At a depth of 7.5 feet, the water intake is highly susceptible to variations in seasonal temperature. A technical study on the intake was performed in 2021 by Woodard & Curran, Inc. to determine the effects of temperature on the intake water and propose an improvement project and conceptual design. The findings of the study show that during the winter, the existing intake sees temperatures less than 0° C. SLCWD staff have noted that the existing intake pulls in both ice crystals and water during the winter. The slushy consistency of the water prevents the WTP from operating efficiently, resulting in increased chemical usage and backwashing in order to keep operations going. This results in increased working hours, water usage, and chemical costs for the District. Typically, if water temperature dips below freezing, the District will switch to Well 01 as its sole source.

The 2021 study proposed that SLCWD extend the intake pipe to a depth of 14 feet below the surface, and 2 to 3 feet above the lake bottom. Woodard & Curran also provide a conceptual design of the intake extension in the study. The full study can be found in Appendix C. It is recommended that SLCWD follow the recommendations of the study and extend the intake pipe to the recommended depth.

Should the District pursue extending the intake pipe, preliminary environmental permitting work would need to be completed before full design, permitting, and construction begins. While it may seem likely that the project would be categorically exempt from the California Environmental Quality Act (CEQA), it is an unknown until there is some agency consultation. Once preliminary agency consultation is completed, the results will guide permitting processes and costs.

3.1.2 Water Treatment Plant

At the WTP, a polymer coagulant is added to the water before it flows through a contact clarifier and three direct pressure filters, operating in parallel. The total plant capacity is 350 gpm. Once the water has gone through the clarifier and filters, it is disinfected with chlorine. Zinc orthophosphate is also added to help mitigate corrosion in the distribution system.

The treated water is then deposited into the Office Tank for chlorine contact time before being pumped to the Hill Tank for distribution. During periods of maintenance or during emergency situations, existing valves at the WTP can be used to bypass the Office Tank or to bypass the Hill tank and pump water directly into the distribution system.

3.2 Well 01 Arsenic Treatment Skid

Well 01 was originally constructed to be a standby, emergency only source for the system. Due to the high arsenic levels, the use of the well was highly regulated and could only be operated 15 days out of the year. In March of 2021, SLCWD submitted plans to the SWRCB for the installation of four Isolux filters to remove the arsenic from the groundwater. In June of 2021, the District submitted an application to amend the SLCWD permit to reclassify Well 01 from a standby source to an active source. This application was approved in September of 2021, with the provision that the well not be used as the system sole source for more than two consecutive days without notifying the SWRCB due to concerns about the corrosive properties of the water.

The treatment skid is comprised of four Isolux adsorption filters, each filter having a capacity of 25 gpm, for a total capacity of 100 gpm. Well 01 has a pumping capacity of 60 gpm, providing adequate redundancy. Additionally, the skid includes the injection of a calcium chloride solution and filtration. This solution is necessary due to the presence of silica in the groundwater and prevents the filter media from fouling. The groundwater is routed through the WTP, with the clarifier and filters bypassed, and is treated with the WTP chlorine injection systems before being deposited into the Office Tank.

3.3 Water Treatment Operations

Normal water treatment operations for the District is to use the WTP on a day-to-day basis and keep Well 01 in reserve. SLCWD staff will only utilize groundwater if there is a major disruption or concern with the surface water quality, or operations at the WTP. Typically, this has only been an issue during winter when the intake pipe experiences freezing and the WTP is operating inefficiently.

While the WTP and intake pump station are able to provide up to 350 gpm, the intake pump station is throttled down to provide only 150 gpm due to the low demands in the system. Additionally, the WTP is not fully automated and will only run when operations staff are present. Currently, SLCWD staff work on a Monday through Friday schedule. To ensure adequate water supply for the District customers during the weekend, staff will ensure that both the Office Tank and Hill Tank are at their max fill height on Friday. Tank levels are then monitored remotely through Saturday and Sunday for possible emergencies. Due to this unorthodox operations strategy, it is recommended that the District improve the automation and SCADA systems at the WTP so that District customers are safeguarded from a drop in supply.

If SLCWD staff deem it necessary to bring Well 01 into operation, several steps must be taken. While the well can be operated remotely from the District office, several valves must be operated in order to route the groundwater into the District system. Additionally, work within the well house must be performed in order to ensure that the arsenic treatment skid is ready to operate. The Well 01 discharge line currently tees into the raw water line that feeds the WTP. Isolation valves must be manipulated at this location in order to route the water. The clarifiers and direct pressure filters are also bypassed, and the zinc orthophosphate injection turned off. The sodium hypochlorite is used to disinfect the groundwater before it reaches the Office Tank.

The main concern with this is not any operational strategy, but the fact that the Well 01 discharge line utilizes the raw surface water line prior to reaching the Office Tank. This is a source of cross contamination and could lead to water quality issues.

A secondary concern for operations staff is being able to reach the Well 01 building during the winter. Currently, the Well 01 building is located in a meadow adjacent to the District office and cannot be reached by road. Staff must utilize a path or dirt road to reach it, both of which are inaccessible during periods of high snowfall and staff must dig out a path to the Well 01 building. This is a time-consuming effort and could lead to large delays if it is necessary for staff to switch sources immediately.

In order to remedy both operational concerns, it is recommended that the District relocate the arsenic treatment skid into the existing WTP building for ease of access. The District should also construct a dedicated line that goes directly to the relocated treatment skid and then deposits directly into the Office Tank. Relocating the arsenic treatment skid will also necessitate the expansion of the WTP building to safely accommodate the added infrastructure.

3.4 Finished Water Quality

While the overall water quality of the system meets all state and federal standards, the District has two water quality issues that require attention. The first is the corrosive nature of the water and the use of zinc orthophosphate to combat this. The second is disinfection byproducts.

3.4.1 Corrosivity

The zinc orthophosphate based corrosion inhibitor used in the WTP provides cathodic protection to steel and copper pipes, which are commonly used in homes. Additionally, it protects against the release of cement from water mains, which is invaluable as the vast majority of the SLCWD distribution system is comprised of asbestos concrete pipes.

Per the most recent consumer confidence report, the District reports a total water hardness of 11 parts per million (ppm). Drinking water hardness levels are typically between 60 ppm and 120 ppm. Levels outside of this range are considered hard (greater than 120 ppm) or soft (less than 60 ppm). With SLCWD hardness levels being at 11 ppm, the water is considered soft and is an indicator of the corrosive nature of the water. However, the most recent hardness level reported is from a test in September of 2016. It is recommended that the District perform a more thorough water quality testing program and review of its treatment processes to determine if zinc orthophosphate is still the best treatment option.

3.4.2 Disinfection Byproducts

Trihalomethanes (TTHM) and haloacetic acids (HAA5) are groups of disinfection byproducts present in drinking water. They are formed when disinfectants are used in drinking water and react with bromide and/or natural organic matter (i.e., decaying vegetation) present in the source water. Both TTHM and HAA5 have MCLs of 80 parts per billion (ppb) and 60 ppb respectively, per the EPA Stage 1 Disinfectants and Disinfection Byproducts Rule. The compliance levels for both analytes are calculated using the running annual average of all samples from the system rather than individual samples. It should be noted that testing for these analytes occur quarterly.

Since 2015, SLCWD has seen individual samples for TTHM range from 34 ppb to 91 ppb, and HAA5 range from 18 ppb to 74 ppb. The running average for both analytes has been steadily increasing since 2020. Figure 5 and Figure 6 show the individual sample results and running averages for TTHM and HAA5 respectively.

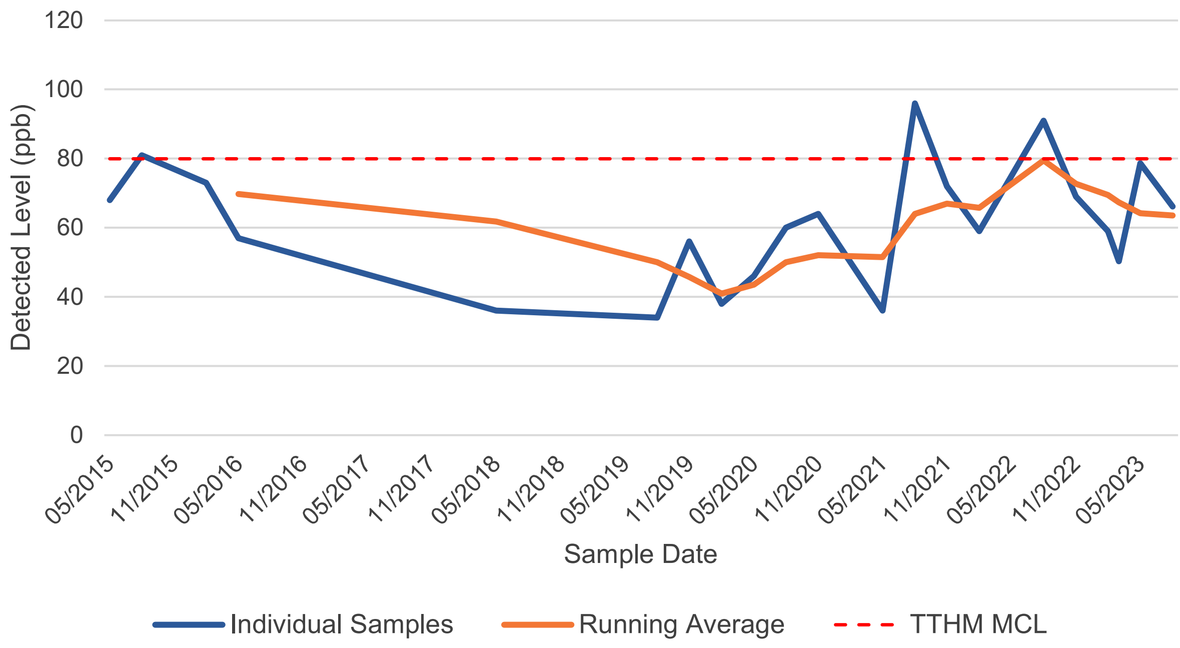

Figure 5: Detected TTHM Levels, May 2015 to August 2023

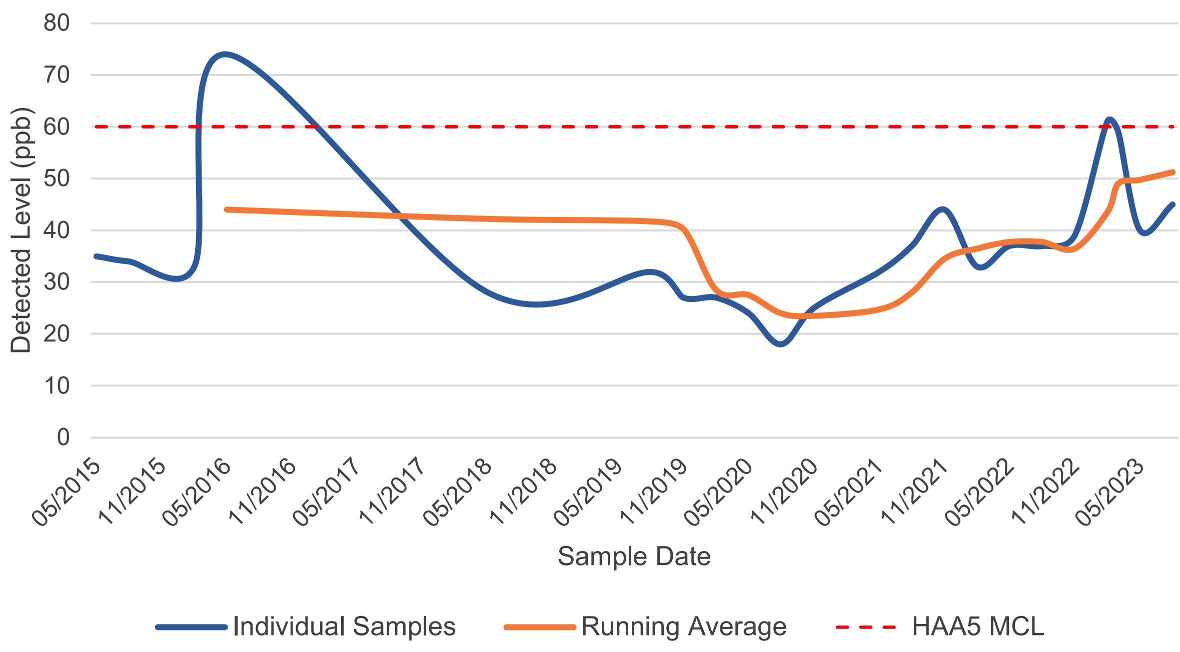

Figure 6: Detected HAA5 Levels, May 2015 to August 2023

Disinfection byproducts like TTHM and HAA5 are more prevalent in water systems that have higher water age. Water age is the time water spends in the distribution system before it is consumed by the end user. Higher water age systems allow disinfected water more time to react with naturally present bromide or organic matter in the source water.

The SLCWD system is susceptible to higher levels of disinfection byproducts for three reasons:

1. The system is reliant on a lake for its source water
2. The system intake is shallow enough to be affected by temperature and algae blooms leading to more organic matter in the water
3. The system demands are extremely low compared to the system infrastructure capacity leading to higher water age

Reducing disinfection byproducts in the District system will require investigation to possible solutions. The first is examining steps that can be taken to reduce water age in the system operationally. This may be accomplished through flushing programs, limiting water production, or a variety of other methods. The second is through adapting treatment processes at the WTP to try and deal with disinfection byproducts on the front end of treatment. Coupled with extending the intake pipe at the lake, reducing the overall amount of organic matter in the system will help reduce the disinfection byproducts. It is recommended that staff perform an in-depth study of the WTP processes and its distribution system water age to determine the best path forward to combat these rising analytes.

3.5 Summary of Findings

Several deficiencies have been identified in the SLCWD water treatment facilities. Table 11 below is list of recommended projects to address these deficiencies. Project cost estimates and a prioritized capital improvement program (CIP) can be found in Section 5.0.

Table 11: Water Treatment Facilities Recommended Projects

Project	Project Description
Intake Pipe Extension	Extend the Intake Pump Station intake pipe so that the pipe end has a final depth of 14 feet
$KMnO_4$ Titration Unit Replacement	Replace the obsolete $KMnO_4$ monitor and titration unit at the District office and integrate the new unit into the SCADA system
WTP SCADA Improvements	Improve the existing SCADA system to allow automation of the WTP
Well 01 Treatment Relocation and Discharge Line	Relocate the existing arsenic treatment skid from the Well 01 building to the WTP, expand the WTP building, and construct a dedicated line to the skid and then the Office Tank
System Water Age and WTP Process Analysis	Perform an analysis of the SLCWD system to determine the areas of highest water age and operational strategies to reduce system water age, as well as an analysis on the WTP processes to determine methods to reduce organic matter in the finished water

4.0 SYSTEM OVERVIEW AND CAPACITY ANALYSIS

4.1 System Overview

The SLCWD water system infrastructure consists of the intake pump station on the north end of Lake Serena, the Lake Serena WTP located near the SLCWD administration building, Well 01 just south of the WTP, the 460,000-gallon Office Tank adjacent to the WTP, the 300,000-gallon Hill Tank located above Pahatsi Road, and over 13 miles of transmission and distribution piping.

4.1.1 Pressure Zones

Due to the smaller size of the utility service area, the SLCWD water system is comprised of a single pressure zone. Figure 7 is a schematic of the system hydraulic grades, and Figure 8 is an overview map of key system infrastructure and the layout of the SLCWD system.

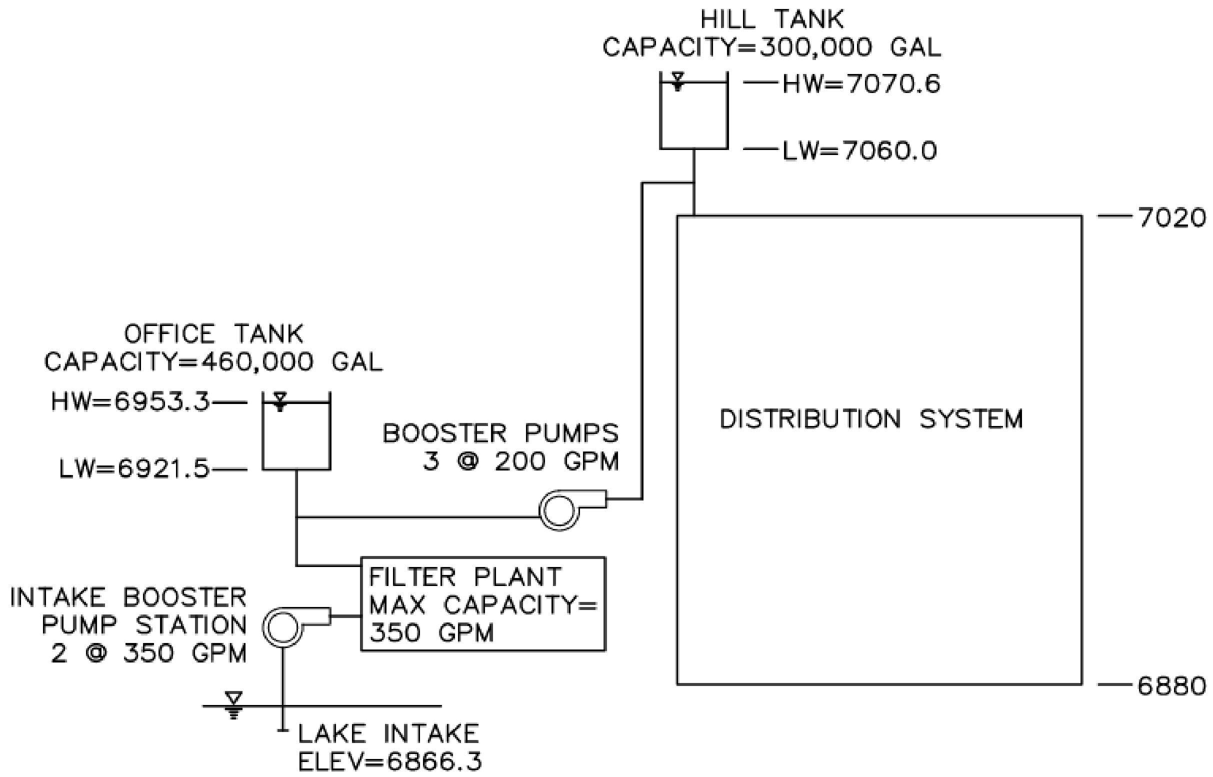

Figure 7: Existing Water System Schematic

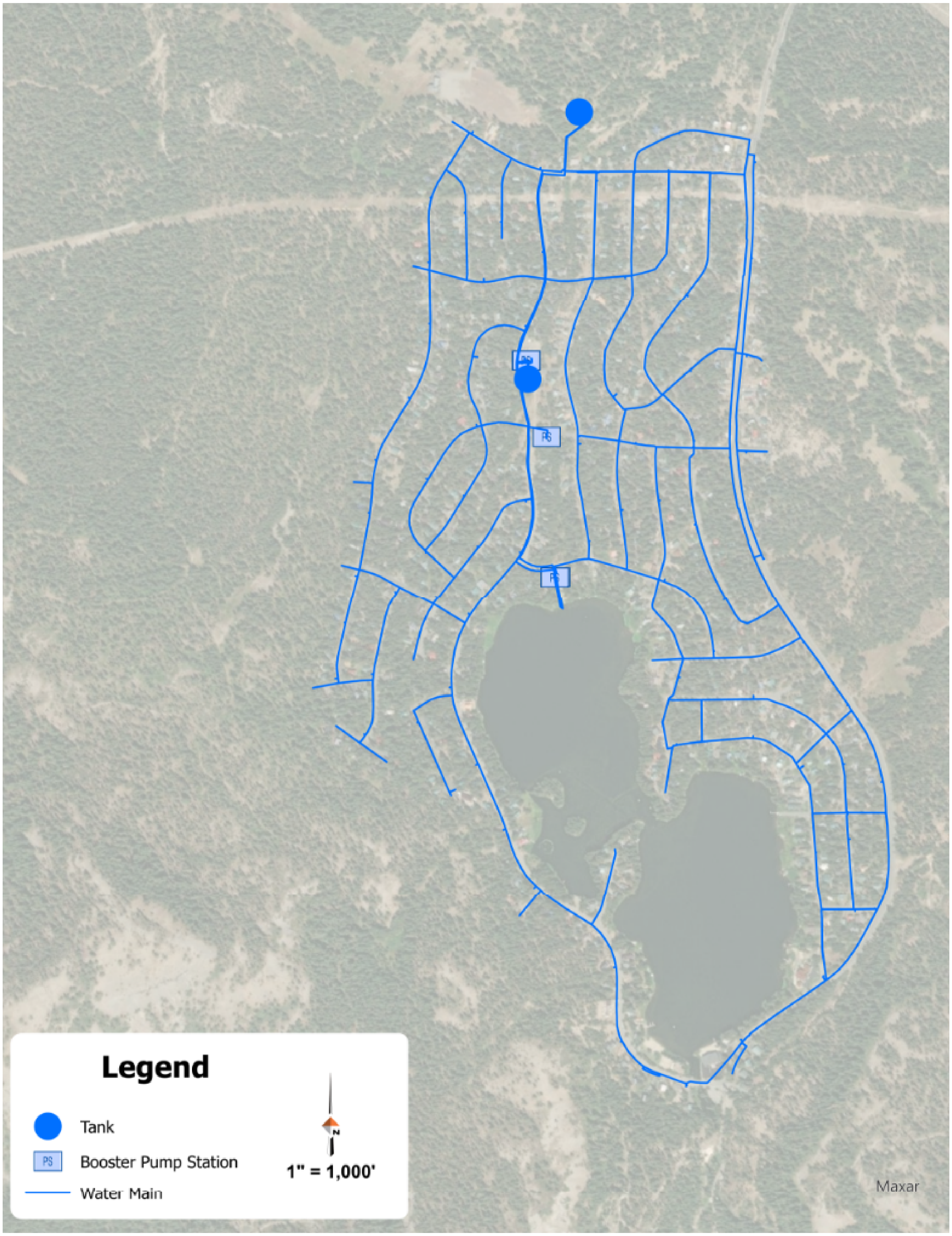

Figure 8: Water System Infrastructure

4.1.2 Booster Pump Stations

The water system utilizes two booster pump stations to move water from the lake intake to the WTP and from the Office Tank to the Hill tank. The intake pump station moves water from Lake Serena to the WTP and Office Tank. The intake pumps provide both pressure and flow through the WTP. The intake pumps can only be manually controlled, thereby they only operate Monday through Friday when District staff is onsite. The office pump station is comprised of three pumps controlled by the tank levels of the Hill Tank. The three pumps are rotated on a daily basis, with each pump operating solo on a single day. A summary of each pump station, capacity, and terminal storage tank can be found in Table 12.

Table 12: Booster Pump Station Summary

BPS ID	Number of Pumps	Pump Flow (gpm)	Controlling Tank ID
Intake BPS	2	350/350	Office Tank
Office BPS	3	200/200/200	Hill Tank

4.1.3 Storage Tanks

The SLCWD system storage is made up of two welded steel storage tanks. The levels within each storage tank control booster pump operations and provide head for the system. Table 13 gives a summary of each tank, elevation, capacity, and the operational levels.

Table 13: Storage Tank Summary

Tank ID	Base Elevation (ft)	Volume (gal)	Operating Range (ft)
Office Tank	6,921.5	460,000	18-30
Hill Tank	7,060.0	300,000	9.8-10.9

4.1.4 Distribution Mains

The distribution system contains over 13 miles of pipe with a range of pipe diameters and materials. Table 14 and Table 15 give summaries of the distribution main diameters and materials, respectively. Figure 9 and Figure 10 show the distribution system pipe diameter and material locations respectively.

Specific pipe age data is not available; however, it is believed that the majority of the system may be original pipes when the system was constructed in the 1960’s and 1970’s. Emergency repairs and replacements of broken mains represent the newer pipes within the system.

Table 14: Distribution Main Diameter Summary

Pipe Diameter (in)	Total Length (ft)
4.00	13,662
6.00	24,254
8.00	20,248
10.00	6,287
12.00	3,467
14.00	290

Table 15: Distribution Main Material Summary

Pipe Material	Total Length (ft)
Asbestos Cement, AC	52,852
C900 PVC	11,514
Unknown	3,842

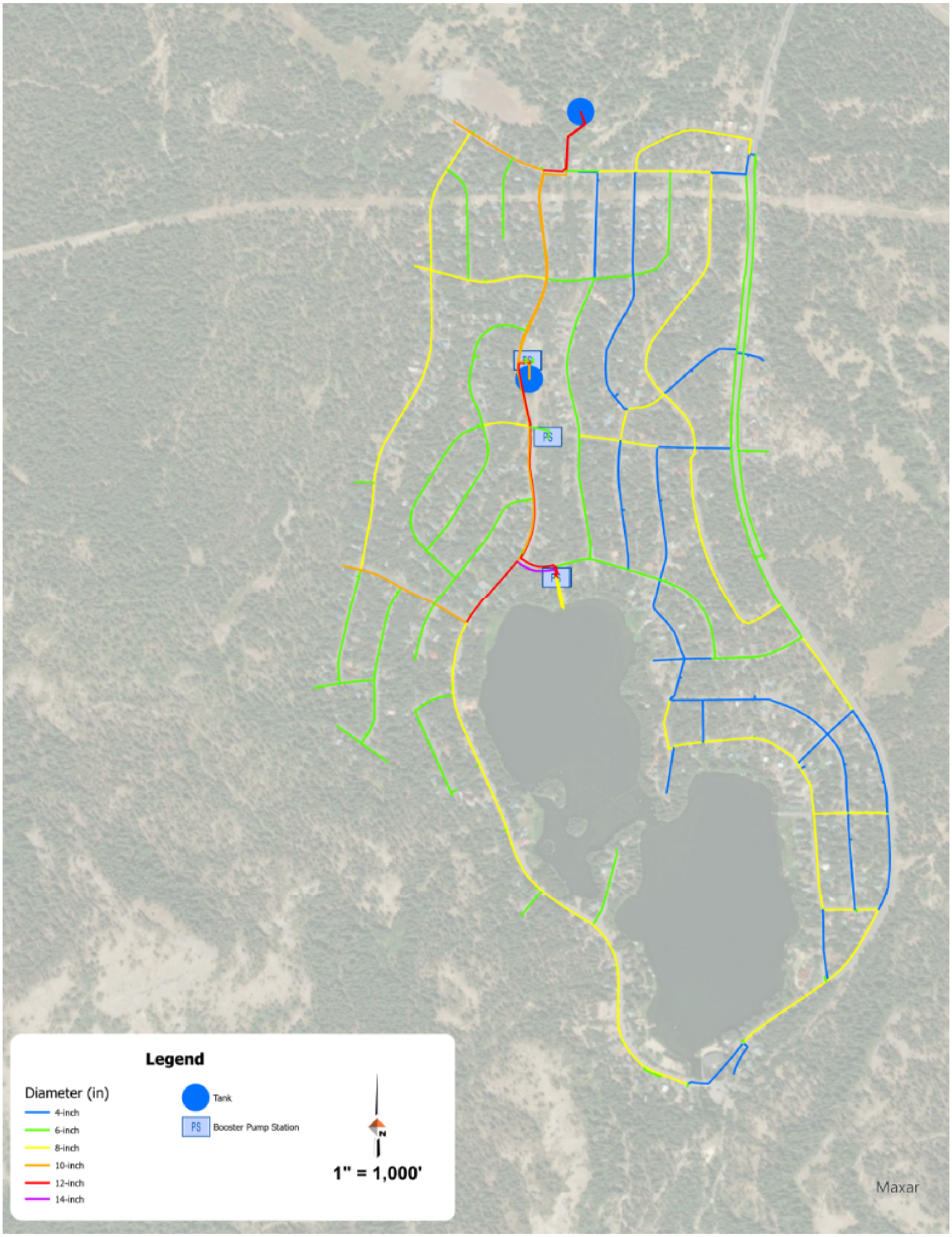

Figure 9: Distribution System Pipe Diameters

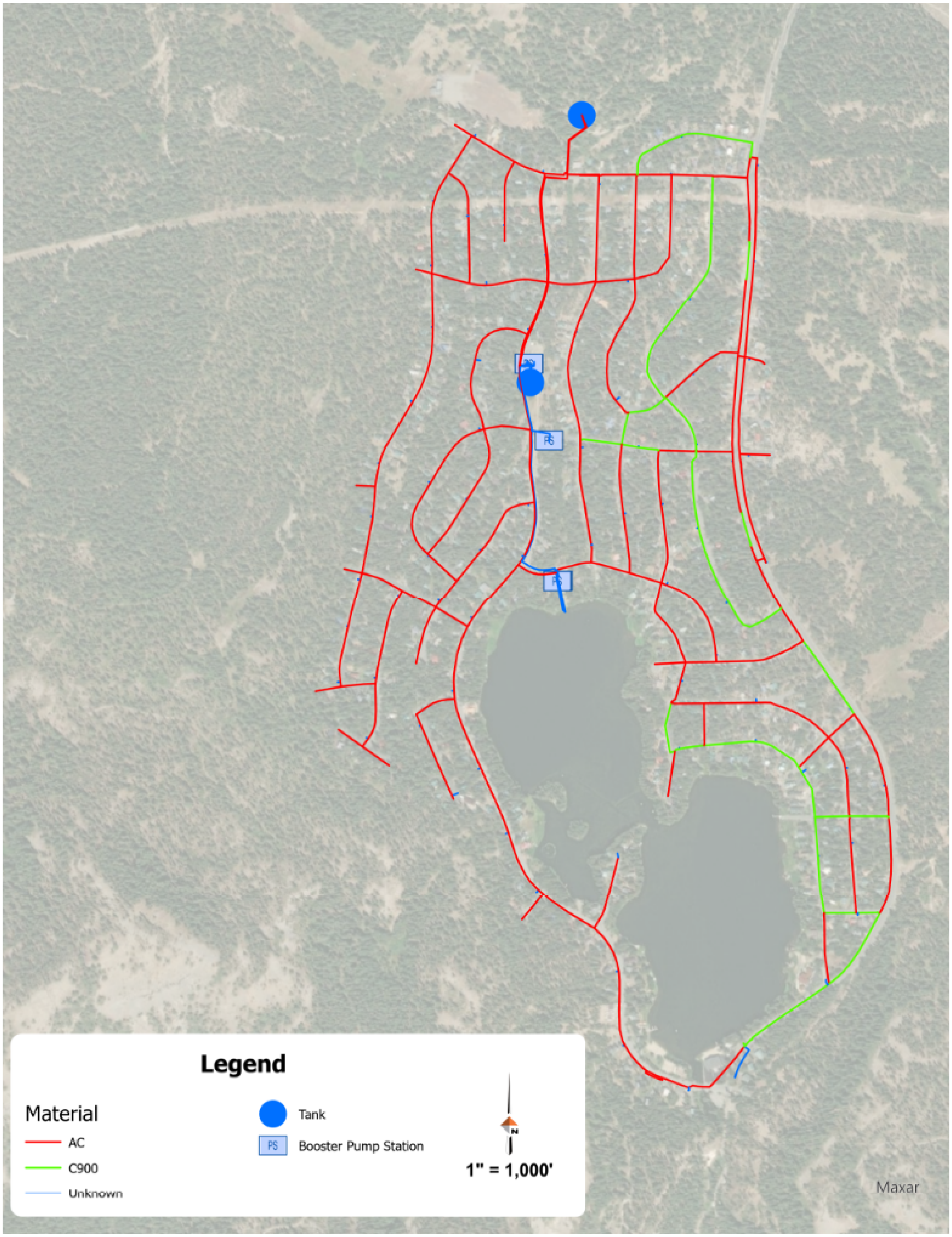

Figure 10: Distribution System Pipe Material

4.2 System Demands

Existing system demands and peaking factors were developed using water production and tank data, as described in Section 1.2.2. The existing and projected ADD, MDD, and PHD for the system is summarized in Table 16. These demands will form the basis for all system capacity calculations and analyses performed.

Table 16: Existing and Buildout Demand Summary

Demand Scenario	ADD (gpm)	MDD (gpm)	PHD (gpm)
Existing	40.91	108.98	170.01
Buildout	49.73	132.46	206.64

4.3 Hydraulic Model Calibration

Calibration of the model occurred in two phases. The first phase ensured data accuracy and consistency in the model inputs. To develop the model geometry, i.e. the physical horizontal layout of the system, an existing AutoCAD drawing of the water system, provided by SLCWD, was used to construct the basic pipe and junction elements within the model. This data included pipe material, diameter, and connectivity. Elevation information was not provided within the AutoCAD data, however, DOWL used a raster elevation file created during a USGS contracted project (Northern CA 3DEP QL1 QL2 LiDAR Project) to set junction elevations within the model. DOWL relied on information provided by SLCWD to set all the model parameters for the corresponding tanks, pumps, and water reservoirs (lake intake and well). Lastly, the water demands, described in Section 1.0, were allocated evenly across the model at specific junctions depending on the location of water customers and their corresponding water service lines. Accurate model development ensured that the model mimics the real-world system and is considered a “gross” calibration of the model.

The second phase is considered the “fine” calibration of the model. Hydrant flow testing results from tests performed in October 2022 were used to calibrate the model further. Hydrant flow testing results were correlated with tank levels and booster pump station status at the time of testing for each flow test, as identified from SCADA data. Each test was entered into the InfoWater Pro Calibrator tool, registering the recorded flow at the test hydrants, as well as the recorded pressure during the test at the residual hydrant. The calibrator tool then adjusted the Hazen-Williams C factor of the model pipes so that the model output matched the field data as closely as possible. System pipes in the model were divided into three different groups based on pipe material. Table 17 is a summary of the final, calibrated Hazen-Williams C factor for each pipe group.

Table 17: Calibrated Water Model Hazen-Williams C Factors

Pipe Material	Total Length (ft)	Calibrated Hazen-Williams C Factor
Asbestos Cement, AC	52,852	103
C900 PVC	11,514	130
Unknown	3,842	120

4.4 System Capacity

System capacity for both the existing system demand and projected buildout demand scenarios of the SLCWD water system was determined using two different methodologies. First, a storage and supply analysis of the system was used to verify that capacity was available to serve the system connections. Second, water pressure, pipe velocity, and system fire flow analyses were used to determine if the distribution infrastructure was sufficient to convey the necessary water to meet the system demands. Distribution system capacity for the Plan area was determined using a calibrated hydraulic model, as described in Section 4.3.

The storage and supply calculations compare the system total storage and pumping capacity of water sources against not only the system demand, but required operational, emergency, and fire storage capacity. No specific standards exist for the storage and supply operational characteristics. Therefore, to determine reasonable characteristics, multiple different water master plans within the State of CA were referenced. Table 18 describes the operational characteristics used within the referenced master plans.

Table 18: Operational Characteristics within Referenced Master Plans

City Name & Date of Master Plan	Operational Storage	Emergency Storage	Fire Storage	Supply Capacity
Stockton, 2021	25% of MDD	100% of ADD	Dependent on building size and construction type	Fire flow event during MDD or PHD
Ontario, 2012	30% of MDD	100% of ADD	Dependent on building size and construction type	Fire flow event during MDD or PHD
Truckee Donner PUD, 2012	33% of MDD	100% of ADD	Dependent on building size and construction type	MDD without largest production source

For the purpose of this analysis, the operational storage for the system is equal to the total volume required to meet 30 percent of MDD, emergency storage is 100 percent of ADD, fire flow storage is assumed to be 240,000 gallons (2,000 gpm of fire flow for a 2-hour duration), and sufficient water production capacity should be provided to meet the greater of MDD with a fire flow event or PHD. Table 19 gives the required storage for the system for the existing and buildout demand scenarios.

Table 19: System Required Storage

Demand Scenario	Operational Storage (gal)	Emergency Storage (gal)	Fire Storage (gal)
Existing	47,080	58,917	240,000
Buildout	57,224	71,612	240,000

System pressures and pipe velocities were analyzed for ADD, MDD, and PHD to ensure the system meets minimum pressure requirements as identified by the California Code of Regulations (CCR) Title 22, Division 4, Chapter 16, Article 8, Section 64602 (a) and industry standards relating to pressures and velocities. The CCR for minimum pressures is summarized below.

Each distribution system shall be operated in a manner to assure that the minimum operating pressure in the water main at the user service line connection throughout the distribution system is not less than 20 pounds per square inch at all times.

High head losses should also be avoided by maintaining normal water velocities below 8 feet per second (fps) during all conditions of flow other than fire flow.

Fire flow capacity for the system was measured against minimum fire flow standards. The fire flow requirements for individual buildings are governed by Appendix B of the CA Fire Code. As each building in the system is unique in its square footage and building type, no sweeping standard can be made for the District system. To address this, any hydrant producing an available fire flow less than 1,000 gpm was deemed deficient.

4.4.1 Existing System Capacity

Per the calculations performed, the system has adequate storage and supply capacity for both MDD and PHD scenarios. Table 20 shows the existing system capacity calculation results. A more thorough calculation worksheet can be found in Appendix D.

Table 20: Existing System Storage and Supply Capacity Summary

MDD Remaining Capacity (gal)	PHD Remaining Capacity (gal)
661,071	573,189

Table 21 summarizes the ADD, MDD, and PHD pressure ranges from the hydraulic model. Figure 11, Figure 12, and Figure 13 are overview maps showing the ADD, MDD, and PHD pressures throughout the system.

Table 21: Existing System Hydraulic Model Pressure Range Summary

Demand Scenario	Lake Intake Transmission Main Pressure Range (psi)	Distribution System Pressure Range (psi)
ADD	19 to 29	31 to 81
MDD	19 to 29	30 to 81
PHD	19 to 29	30 to 81

For the ADD, MDD, and PHD model scenarios, the distribution system pressure is greater than 20 psi. Therefore, the SLCWD water system meets the CCR Title 22, Division 4, Chapter 16, Article 8, Section 64602 (a), during normal operating conditions.

As shown in Table 21, the raw water line from the intake pump station to the WTP has an operating pressure range of 19 to 29 psi for all demand scenarios. These model results are consistent with field reports from SLCWD staff when the intake pump station is operating. However, when the intake pumps turn off, the raw water line sees large pressure drops. Per operator testimony, the pressure gauges at the upstream end of the adsorption filters drops to zero when the intake pumps turn off. This drop is indicative of the pipeline losing pressure and equalizing to atmospheric pressure. There are several reasons that this could be happening, including a large leak in the raw water line, or faulty check valves at the intake pumps. It is recommended that a field investigation take place to determine the cause of this problem, and then make an informed decision on how best to resolve the problem. This field investigation should include leak detection of the raw water line.

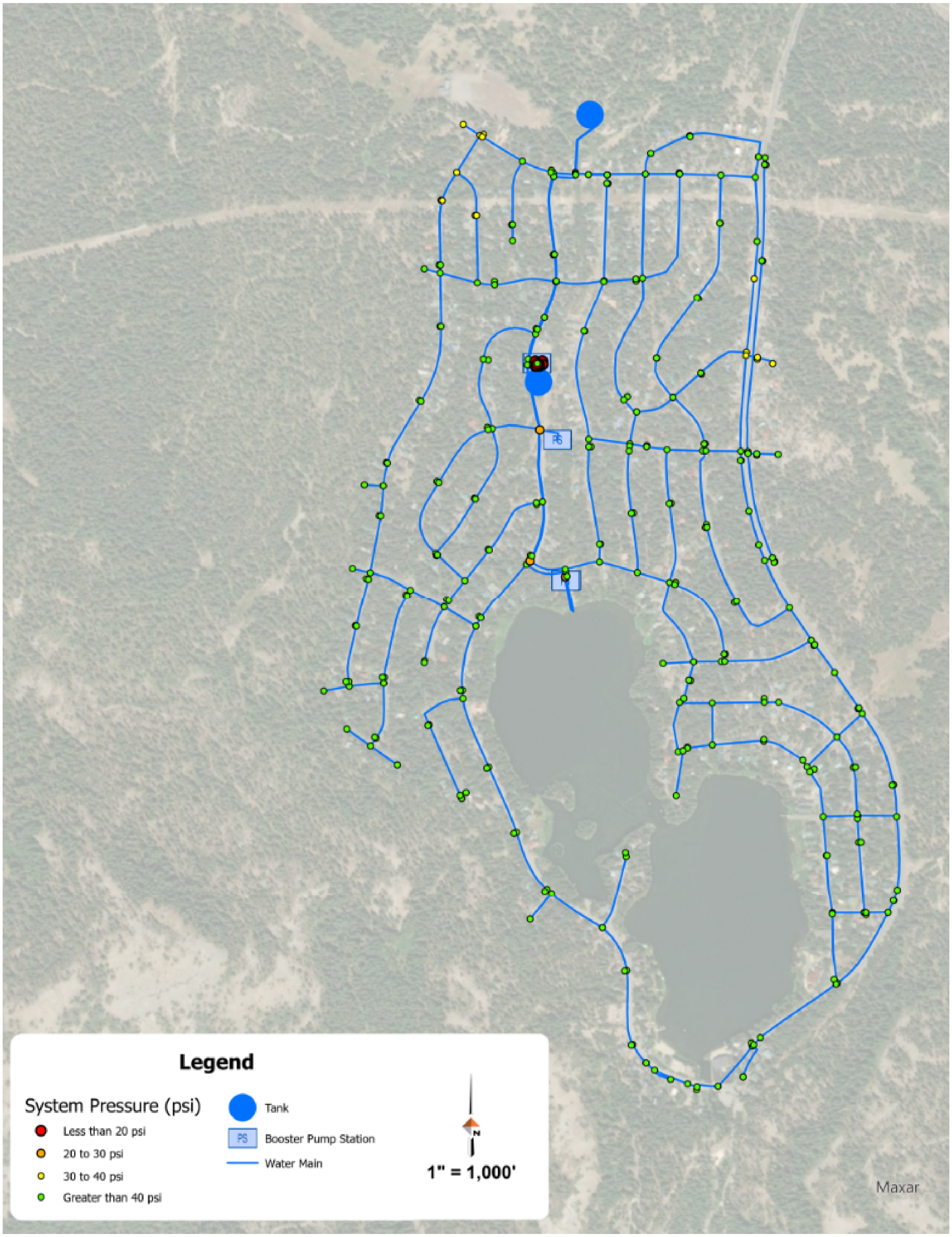

Figure 11: Existing System ADD Pressure

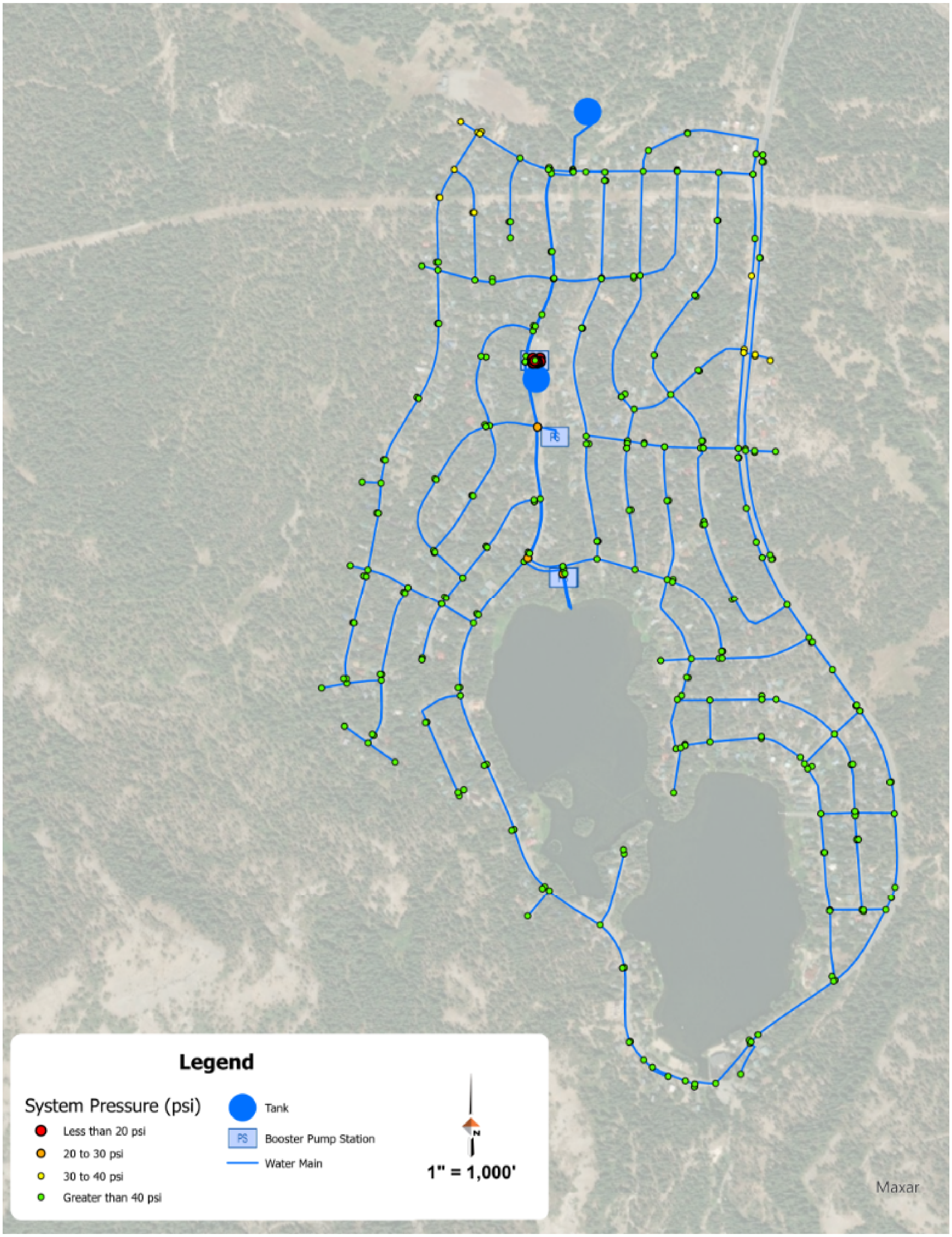

Figure 12: Existing System MDD Pressure

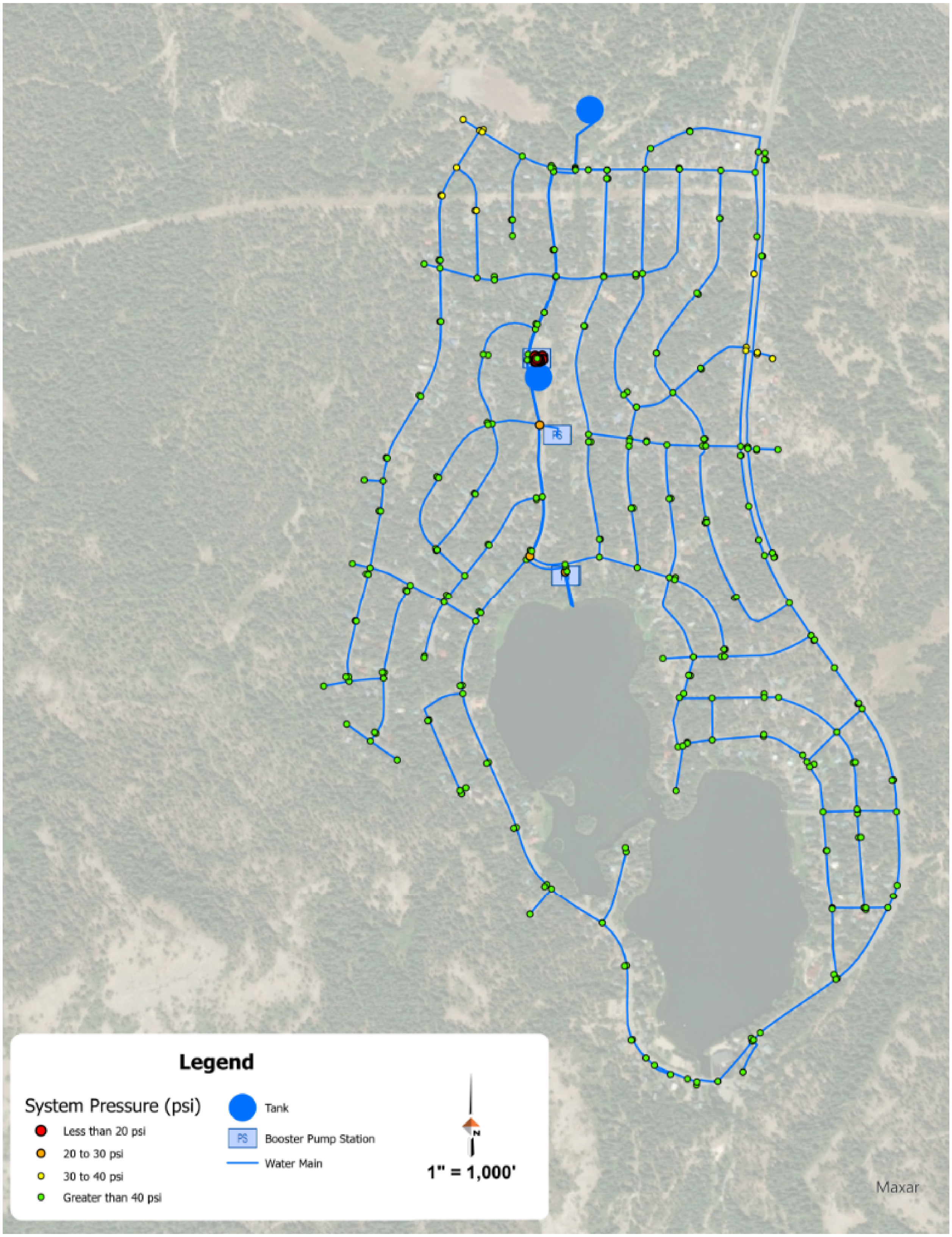

Figure 13: Existing System PHD Pressure

The fire flow scenario is modeled at existing fire hydrants throughout the system while maintaining a 20 psi residual pressure throughout the pressure zone. Figure 14 is an overview map showing the fire flow range throughout the system.

Table 22 summarizes the distribution of available fire flow within the hydraulic model assuming a fire flow demand occurred during the MDD demand scenario. Table 23 gives the hydrant ID and location for the seven hydrants with fire flow below 1,000 gpm. These hydrants are located in areas of older, smaller diameter pipes or at dead ends. It is recommended that these areas are prioritized in future waterline replacement and improvement projects.

Table 22: Existing System Hydraulic Model Fire Flow Summary

Fire Flow (gpm)	Number of Hydrants
Less than 500	1
500 to 1,000	6
1,000 to 1,500	18
1,500 to 2,000	32
Greater than 2,000	23

Table 23: Existing System Deficient Fire Hydrants

Hydrant ID	Location
H03	Along Soda Springs Road between Pahatsi Road and Cascade Road
H04	Dead end of Cascade Road to the east of Soda Springs Road
H20	Dead end of Hillary Drive
H26	Near intersection of Slumber Way and Kidd Court
H63	Near intersection of Donner Drive and Summit Road
H73	Along Cascade Road between Palisade Road and Soda Springs Road
H75	Along Hemlock Drive between Tamarack Way and Bales Road

The maximum velocities observed within the system are less than 2 fps. Figure 15 is an overview map showing the velocity range throughout the system.

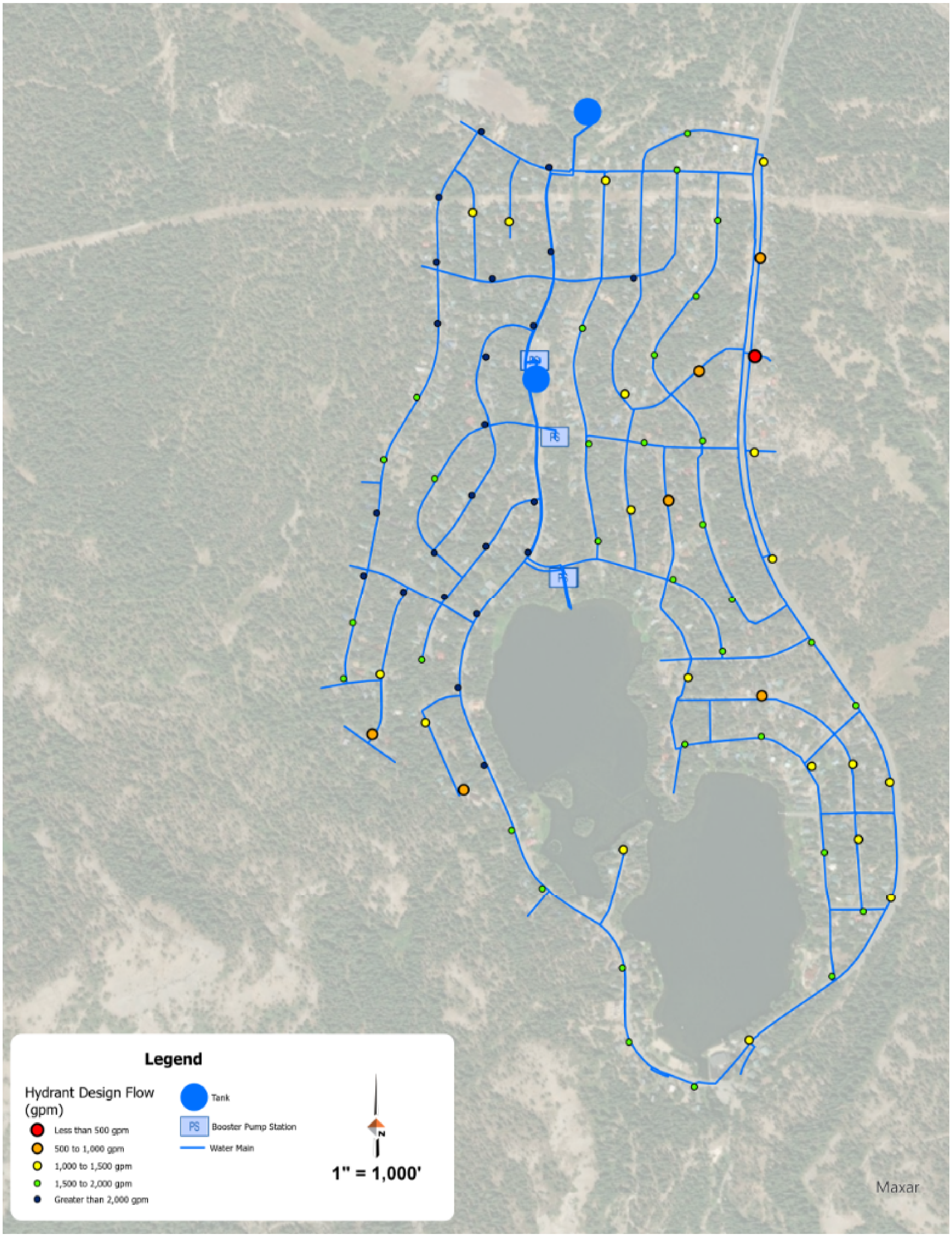

Figure 14: Existing System Fire Flow

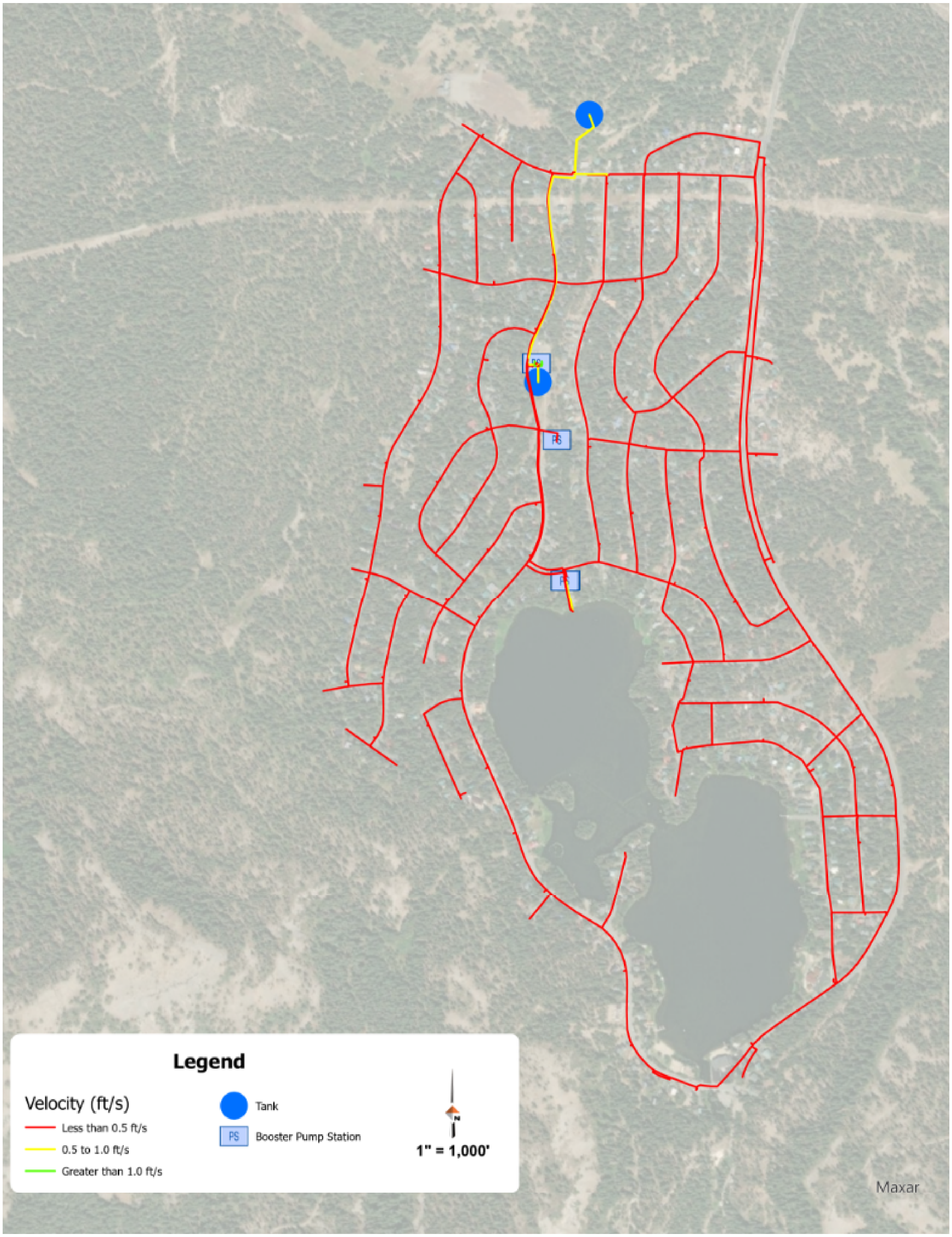

Figure 15: Existing System Velocity

4.4.2 Buildout System Capacity

As limited growth is anticipated, the buildout scenario for the SLCWD system shows that adequate capacity is available in the existing infrastructure to be able to serve the buildout demands. Table 24 shows the buildout system capacity calculation results. A more thorough calculation worksheet can be found in Appendix D.

Table 24: Buildout System Storage and Supply Capacity Summary

MDD Remaining Capacity (gal)	PHD Remaining Capacity (gal)
604,416	497,598

Table 25 summarizes the ADD, MDD, and PHD pressure ranges from the hydraulic model. Figure 16, Figure 17, and Figure 18 are overview maps showing the ADD, MDD, and PHD pressures throughout the system at buildout.

Table 25: Buildout System Storage and Supply Capacity Summary

Demand Scenario	Lake Intake Transmission Main Pressure Range (psi)	Distribution System Pressure Range (psi)
ADD	19 to 29	30 to 81
MDD	19 to 29	30 to 81
PHD	19 to 29	30 to 81

For the ADD, MDD, and PHD model scenarios, the distribution system pressure is greater than 20 psi. Therefore, the SLCWD water system will meet the CCR Title 22, Division 4, Chapter 16, Article 8, Section 64602 (a), during normal operating conditions.

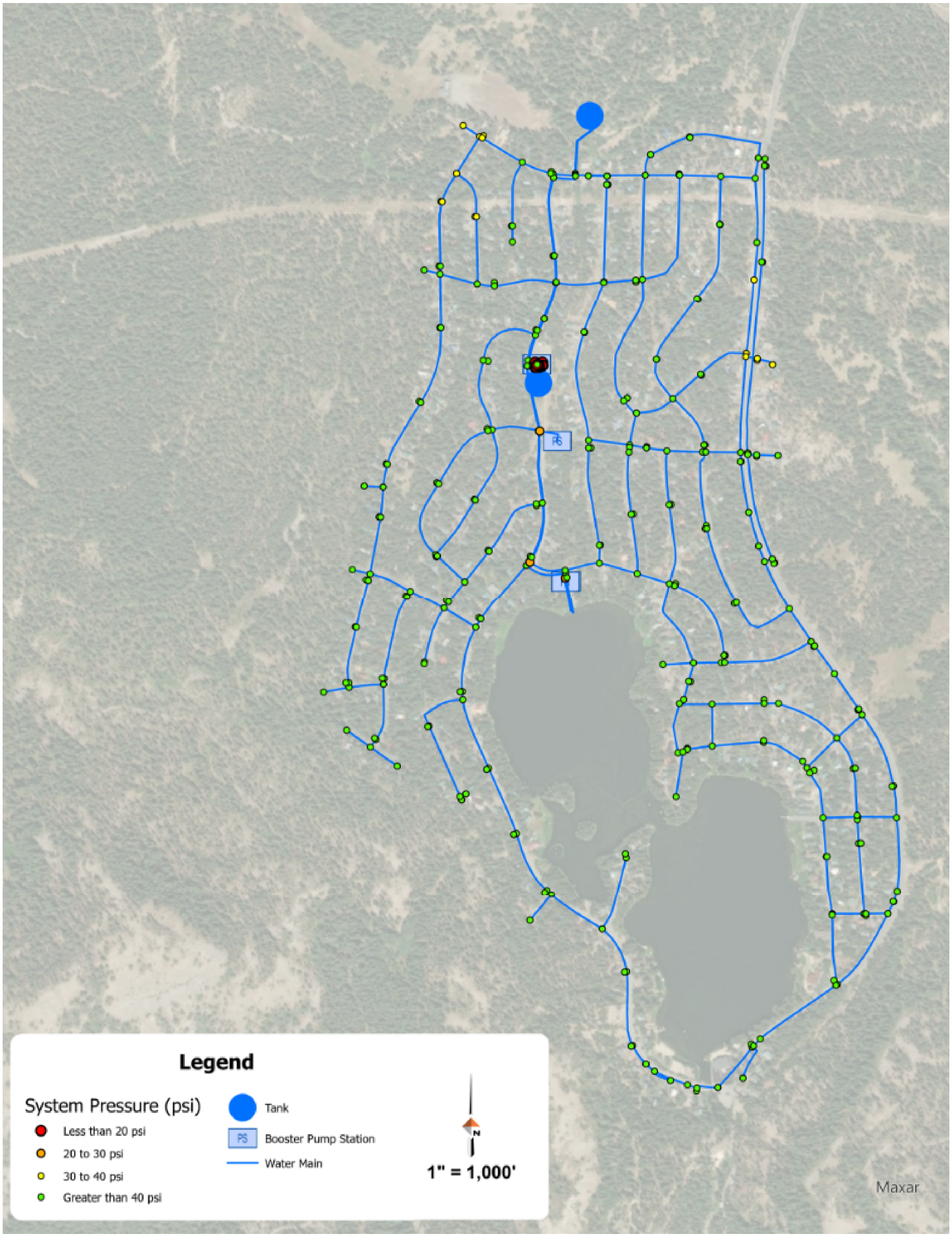

Figure 16: Buildout System ADD Pressure

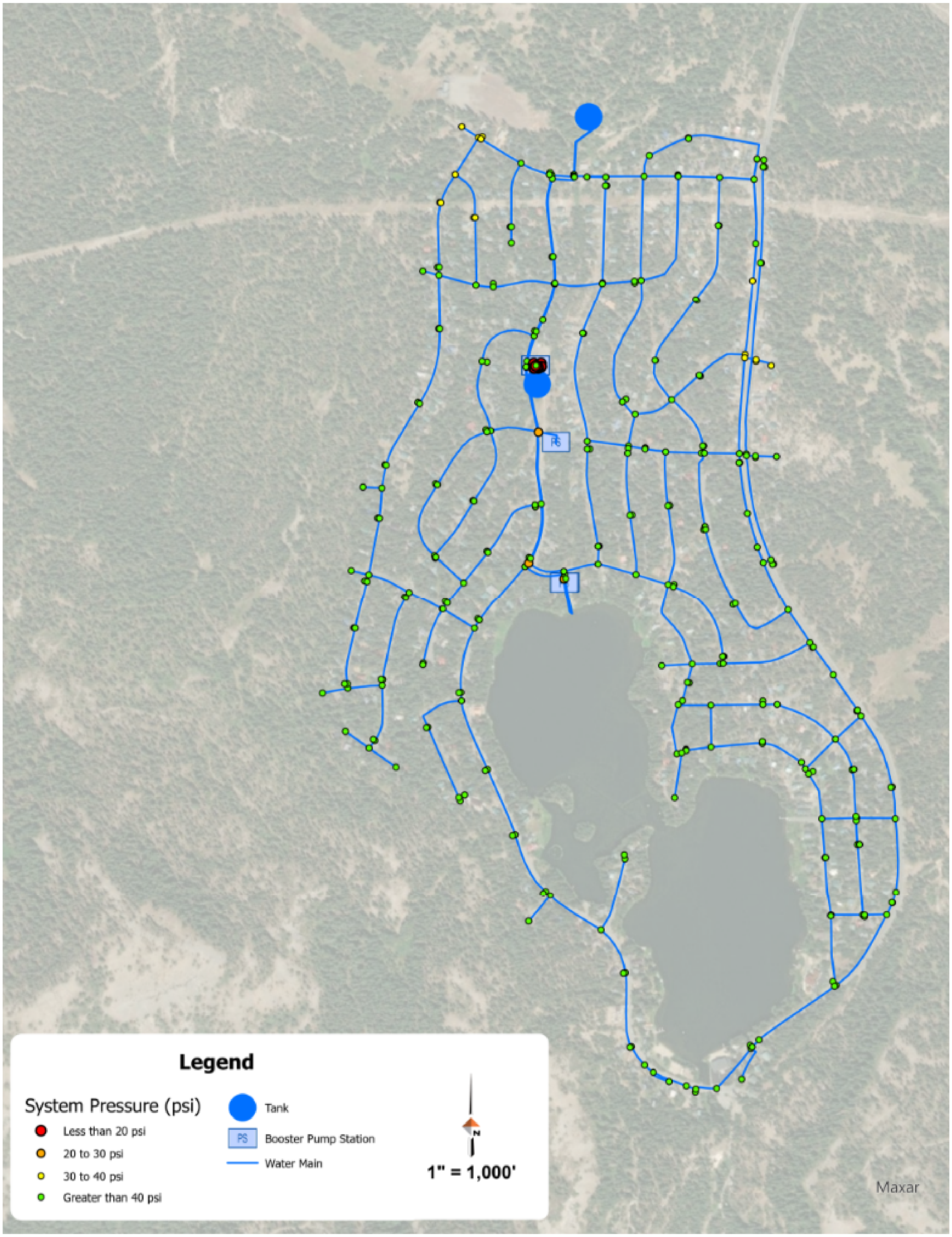

Figure 17: Buildout System MDD Pressure

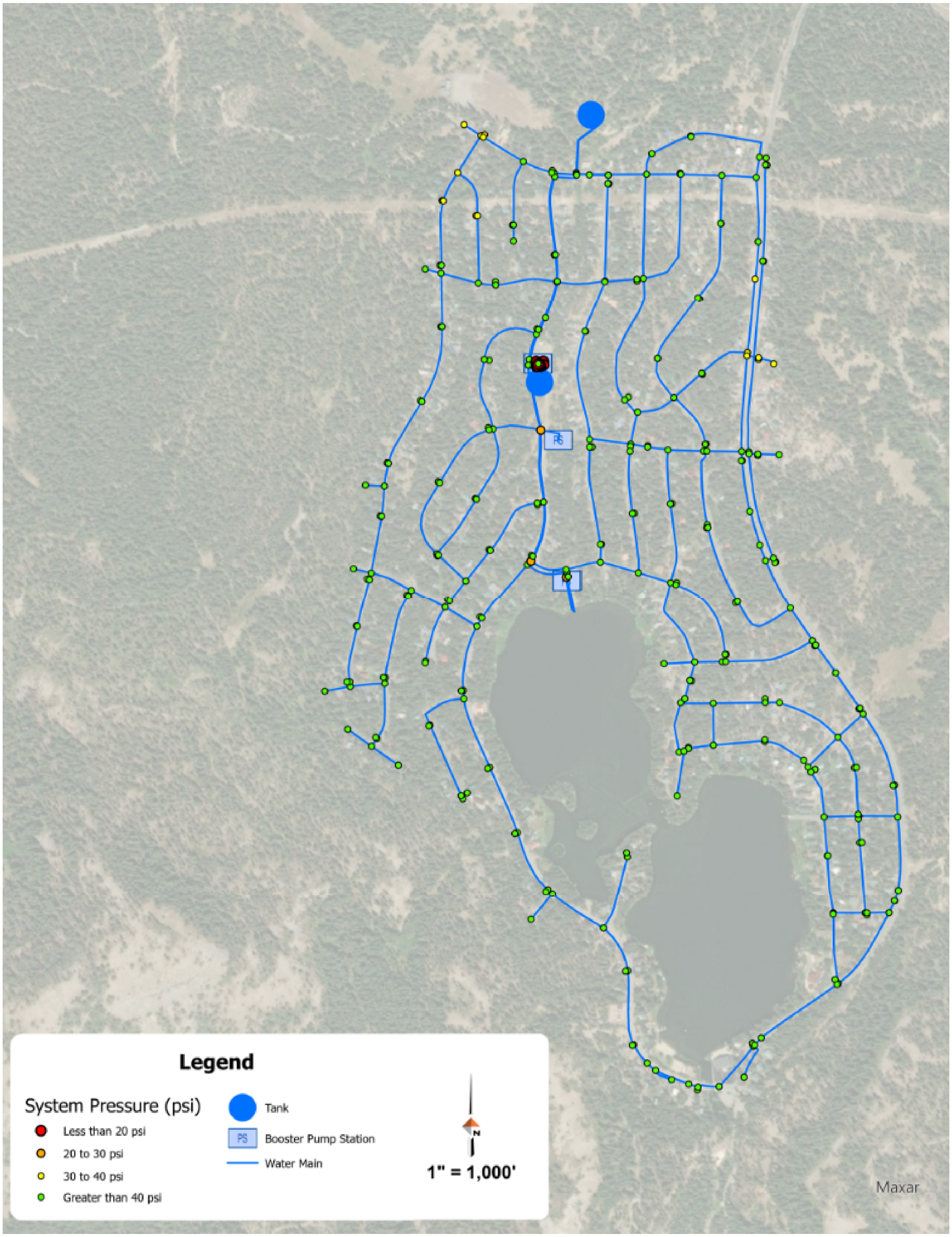

Figure 18: Buildout System PHD Pressure

The fire flow scenario is modeled at existing fire hydrants throughout the system while maintaining a 20 psi residual pressure throughout the pressure zone. Figure 19 is an overview map showing the fire flow range throughout the system.

Table 26 summarizes the distribution of available fire flow within the hydraulic model assuming a fire flow demand occurred during the MDD demand scenario. The expected buildout demand had minimal effect on the system fire flow demand, with only one additional hydrant dropping below 1,000 gpm of available fire flow. The hydrant is located along Spruce Road between Tamarack Way and Bales Road (hydrant ID H57). As this won't occur until system buildout, there is no need to prioritize the Spruce Road waterline in future replacement projects unless other deficiencies are identified. Figure 20 shows how to best address the deficient fire flow areas in the system with pipe size upgrades.

Table 26: Buildout System Hydraulic Model Fire Flow Summary

Fire Flow (gpm)	Number of Hydrants
Less than 500	1
500 to 1,000	7
1,000 to 1,500	17
1,500 to 2,000	33
Greater than 2,000	22

The maximum velocities observed within the system are less than 2 fps. Figure 21 is an overview map showing the velocity range throughout the system.

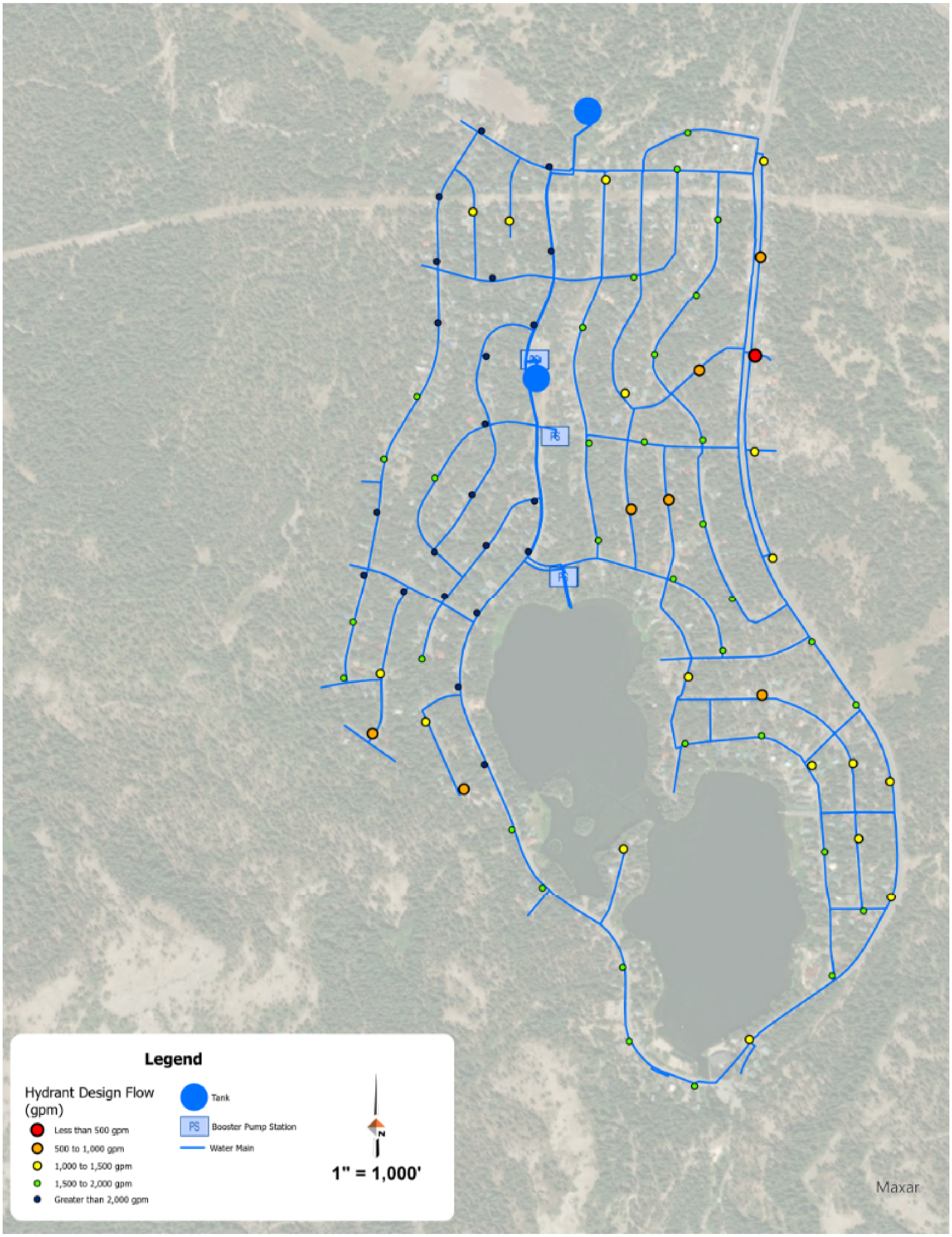

Figure 19: Buildout System Fire Flow

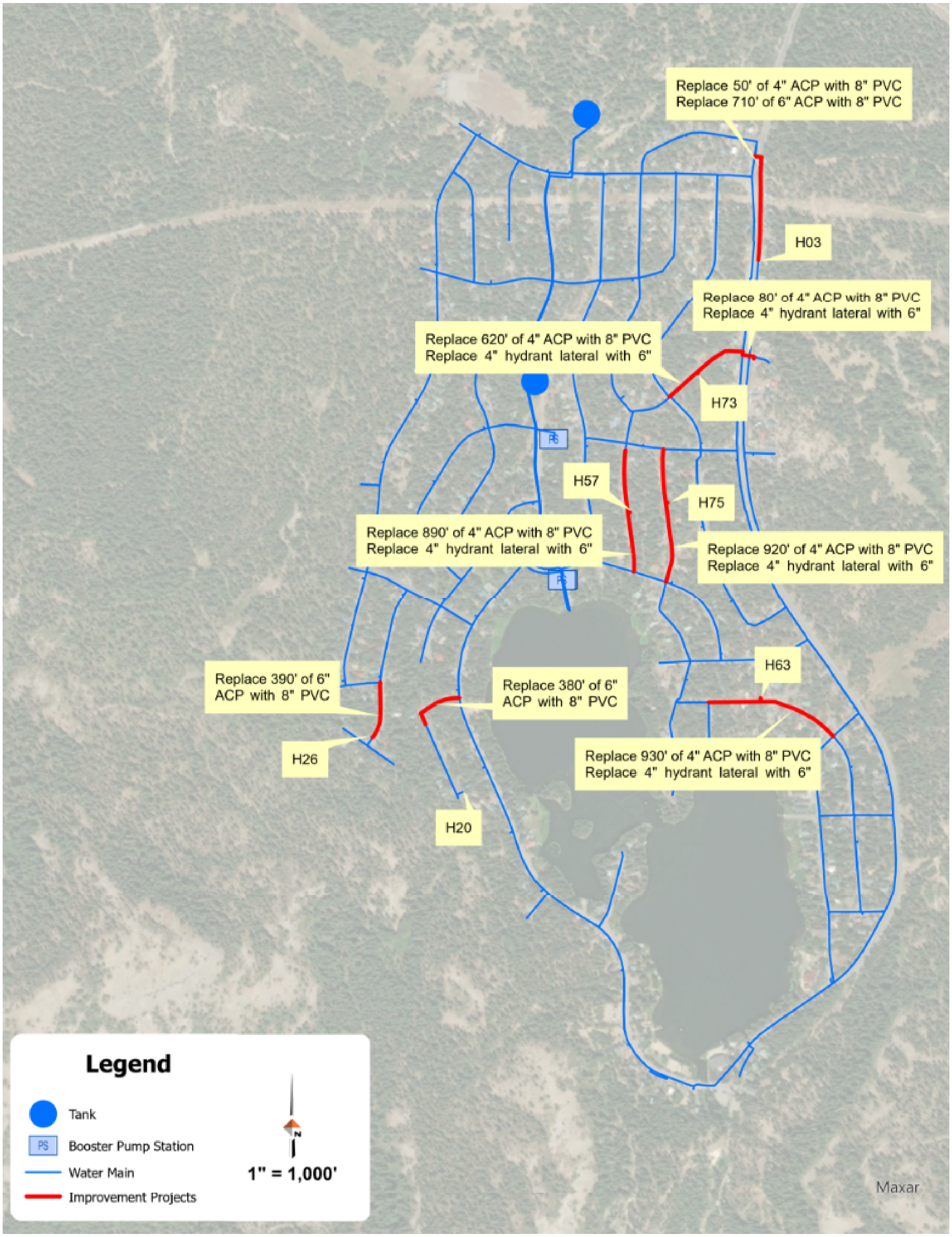

Figure 20: Recommended Fire Flow Improvements

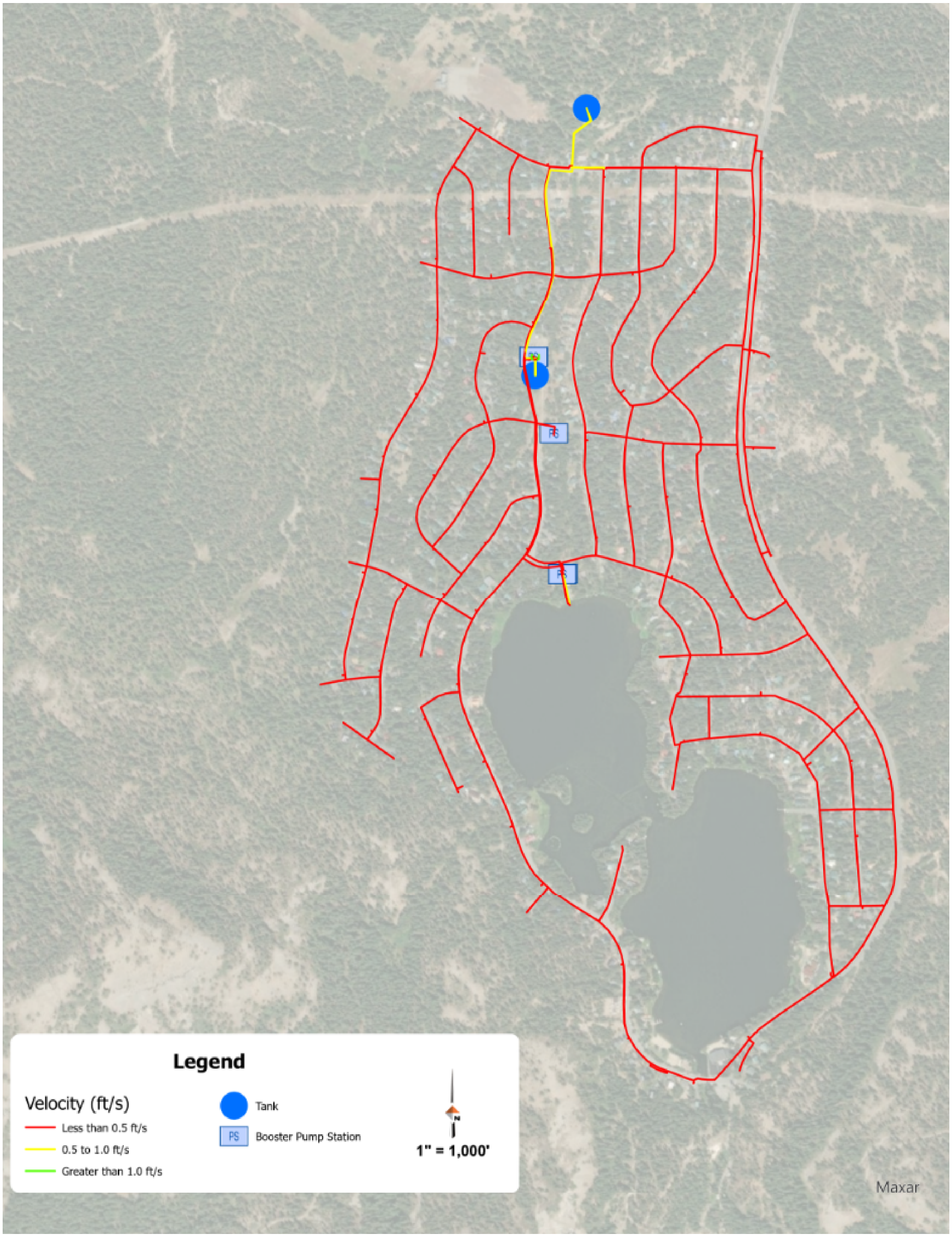

Figure 21: Buildout System Velocity

4.5 System Deficiencies and Operational Challenges

4.5.1 Aging Water Mains

The largest problem facing the distribution mains within the system are leaks and water main breaks. Previous studies have been conducted to evaluate the structural integrity of the asbestos cement pipe that makes up approximately 80 percent of the distribution mains within the system. As discussed within the previous integrity study,

> *It seems that the most significant problem affecting the structural integrity of asbestos cement pipes results from the leaching of the cement mortar binder out of the pipe wall. This leaching mechanism can occur both from the inside of the pipeline as well as from the exterior of the pipeline as a result of aggressive soils or groundwater.*

Multiple soil and water samples were taken and analyzed at the time of the previous integrity study. The results indicated that the soils are non-corrosive, but the groundwater is very aggressive towards the asbestos cement pipes within the system. As stated in the integrity study,

> *The chemical analysis of the groundwater indicates that the protective calcium carbonate scale on the pipe will dissolve and leave the pipe exposed to the corrosive and aggressive qualities of the water. The groundwater is thought to be the cause of the leaching of the cement mortar binder from the asbestos cement pipe due to visual examination of Pipe B. The external surface of this pipe had deteriorated badly, while the internal surface still had scale from the water running through the pipe. With the external surface in that condition, it was concluded that the groundwater had been leaching the cement mortar from the asbestos cement pipe.*

It is recommended that the aging asbestos cement pipe be replaced with a more corrosion resistant pipe material, prioritizing the southern portion of the system.

It was also identified by SLCWD staff that there have been multiple breaks within water mains that were constructed underneath storm water culverts. It is recommended that these water mains be re-routed around the culvert locations so that the water main is easier to get to and repair as needed.

In addition to the aging pipe, the customer service saddles installed in the northwest portion of the system are beginning to fail. These service saddles utilize a nylon bushing that is reaching the end of its lifecycle. It is recommended that this area be targeted as a second or third priority for water main replacements. In the interim, District staff should target known service saddles with these nylon bushings and replace as necessary.

4.5.2 Water Loss Data Availability

As described in Section 1.2.3, calculating water loss for the District is imprecise. While the individual customer metering will greatly improve the ability of SLCWD staff to calculate and monitor water loss, better data surrounding the supply to the system is also required. The Hill

Tank currently has no flow meter on site. It is recommended that a flow meter be installed on the outlet pipe of the tank.

4.5.3 Utility Location Data

Currently, SLCWD staff utilize printed maps known as runbooks to locate all underground utilities within the District service area. Many of these maps are outdated and staff are becoming dependent on handwritten corrections of the maps. The District has begun bringing their utility information into a geographic information system (GID) database so that it can be easily accessed via web apps in the future. It is recommended that the District complete the GIS database project in the next year.

4.6 Summary of Findings

Several deficiencies have been identified in the SLCWD water distribution system. Table 27 below is list of recommended projects to address these deficiencies. Project cost estimates and a prioritized CIP can be found in Section 5.0.

Table 27: Distribution System Recommended Projects

Project	Project Description
Water Main Replacement Program	Replace aging asbestos concrete water mains and corresponding service saddles throughout system
Raw Water Line Leak Detection and Investigation	Perform leak detection on raw water transmission main, investigate other possible issues resulting in pressure drop
Hill Tank Flow Meter	Install a flow meter on the outlet pipe of the Hill Tank
Water System GIS	Complete previous efforts to create a full system GIS for the District

5.0 CAPITAL IMPROVEMENT PROGRAM

This Plan has given several recommendations for capital improvements to the SLCWD water system in order to address identified deficiencies. This section will provide a short description and cost estimate for each recommended project. The recommended projects will then be presented in a 10-year CIP.

5.1 Basis of Estimate

The cost estimates provided in this CIP are in line with AACE Level 5 Estimates. A Level 5 estimate has an accuracy range of -50 percent to +100 percent. These estimates are considered planning level, and the final project cost can vary widely if taken to bid or construction due to factors outside of reasonable predictability. Cost estimates were developed by taking costs from similar projects constructed in the last two years in the area. Inflation factors have been applied to costs as applicable. The costs were calculated in 2023 dollars and then projected forward to the recommended year of the project at an inflation rate of 3.8 percent. A breakdown of each cost estimate in 2023 dollars and the projected costs can be found in Appendix E.

All soft costs associated with construction projects were calculated as a percentage of the construction total. Soft costs include the contingency, engineering services, permitting, construction observation and management, and administration. The percentage used for each soft cost was consistent across all estimates, unless otherwise noted, and are presented as percentages in Table 28.

Table 28: Percentage of Construction Total Used for Soft Costs

Soft Cost Description	Percentage of Construction Total
Contingency	20%
Engineering	15%
Permitting	5%
Construction Observation and Management	12%
Administration	5%

5.2 Water Main Replacement Program

The majority of the SLCWD water distribution system is comprised of aging asbestos concrete pipes. While some water main improvement projects have occurred in the last few years, they have mainly been emergency replacements to deal with the older pipe failing. Due to the high number of pipe failures and repairs made by operations staff each year, it is recommended that the District begin a water main replacement program. It is also recommended that the District replace all 52,852 feet of asbestos concrete pipe in the distribution system with newer C900 PVC pipe. The total cost of this water main replacement program in 2023 dollars is $55,439,700.

Due to the current financial state of the District, future discussions and planning will be required to determine how much SLCWD can self-fund each year for this replacement program. As such, it is recommended that the District begin engaging with the SWRCB Division of Financial Assistance to determine possible funding sources. As this will be a long-term investment in the District infrastructure, utilizing state and federal loan and grant programs is beneficial in providing short- and long-term stability to the SLCWD water system, while allowing the cost of these improvements to be spread over a longer period of time. In order to account for all possible costs associated with this project, it is recommended that the District complete a Water Main Replacement Preliminary Engineering Report (PER) that can be used in funding applications. The PER is estimated cost is **$104,000** and should be completed in **2024**.

Whether self-funded, or utilizing state and federal funding, the water main replacement program will need to be completed in phases. It is recommended that the first phase of project target the far south of the system. The first phase should begin in Soda Springs Road where the end of the asbestos concrete pipe connects to newer PVC main. The project should then continue towards Serene Road and then move north into the rest of the system. During the development of the PER and initial design, placement of utilities in and around existing culverts in District roadways will need to be prioritized.

Subsequent phases of the project continue to build on the last, working towards the northwest portion of the system, to target the failing nylon bushing service saddles, before looping back to the south end. Additionally, each phase should determine if the areas shown in Figure 20 with low fire flow should be targeted for main replacement sooner rather than later. A full phasing plan is recommended to be included in the PER.

Based on discussions with SLCWD staff, and the current financial state of the District, it is recommended that the water main replacement program take place over a 20-year period. The first nine phases of the project have been included in the CIP, beginning in **2025.** The cost of each phase is 5 percent of the total cost, and then projected forward to the planned year of the phase. Table 29 shows the full phasing and estimated cost of each phase over the 20-year period.

Table 29: Water Main Replacement Phasing

Phase	Year	Estimated Cost
1	2025	$2,987,000
2	2026	$3,101,000
3	2027	$3,218,000
4	2028	$3,341,000
5	2029	$3,468,000
6	2030	$3,599,000
7	2031	$3,736,000
8	2032	$3,878,000
9	2033	$4,026,000
10	2034	$4,178,000
11	2035	$4,337,000
12	2036	$4,502,000
13	2037	$4,673,000
14	2038	$4,851,000
15	2039	$5,035,000
16	2040	$5,226,000
17	2041	$5,425,000
18	2042	$5,631,000
19	2043	$5,845,000
20	2044	$6,067,000
Total		**$87,124,000**

5.3 Intake Pipe Extension

The intake pipe for the Intake Pump Station is currently sitting at a depth of approximately 7.5 feet. At this depth, the intake is subject to freezing and at times will pull in both ice crystals and water into the pump station. The slushy consistency of the water during these conditions reduces efficiency and efficacy of the WTP, resulting in operations staff having to switch to Well

01 to provide water to the system. A previous study performed in 2021 recommended extending the intake pipe so that the depth of the intake is 14 feet below the surface of the lake. This study provided a Level 5 construction cost estimate of $100,000 at the time of the study (March 2021). This cost was then projected forward for this cost estimate. Additionally, the study estimated permitting costs to range between $40,000 and $150,000 depending on the status of the project in regard to CEQA and other factors. Based on a review of the permitting strategy presented in the 2021 study, it is recommended that a permitting cost of $150,000. The total project cost is estimated to be **$332,000** and should be completed in **2024**.

5.4 Utility Rate Study

With the large number of improvement projects required for the District, in addition to the pending completion of the metering program, it is recommended that SLCWD staff engage with an outside party to perform a utility rate study. This rate study would include a revenue requirement analysis taking into consideration the CIP below. The rate study should also include an equitable cost of service analysis that it complies with Proposition 218. The water rate study is estimated to cost **$26,000** and should be completed in **2024**.

5.5 Water System GIS

The District has begun the process of converting their old utility drawings from an AutoCAD format to a GIS database. This project included updating the utility drawings and creating new runbooks for operations staff. It is recommended that the District complete the GIS database by updating all underground utility locations within the GIS and then purchase ESRI ArcGIS Online (AGOL) accounts to host the information. SLCWD staff will be able to access AGOL through a web app while in the field or in the office. It is expected that the completion of the underground utility GIS will be $18,000 in total, however the water system portion of that cost is only **$9,000**. It is recommended that the project be completed in **2024**. The District will also have to factor in an annual cost of $1,500 per year to ESRI for the AGOL licensing.

5.6 System Water Age and WTP Process Analysis

The District water system has seen a rise in the running annual average of disinfection byproducts in the last few years. Specifically, testing for TTHM and HAA5 have produced spikes in the test results, as well as a growing trend. Disinfection byproducts can be combated using several methods, including changes to treatment processes and operational changes in the distribution system. It is recommended that SLCWD perform a study on the system water quality and water age to determine the most productive means in reducing TTHM and HAA5. This study would include analyzing water quality samples of the raw and treated water, analyzing dosing rates at the WTP, performing treatment simulations to provide options, performing a water age analysis utilizing the District system model, and documenting the findings and suggestions in a report. It is anticipated that this study would cost **$76,000** and should be completed in **2025**.

5.7 Well 01 Treatment Relocation and Discharge Line

The current layout of the Well 01 treatment skid and discharge line cause several operational and possible water quality concerns. Due to the remote access of the Well 01 building, operations staff have difficulty accessing the facility during the winter season. It is recommended that the arsenic treatment skid be relocated to the WTP, as the well can be operated remotely from the District office. With this relocation, it is also recommended that the Well 01 discharge line be disconnected from the raw water intake line and a dedicated discharge line built. The relocation of the treatment skid will also necessitate an expansion of the existing building housing the WTP.

This new line will route parallel to the raw water intake line and terminate at the relocated arsenic treatment skid in the WTP. The treatment skid discharge will then be routed to the WTP discharge line leading to the Office Tank. This will allow the District to utilize the WTP disinfection infrastructure for the Well 01 groundwater. A preliminary layout of this project can be found in Figure 22. The total project cost is anticipated to be **$694,000** and should be completed in **2026**.

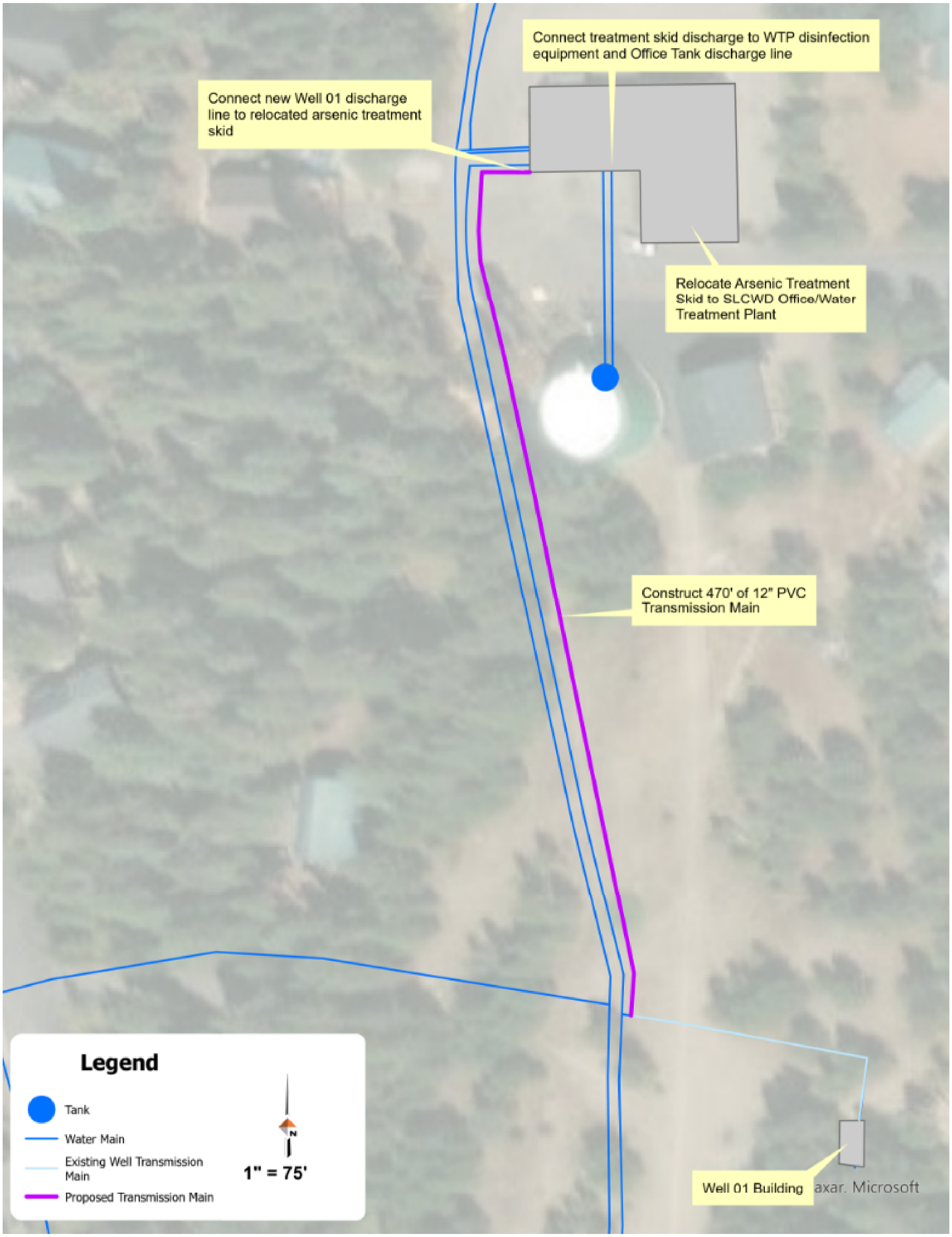

Figure 22: Proposed Arsenic Treatment Skid Relocation and Discharge Line

5.8 Raw Water Line Leak Detection, Investigation, and BDR

When the intake pumps turn off, District operations staff have noted that pressures upstream of the filters at the WTP drops to zero. This would only occur if large leaks were present in the raw water transmission main, the intake pump check valves are not properly seating after operation, or a variety of other issues. It is recommended that the District perform leak detection on the raw water intake line, as well as investigate the other possible issues that may be causing this pressure drop. The findings of the leak detection and investigation would then yield a proposed project to rectify the situation and a basis of design report (BDR) should be compiled. It is estimated that this project would cost **$56,000** and should be completed in **2026**.

5.9 WTP SCADA Improvements

The WTP is only able to be operated manually at this time. With staff onsite only five days a week, operation of the water system stipulates that both the Office Tank and Hill Tank are at capacity when staff finishes working on Friday evenings. The tanks are then allowed to drain through the weekend and refilled first thing Monday morning. As weekend water usage can be twice as high as weekday usage, this strategy places undo stress on the system during its time of peak usage. It is recommended that SLCWD engage with a SCADA vendor to determine the cost and infrastructure required to automate the WTP using the existing SCADA system. It is estimated that this effort would cost **$29,000** and should be completed in **2027**.

5.10 $KMnO_4$ Titration Unit Replacement

SLCWD is currently unable to accurately monitor and control the titration rates of $KMnO_4$ at the intake pump station. Previously, staff were able to use an older titration unit located in the operations staff office. However, that unit is currently inoperable and requires replacement. It is recommended that SLCWD purchase a new chemical monitor and controller to replace the broken unit. It is estimated that with equipment purchase, equipment installation, and SCADA integration, the total project cost is estimated to be **$29,000** and should be completed in **2027**.

5.11 Hill Tank Flow Meter

In order for the District to be able to fully utilize the customer meters being installed for water loss calculations, it is recommended the District install a flow meter on the outlet pipe of the Hill Tank feeding the distribution system. It is estimated that the total project cost will be **$239,000** and should be completed in **2027**.

5.12 10-Year CIP

The total SLCWD water system CIP can be found below in Table 30. The projects are organized by the priority in which they are recommended to be implemented.

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Table 30: 10-Year Capital Improvement Program

Project	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Water Main Replacement PER	$104,000									
Intake Pipe Extension	$332,000									
Utility Rate Study	$26,000									
System GIS	$9,000									
Water Main Replacement Phase 1		$2,987,000								
Water Age and WTP Process Analysis		$76,000								
Water Main Replacement Phase 2			$3,101,000							
Well 01 Treatment Relocation & Discharge Line			$694,000							
Raw Water Line Leak Detection & Investigation			$56,000							
Water Main Replacement Phase 3				$3,218,000						
WTP SCADA Improvements				$29,000						
KMNO4 Titration Unit Replacement				$29,000						
Hill Tank Flow Meter				$239,000						
Water Main Replacement Phase 4					$3,341,000					
Water Main Replacement Phase 5						$3,468,000				
Water Main Replacement Phase 6							$3,599,000			
Water Main Replacement Phase 7								$3,736,000		
Water Main Replacement Phase 8									$3,878,000	
Water Main Replacement Phase 9										$4,026,000
Water System Master Plan Update										$290,000
Total Annual Capital Cost	**$471,000**	**$3,063,000**	**$3,851,000**	**$3,515,000**	**$3,341,000**	**$3,468,000**	**$3,599,000**	**$3,736,000**	**$3,878,000**	**$4,316,000**

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APPENDIX A:
2017 LEAK DETECTION STUDY

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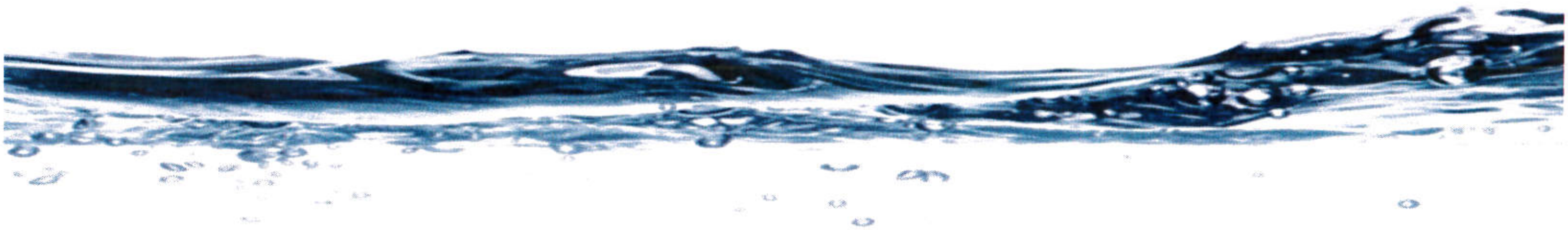
Final Report



Water Line Leak Detection Project for:
Sierra Lakes County Water District
Soda Springs, CA

Project Dates:
06/05/2017 through 06/08/2017

19655 1st Avenue South, Suite 101
Seattle, WA 98148

Phone: (877) 585-LEAK(5325)
Fax: (206) 429-3441
Email: info@leakdetectionservice.com

Web: www.leakdetectionservice.com

UTILITY SERVICES
ASSOCIATES
Leak Detection & Solutions

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COVER LETTER

July 11, 2017

Sierra Lakes County Water District
Attn: Bill Quesnel
PO Box 1039
Soda Springs, CA 95728

Re: **June 2017 Water Distribution System Leak Detection Project**

Dear Mr. Quesnel:

Utility Services Associates, LLC, (USA) is pleased to submit the enclosed Final Report on leak detection services recently completed.

The information contained in this Final Report details the procedures and results specific to this project. When applicable, recommendations have been made concerning the best approach for the repair of leaks detected and preparation for future leak detection projects.

As you review this Final Report, please pay close attention to the Water Loss Consultant's remarks and field observations in the Project Observation section of this report. These may assist you in determining the best course of action regarding specific leaks.

At times specific individual Leak Reports may differ in the Final Report from those provided during the course of the project. These changes, usually insignificant, generally pertain to the manner in which we report leaks and do not alter the methods used or results of pinpointing.

We strongly suggest you contact us prior to excavating any leak that we have labeled with "CAUTION" for further explanation.

This leak detection project is productive since we pinpointed leakage that, when repaired, can reduce your water loss, saving Sierra Lakes County Water District dollars now and in the future. We appreciate your confidence in USA. If you have any questions, call us at (877) 585-5325 or (206) 429-3751.

Sincerely,

Rob Meston
President

EXECUTIVE SUMMARY

LEAK DETECTION EXECUTIVE SUMMARY

From June 5, 2017 through June 8, 2017, USA performed a leak survey for **Sierra Lakes County Water District in Soda Springs, CA.** Our Water Loss Consultant, Matt Baker, used and appreciated the information provided by Jeff Krebill to expedite and provide an accurate survey. The tables below detail the information gathered.

Time Spent on Project	
Surveying:	29 Hr
Pinpointing:	3.5 Hr
Other Time:	0 Hr
Total Time:	32.5 Hr

Total Areas Surveyed	
Total Distance in Miles	12
Total Distance in feet	63,360

The mileage was estimated by the Water Loss Consultant and may not match maps.

Access Points Contacted	
Hydrants	80
Valves	218
Services	297
Other	0
Total	595

Leak Type Noises Detected	
Hydrants	0
Valves	2
Services	6
Other	0
Total	8

Leaks Pinpointed	
Main	0
Valve	0
Hydrant	0
Service Line	3
Service Connection	0
Curbstop	0
Meter	0
Total	3

Total Water Loss Identified	
Gallons Per Minute (GPM):	9
Gallons Per Day:	12,960
Gallons Per Month:	394,200
Gallons Per Year:	4,730,400

Unidentified Water Loss	
Faulty Meters	0
Unidentified Leaks	0
Possible Consumer Side Leaks	0

This project was divided into two phases; the survey phase and the pinpointing phase. The following pages outline exactly how those two phases progressed and the results of each. Any leaks pinpointed will be detailed in the attached Leak Reports.

PROJECT OBSERVATIONS

PROJECT OBSERVATIONS
(Water Distribution Lines)

GENERAL

USA recently completed a water system leak detection project for the Sierra Lakes County Water District in Soda Springs, CA. The fieldwork portion of the project was started on June 05, 2017 and was completed on June 08, 2017. The information listed below was generated from data collected by USA Water Loss Consultant, Matt Baker over the course of the fieldwork.

SPECIFICS

The project was broken down into two different phases:

1. ***Survey Phase*** – sounding of appurtenances and recording all leak anomalies detected for further investigation.

2. ***Pinpointing Phase*** – pinpointing all anomalies that were detected during the survey phase.

1. *Survey Phase Information*

The survey phase of the project went exceptionally well. The acoustics were as expected on a system, which consisted of main lines of 6 to 10" of AC and C900 pipe type. Service lines were polyvinyl chloride (PVC) or copper. Regardless of sound travel, we were asked to provide a point-to-point survey, sounding all available appurtenances (valves, hydrants and service meter) in the system is to be sounded, regardless of acoustic properties of the system. However, with the winter the region received, there was still plenty of snow on the ground. This made locating every service meter an insurmountable obstacle. Unfortunately, we were not able to check every access point because of this.

Lines with limited access

- There were no lines with limited access

Lines were surveyed on the following map zones

- No map numbers were used

System Maintenance List

- No maintenance items were found (broken valve boxes, etc.)

As a result of the Survey Phase, we detected and recorded three (3) leak type noises for re-investigation during the Pinpointing Phase.

2. *Pinpointing Phase Information*

As a result of the Pinpointing Phase, we have pinpointed seven (7) leaks. Information follows on specific leaks. For additional information and a drawing of each leak, please refer to the Leak Report section of the Final Report.

Leak Report No. 2 – 5409 Hillside Dr.

While we are confident this leak is on the service line, we could not pinpoint the exact location. We suggest you expose the line at the "Y" and dig towards the service connection.

Leak Report No. 3 – 6134 Cascade Rd.
While we are confident this leak is on the service line, we could not pinpoint the exact location. We suggest you expose the line at the "Y" and dig towards the service connection.

RECOMMENDATIONS
We recommend a continued focus on water loss and real loss reduction. Once repairs are made, note any observed differences in estimate as errors in our estimates will have a significant impact on water loss numbers if this report will be used for that purpose, or to support other estimated/actual real losses.

CONCLUSION
We would like to thank Jeff Krebill for his field assistance. His hard work and knowledge of the system proved invaluable. We look forward to working with the Sierra Lakes County Water District on future conservation projects.

Matt Baker
Water Loss Consultant

SURVEY PHASE REVIEW

SURVEY PHASE REVIEW
(Water Distribution Lines)

The first step in our survey was to review the distribution maps of the system for familiarization of the pipe network and available appurtenances to be used for contact points.

We then conducted a comprehensive survey by making physical contact with all available appurtenances (valves, hydrants, and services). USA used a sonic leak detection amplification instrument designed for this purpose.

Appurtenances Surveyed

Hydrant	80
Valves	218
Services	297
Other	0
Total	**595**

When normal contact points were not available or could not be created within a reasonable distance, we made an attempt to use a sonic ground listening instrument to make physical ground contact at intervals no greater than 6 feet directly over the pipe. If conditions did not allow this procedure our Water Loss Consultant advised you at time of project and notes of such are included in the Project Observations. Ground listening devices are employed when ground cover is pavement, cement or similar hard surface.

When ground cover was not a hard surface and normal contact points were not available, we made an attempt to use probe rods or a specially designed sounding plate at 6-foot intervals. A sound amplification instrument with 3VG or greater transducer was employed in conjunction with this equipment, directly over the pipe. If conditions did not allow this procedure our Water Loss Consultant advised you at time of project and was detailed in the Project Observations section of this Final Report. Direct contact to the main line at intervals outlined in Preparation for Service resulted in the most thorough survey.

Areas Surveyed

Street	From	To
Serene Rd	1001 Serene Rd	West end or road
Island Way	Serene Rd	End of road
Swiss Ct	Serene Rd	End of road
Frosty Way	Serene Rd	Hillary Dr
Hillary Dr	Frosty Way	End of road
Kilborn Dr	Serene Rd	End of road
Westshore Dr	Serene Rd	End of road
Slumber Way	Kidd Cut	Kilborn Dr
Baxter Dr	Slumber Way	End of road
Hillside Dr	Baxter Dr	Pahatsi Rd
Kidd Ct	End of road	End of road
Bluff Dr	Hillside Dr	Acorn Rd
Tamarack Way	Westshore Dr	End of road
Alpine Way	Tamarack Way	Tamarack Way
Pahatsi Rd	Serene Rd	End of road

Serene Rd	Pahatsi Rd	Short Rd
Muir Ct	Pahatsi Rd	End of road
Soda Springs Rd	Serene Rd	Dulzura Rd
Dulzura Rd	Soda Springs Rd	Lake Dr
Lake Dr	Hemlock Dr	End of road
Donner Dr	Hemlock Dr	Dulzura Rd
Sierra Rd	Lake Dr	Soda Springs Rd
Beacon Rd	Lake Dr	Soda Springs Rd
Castle Rd	Lake Dr	Donner Dr
Allen Dr	Soda Springs Rd	End of road
Palisade Rd	Tamarack Way	Soda Springs Rd
Yuba Dr	Tamarack Way	Bales Rd
Spruce Rd	Tamarack Way	Bales Rd
Hemlock Dr	Tamarack Way	End of road
Bales Rd	Serene Rd	Allen Dr
Tamarack Way	Palisade Rd	Spruce Rd
Tamarack Way	Spruce Rd	Yuba Dr
Soda Springs Rd	Beacon Rd	Cascade Rd
Soda Springs Rd	End of Line	Cascade Rd
Palisade Rd	Pahatsi Rd	Tamarack Way
Cascade Rd	Soda Springs Rd	Soda Springs Rd
Acorn Rd	Pahatsi Rd	Bluff Dr
Spruce Rd	Tamarack Way	Cascade Rd
Pahatsi Rd	Soda Springs Rd	Serene Rd
Yuba Dr	Tamarack Way	Pahatsi Rd
Alpine Way	Serene Rd	Tamarack Way
Hillside Dr	Spot Check	Spot Check
Slumber Way	Spot Check	Spot Check
2" PVC	Serene Rd	End of line
Total Area Surveyed in Feet		
Total Area Surveyed in Miles		

A detailed report of decibel levels at suspected leak sound locations and observations were compiled during the survey for reinvestigation and possible pinpointing at a later time. This reinvestigation increased the speed of the survey and eliminated correlating on most false leak sounds.

Leak Type Noises Detected

Contact Points	Noises Detected
Hydrant	0
Valves	2
Services	6
Other	0
Total	**8**

All indications of leaks found during the survey were verified a second time, after which, the leaks were pinpointed with a computer based sound correlator when possible. Pinpointing information can be found in the Pinpointing and Leak Reports Sections.

PINPOINTING PHASE REVIEW

PINPOINTING PHASE REVIEW
(Water Distribution Lines)

All indications of leaks found during the survey were verified a second time, after which, the leaks were pinpointed with a computer based sound correlator when possible. Pinpointing leak locations through interpretation of sound intensity, either by ear, decibel metering or other like methods was not used when contact points were available for use with the correlator. However, ground listening devises were used as a quick double check on pinpointed leaks.

The equipment used did not normally require valves to be operated during surveying and pinpointing. However, on occasion, services or valves were operated to eliminate service draw noises or to change velocity noise.

The correlator equipment used had the capability to prompt the operator to input the variables when different pipe sizes and/or pipe material were encountered in the same span to be investigated. This is necessary to insure accuracy of results based on the automatic computation of the correct leak sound velocity in leak pinpointing operations. Our correlators have the capability of correlating up to seven various pipe sizes and types at one time in a given space. To insure effective performance in all field environments encountered in the distribution system (i.e. traffic noise, draw, pump operation, industrial noise, etc.), the correlator equipment provides 16 auto filter options and/or infinite manual filter options.

We provided a copy of leak reports, when pinpointed, which included leak locations and estimated GPM loss.

Leaks Pinpointed

Number	Leak Type	Location	GPM
1	Service Line	9349 Pahatsi Rd	5.00
2	Service Line	5409 Hillside Dr	2.00
3	Service Line	6134 Cascade Rd	2.00
Total			**9.00**

These leak reports, also included a leak repair priority classification. These classifications are as follows:

Class I Any leak which is hazardous in terms of potential undermining, possibly resulting in surface collapse, encroachment and/or damage to nearby utilities, commercial or private properties or leaks severe enough to warrant immediate repair.

Class II All leaks that display water losses significant enough to be monitored on a regular repair schedule.

Class III Relatively small leaks that should be repaired as workload permits.

Repair Priority

Number	Leak Type	Location	GPM
Total Class I			**0.00**

Number	Leak Type	Location	GPM
1	Service Line	9349 Pahatsi Rd	5.00
2	Service Line	5409 Hillside Dr	2.00
3	Service Line	6134 Cascade Rd	2.00
Total Class II			**9.00**

Number	Leak Type	Location	GPM
Total Class III			**0.00**

Whenever any of the leaks detected by USA were repaired prior to completion of the field work, we gave Sierra Lakes County Water District the option to have that section of the system re-surveyed to be sure no very quiet leaks were missed due to an over powering noisy leak sound.

Please note that leakage that was detected and pinpointed may be larger or smaller than estimated. Estimates are based on several variables including type and size of pipe, pressure and interpretation of correlation filter results.

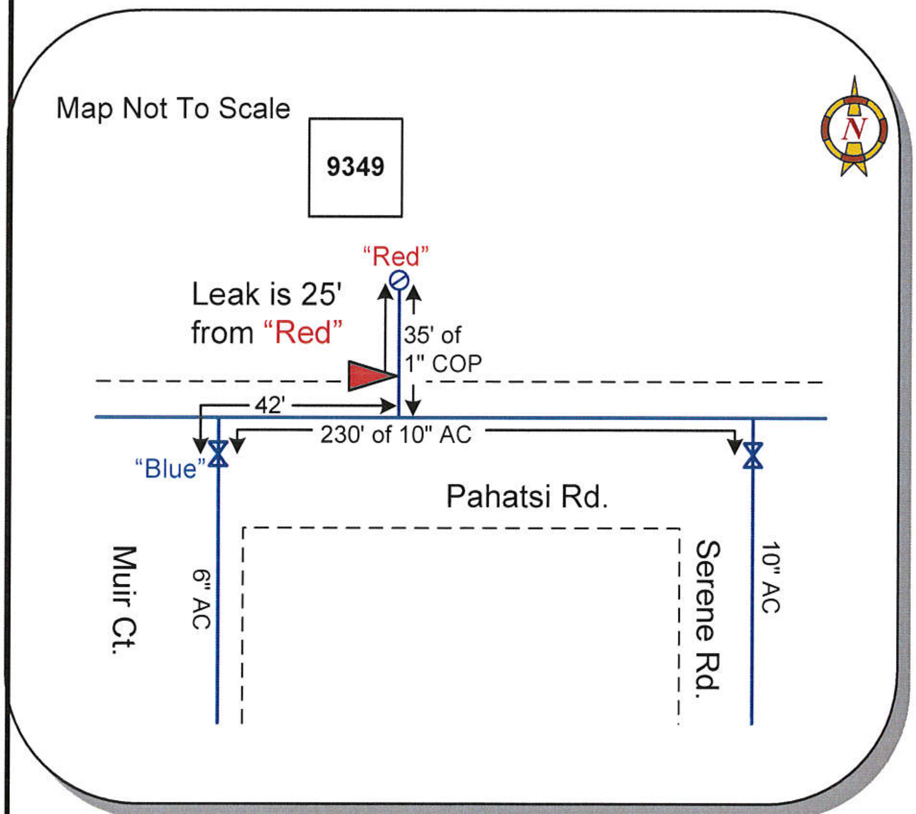
End of Section

LEAK REPORTS

Leak Report

Utility Services Associates, LLC

Location: 9349 Pahatsi Rd.
Map #: GPS:
Remarks: Correlations and ground mic confirmed leak on service line. Leak is 25' from meter.
Leak Type: Service Line
Recommendations: Excavate & Repair



Leak Consultant: MB
Leak No: 1
Leak Class: II
Leak Rate: 5 GPM
Cover Type: Soil
Site Marked: No
Date: 06/06/17
Job No: 17223

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Equipment used: S-30 Portable Listening Device, LD-12 and LC-2500

Computer Correlation Results

Scan Time	Grade	Dist "Red"	Dist "Blue"
300	A	25	42

Water Loss
(this leak, in gallons)

DAILY.................... 7,200
WEEKLY 50,400
MONTHLY 219,000

Utility Services Associates, LLC

Leak Report

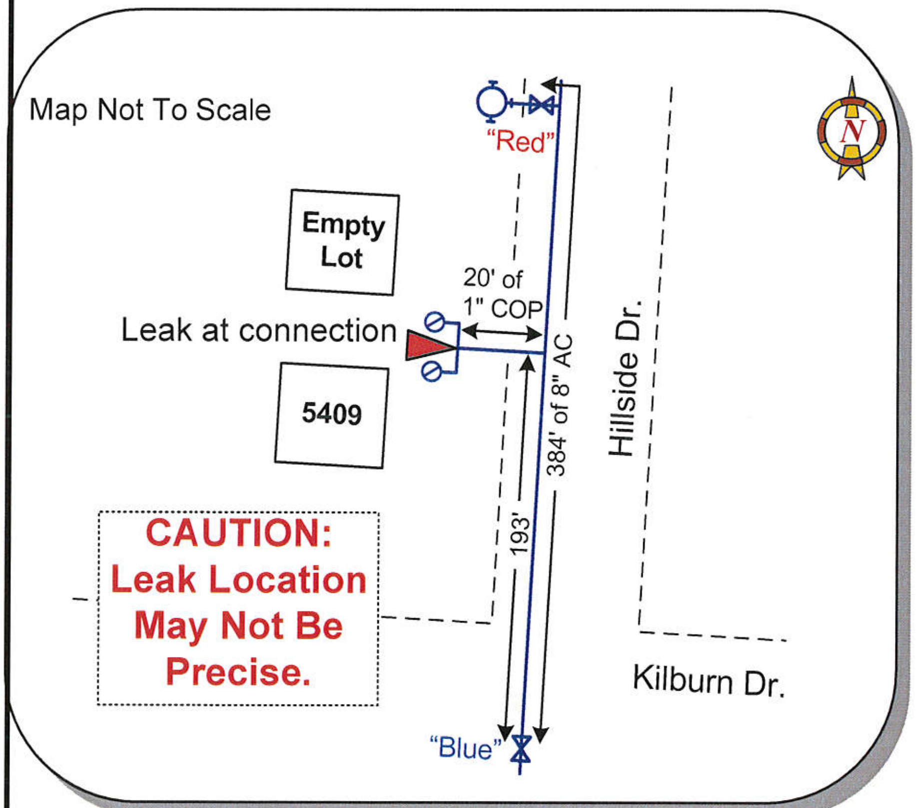
Location: 5409 Hillside Dr.

Map #: GPS:

Remarks: First correlation put leak at service corp. Second correlation put leak at or near curb stop. Both were marginal. Leak noise localized to area. Difficult to probe (tree/deep snow). Leak is likely on Y connection.

Leak Type: Service Line

Recommendations: Excavate & Repair



Leak Consultant: MB

Leak No: 2

Leak Class: II

Leak Rate: 2 GPM

Cover Type: Soil

Site Marked: No

Date: 06/07/17

Job No: 17223

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Equipment used: S-30 Portable Listening Device, LD-12, LC-2500 & Probe Rod

Computer Correlation Results

Scan Time	Grade	Dist "Red"	Dist "Blue"
300	B	191	193
300	B	2	191

Water Loss
(this leak, in gallons)

DAILY.................. 2,880
WEEKLY 20,160
MONTHLY 87,600

Utility Services Associates, LLC

Leak Report

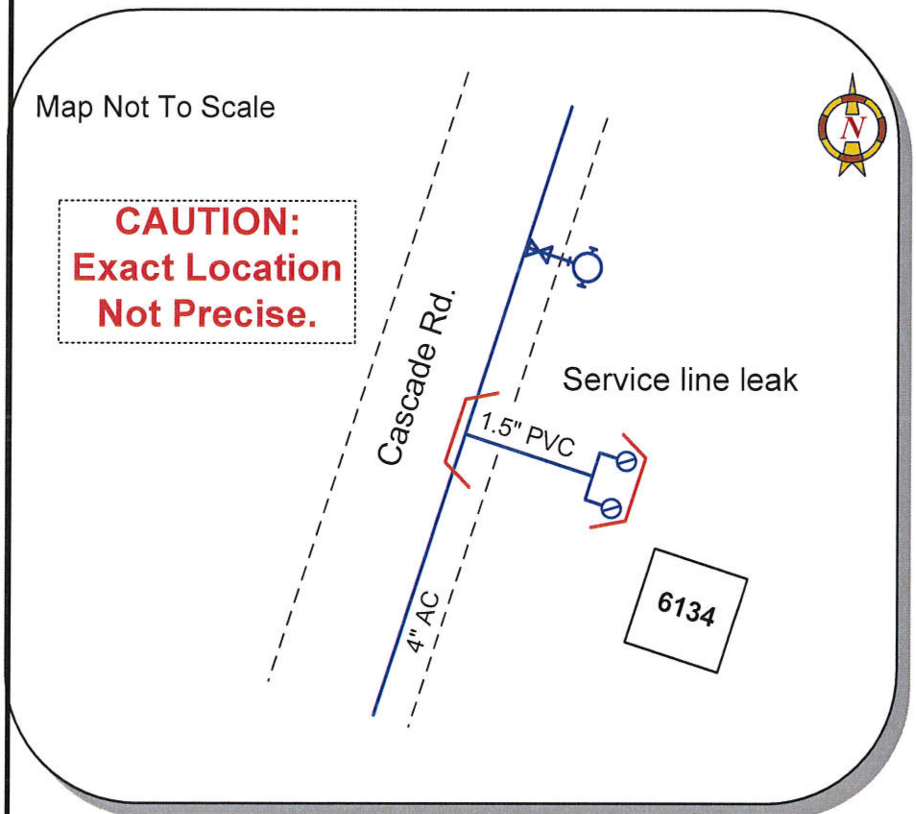
Location: 6134 Cascade Rd.

Map #: GPS:

Remarks: Unsuccessful correlations. No noise with portable unit. Localized leak noise on dual curb stop meter pit. Only one meter connected. Meter was not showing usage. Leak was unable to be pinpointed and caution should be used when excavating.

Leak Type: Service Line

Recommendations: Excavate & Repair



Leak Consultant: MB

Leak No: 3

Leak Class: II

Leak Rate: 2 GPM

Cover Type: Soil

Site Marked: No

Date: 06/07/17

Job No: 17223

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Equipment used: S-30 Portable Listening Device, LD-12, LC-2500 & Probe Rod

Computer Correlation Results

Scan Time	Grade	Dist "Red"	Dist "Blue"

Water Loss
(this leak, in gallons)

DAILY.................. 2,880
WEEKLY 20,160
MONTHLY 87,600

CONCLUSION

UTILITY SERVICES
ASSOCIATES
Leak Detection & Solutions

LEAK SURVEY CONCLUSION

Our thanks to Bill Quesnel and all persons involved with this project for their assistance in gathering all the necessary paperwork and personnel to create, with USA, a mutually beneficial leak detection project.

With this survey you have demonstrated concern for prudent water utilization and conservation.

Capitalizing on the most advanced leak detection technology available today, USA has successfully completed this Leak Detection Survey. The contents of this Final Report provide Sierra Lakes County Water District with a permanent record of the activities performed to complete a Leak Survey along with the results achieved.

An important characteristic of this Leak Report is that the facts contained herein can be used in formulating a database for decision making regarding: the need for possible future meter programs, rehabilitation and pipe line replacement and/or the investigation of new water sources, etc. These types of decisions, regarding your utilization of water, now can be predicated more on facts rather than supposition or conjecture.

Prompt repair of any leaks reported provide an immediate benefit to Sierra Lakes County Water District, which includes recovery of most water revenue and water conservation, etc.

Having achieved these results, we recommend that you continue to set up the infrastructure necessary to continue investigating leakage in the water distribution system. Implementation of any on-going leak survey program will ensure that leak losses are kept to a minimum, and the added enhancement of saving costs due to emergency call outs.

Utility Services Associates, LLC, is proud to have served Sierra Lakes County Water District in this way and we wish to thank you for your substantial assistance and cooperation in this project.

If you or your staff has any questions regarding this Final Report, please feel free to call us at (877) 585-5325 or (206) 429-3751.

Best Regards,

Rob Meston
President

19655 1ST AVE SOUTH • SUITE 101 • SEATTLE, WA 98148 P 877.585.LEAK F 206.429.3441
LEAKDETECTIONSERVICE.COM

APPENDIX B:
2022 CONSUMER CONFIDENCE REPORT

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2022 Consumer Confidence Report

Water System Information

Water System Name: Sierra Lakes County Water District

Report Date: June 1, 2023

Type of Water Source(s) in Use: Reservoir and Well

Name and General Location of Source(s): Lake Serena, the northernmost of the two lakes in Serene Lakes. The District Maintains a well as a backup source on Lot A.

Drinking Water Source Assessment Information: A 2003 Source Assessment prepared by the State of California is available for review at the District office. The Assessment indicates “the source is most vulnerable to sewer collection system activities”.

Time and Place of Regularly Scheduled Board Meetings for Public Participation: The Board of Directors meets on the Second Thursday of each month at the District office located at 7305 Short Road, Soda Springs, CA 95728

For More Information, Contact: Patrick Baird, Utility Operations Manager Phone: (530) 426-7802

About This Report

We test the drinking water quality for many constituents as required by state and federal regulations. This report shows the results of our monitoring for the period of January 1 to December 31, 2022 and may include earlier monitoring data.

Terms Used in This Report

Term	Definition
Level 1 Assessment	A Level 1 assessment is a study of the water system to identify potential problems and determine (if possible) why total coliform bacteria have been found in our water system.
Level 2 Assessment	A Level 2 assessment is a very detailed study of the water system to identify potential problems and determine (if possible) why an *E. coli* MCL violation has occurred and/or why total coliform bacteria have been found in our water system on multiple occasions.
Maximum Contaminant Level (MCL)	The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.
Maximum Contaminant Level Goal (MCLG)	The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency (U.S. EPA).

Term	Definition
Maximum Residual Disinfectant Level (MRDL)	The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
Maximum Residual Disinfectant Level Goal (MRDLG)	The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
Primary Drinking Water Standards (PDWS)	MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
Public Health Goal (PHG)	The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.
Regulatory Action Level (AL)	The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.
Secondary Drinking Water Standards (SDWS)	MCLs for contaminants that affect taste, odor, or appearance of the drinking water. Contaminants with SDWSs do not affect the health at the MCL levels.
Treatment Technique (TT)	A required process intended to reduce the level of a contaminant in drinking water.
Variances and Exemptions	Permissions from the State Water Resources Control Board (State Board) to exceed an MCL or not comply with a treatment technique under certain conditions.
ND	Not detectable at testing limit.
ppm	parts per million or milligrams per liter (mg/L)
ppb	parts per billion or micrograms per liter (µg/L)
ppt	parts per trillion or nanograms per liter (ng/L)
ppq	parts per quadrillion or picogram per liter (pg/L)
pCi/L	picocuries per liter (a measure of radiation)

Sources of Drinking Water and Contaminants that May Be Present in Source Water

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

- Microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

- Inorganic contaminants, such as salts and metals, that can be naturally occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.
- Pesticides and herbicides, that may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, agricultural application, and septic systems.
- Radioactive contaminants, that can be naturally occurring or be the result of oil and gas production and mining activities.

Regulation of Drinking Water and Bottled Water Quality

In order to ensure that tap water is safe to drink, the U.S. EPA and the State Board prescribe regulations that limit the amount of certain contaminants in water provided by public water systems. The U.S. Food and Drug Administration regulations and California law also establish limits for contaminants in bottled water that provide the same protection for public health.

About Your Drinking Water Quality

Tables 1, 2, 3, 4, and 5 list all of the drinking water contaminants that were detected during the most recent sampling for the constituent. The presence of these contaminants in the water does not necessarily indicate that the water poses a health risk. The State Board allows us to monitor for certain contaminants less than once per year because the concentrations of these contaminants do not change frequently. Some of the data, though representative of the water quality, are more than one year old. Any violation of an AL, MCL, MRDL, or TT is asterisked. Additional information regarding the violation is provided later in this report.

Table 1. Sampling Results Showing the Detection of Lead and Copper

Lead and Copper	Sample Date	No. of Samples Collected	90th Percentile Level Detected	No. Sites Exceeding AL	AL	PHG	No. of Schools Requesting Lead Sampling	Typical Source of Contaminant
Lead (ppb)	Sept. 2020	10	0	0	15	0.2	Not Applicable	Internal corrosion of household water plumbing systems; discharges from industrial manufacturers; erosion of natural deposits
Copper (ppm)	Sept. 2020	10	0	0	1.3	0.3	Not applicable	Internal corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives

Table 2. Sampling Results for Sodium and Hardness

Chemical or Constituent (and reporting units)	Sample Date	Level Detected	Range of Detections	MCL	PHG (MCLG)	Typical Source of Contaminant
Sodium (ppm)	Sept. 2016	4.6	NA	None	None	Salt present in the water and is generally naturally occurring
Hardness (ppm)	Sept. 2016	11	NA	None	None	Sum of polyvalent cations present in the water, generally magnesium and calcium, and are usually naturally occurring

Table 3. Detection of Contaminants with a Primary Drinking Water Standard

Chemical or Constituent (and reporting units)	Sample Date	Level Detected	Range of Detections	MCL [MRDL]	PHG (MCLG) [MRDLG]	Typical Source of Contaminant
Total Trihalomethanes (ppb)	quarterly	59.25*	36 - 96	80	NA	Byproduct of drinking water disinfection process
Hal-acetic Acids (ppb)	quarterly	36.50	32 - 44	60	NA	Byproduct of drinking water disinfection process

*compliance with drinking water standards for total trihalomethanes is based on the running annual average of the Range of Detections, and not based on a single sampling result.

Table 4. Detection of Contaminants with a Secondary Drinking Water Standard

Chemical or Constituent (and reporting units)	Sample Date	Level Detected	Range of Detections	SMCL	PHG (MCLG)	Typical Source of Contaminant
Color (units)	May 2017	4	N/A	15	N/A	Naturally occurring organic materials
Zinc (ppb)	Sept. 2016	108	N/A	5000	N/A	Runoff/leaching from natural deposits; industrial wastes
Odor (ton)	May 2017	1	N/A	3	N/A	Naturally occurring organic materials
Sulfate (ppm)	Sept. 2016	0.7	N/A	500	N/A	Leaching from natural deposits; industrial wastes

Table 4. Detection of Contaminants with a Secondary Drinking Water Standard (cont.)

Chemical or Constituent (and reporting units)	Sample Date	Level Detected	Range of Detections	SMCL	PHG (MCLG)	Typical Source of Contaminant
Chloride (ppm)	Sept. 2016	3.4	N/A	500	N/A	Runoff/leaching from natural deposits
Specific Conductance (μS/cm)	Sept. 2016	55.6	N/A	1600	N/A	Substances that form ions when in water

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the U.S. EPA's Safe Drinking Water Hotline (1-800-426-4791).

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. U.S. EPA/Centers for Disease Control (CDC) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline (1-800-426-4791).

Lead-Specific Language: If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. [Enter Water System's Name] is responsible for providing high quality drinking water but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. [Optional: If you do so, you may wish to collect the flushed water and reuse it for another beneficial purpose, such as watering plants.] If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline (1-800-426-4791) or at http://www.epa.gov/lead.

Table 5. Sampling Results Showing Treatment of Surface Water Sources

Treatment Technique [a] (Type of approved filtration technology used)	Direct Filtration
Turbidity Performance Standards [b] (that must be met through the water treatment process)	Turbidity of the filtered water must: 1 – Be less than or equal to 0.3 NTU in 95% of measurements in a month. 2 – Not exceed 1.0 NTU for more than eight consecutive hours. 3 – Not exceed 5.0 NTU at any time.
Lowest monthly percentage of samples that met Turbidity Performance Standard No. 1.	100
Highest single turbidity measurement during the year	0.14
Number of violations of any surface water treatment requirements	0

(a) A required process intended to reduce the level of a contaminant in drinking water.

(b) Turbidity (measured in NTU) is a measurement of the cloudiness of water and is a good indicator of water quality and filtration performance. Turbidity results which meet performance standards are considered to be in compliance with filtration requirements.

APPENDIX C:

2021 INTAKE IMPROVEMENTS STUDY

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DRAFT TECHNICAL MEMORANDUM

TO: Sierra Lakes County Water District (SLCWD)

CC: Paul Shultz

PREPARED BY: Katie Howes, E.I.T.

REVIEWED BY: Ryker Brown, P.E.

DATE: April 5, 2021

RE: Serene Lakes Intake Improvements and Conceptual Design

At the request of the Sierra Lakes County Water District (SLCWD, District), Woodard & Curran (W&C) evaluated alternatives and the conceptual design for intake improvements for Serene Lakes. The District wishes to evaluate options to rehabilitate and/or replace the existing Serene Lakes intake pipe to alleviate water quality issues in the raw water supply. Below is a conceptual level design memorandum presenting the findings and recommendations associated with our investigations, as well as a budgetary level cost information on the feasible alternative.

1. PROJECT UNDERSTANDING

The purpose of the Serene Lakes Intake Improvements and Conceptual Design is to evaluate various alternatives for the feasibility of extending the intake pipe further into the lake. The existing intake pipe is approximately 6.5 feet deep (from the invert of intake cap to the water surface) and takes in ice crystals in addition to water during winter months, making the influent a slushy consistency. The District has conducted water quality sampling at four sites at various depths and seasons, measuring turbidity, dissolved oxygen (DO), pH, temperature, and other parameters. The water quality data also shows higher turbidity in shallow depths during the winter season at the location of the existing intake structure. The District would like to extend the intake pipe to deeper waters in the lake where temperatures are warmer and turbidity is lower during the winter, but it has been noted that water quality varies at deeper portions in the lake as well. The District would like W&C to evaluate various alternatives for the feasibility, reliability, constructability, and other criteria of extending the intake pipe farther into the lake.

2. PROJECT LOCATION AND SITE CONSTRAINTS

<u>Project Location</u>

The District provides water and sanitary sewer services to the residents of the Serene Lakes community on Donner Summit. Serene Lakes is part of the North Tahoe area located in the northern Sierra Nevada mountain range. The District service area spans 2,450 acres, serving roughly 830 private homes of the 1,000 residential lots in the development. The Serene Lakes themselves, Lake Serena and Lake Dulzura, are lakes of about 40 acres each and are joined via a small gap (**Figure 1**). Both lakes are closed to gasoline-powered watercraft. The Serene Lakes are situated at approximately 6,900 feet above mean sea level.

The District maintains and operates two sources that provide the community's drinking water. The primary source is Lake Serena, the northernmost lake, with pumping and treatment capacity of up to 200 gallons per minute (gpm). The secondary source is a well which is permitted as a backup supply. The current intake pipe is located on the northern end of Lake Serena, adjacent to the District's pump house where the water is pumped to the District's treatment plant.

Figure 1: Serene Lakes Overview Location

Weather

During winter months, temperatures drop below freezing, the community experiences heavy snowfall, and the lakes freeze over. Maximum depth of Lake Serena is approximately 24 feet. During the winter of 2019, there was a depth of approximately 9 feet of ice in the lake.

Site Visit and Background Data and Information Review

W&C conducted a kickoff meeting and site visit with the District on August 15, 2019. The District team described the operation of the system and the issues with temperature and water quality they are having before showing W&C the pump house and intake location. It was noted during the site visit that the Serene Lakes distribution system consists of a large amount of aged asbestos concrete (AC) pipe experiencing high groundwater conditions. These conditions can result in an increased rate of wall thickness reduction.

Following the site visit, the District provided W&C with various record drawings and condition assessment videos showing the intake pipe, as well as the water quality data from the winter, spring, and summer of 2019. W&C reviewed the information before beginning the alternative analysis.

Existing Intake Pipe and Structure

Description

The intake pipe is approximately 320 linear feet (LF). The intake pipe connects to the wet well in the pump house on Bales Road and extends underground from the pump house approximately 110 LF to an abandoned wet well, and then continues for approximately 210 LF to a point approximately 110 feet off the shoreline. The intake pipe daylights as it reaches the location of the actual intake. The intake pipe extends to a depth of about 9.5 feet and the end is elevated approximately two feet off the bottom of the lake. As the pipe travels along lake bottom, a portion of the pipe has a tar coating, where it is assumed two pipes of different material come together. The tar coating is blistering and cracking, and small pieces are releasing into the water surrounding the pipe. At approximately 50 LF after the location of the tar coating, the pipe is raised off the bottom of the lake and angled southeast. Two 45-degree fittings were used to raise the intake off of the lake bottom. The condition of the fittings is unknown, but the District's hired diver from the condition assessment video noted that one of the fittings was loose. The intake consists of an approximately 10 to 15 LF section of perforated PVC pipe with a cap at the end, which is also perforated. The pipe intake rests on cinder blocks and is not secured. See **Figure 2** for a plan view of the existing intake, and

Figure 3 for profile view of the existing intake.

Size

The intake pipe is either a 10-inch or 12-inch pipe. District staff noted the intake pipe was a 10-inch pipe that extended from the pump house into the lake. The District hired a diver in 2016 to document the current intake structure configuration and conditions and noted that the intake pipe was a 12-inch pipe. For the purposes of this analysis, it was assumed the intake pipe was the larger of the two sizes (the 12-inch) for a more conservative approach to the cost estimate. The District should verify this information prior to proceeding with design.

Material

The material of the existing intake pipe is unknown. Condition assessment video provided by the District notes that the pipe material in the lake is PVC. Material of the pipe from the pump house to the abandoned wet well is unknown, but is potentially AC based on the white color observed during a condition assessment.

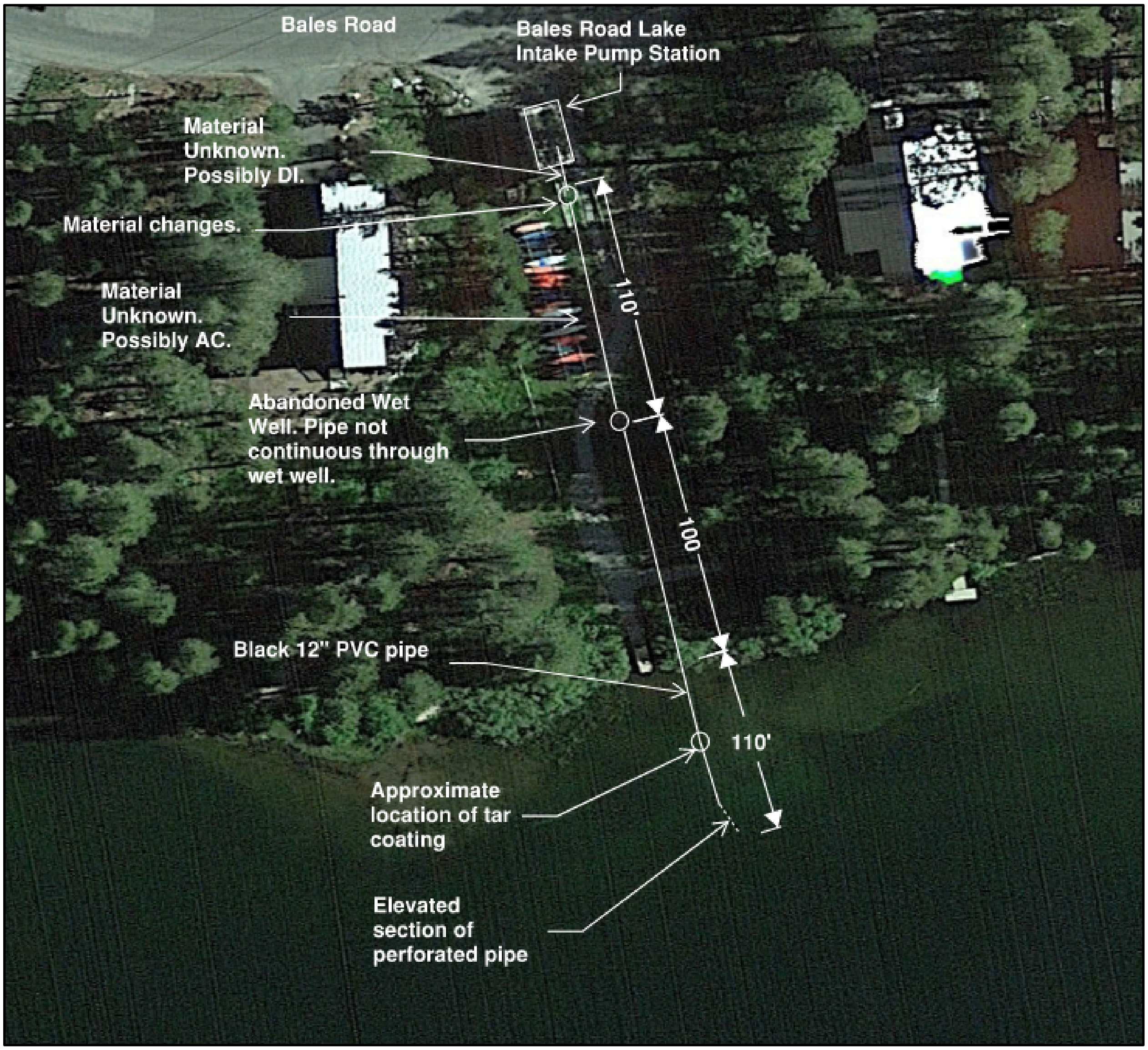


Figure 2: Plan View of Existing Sierra Lakes Intake Structure

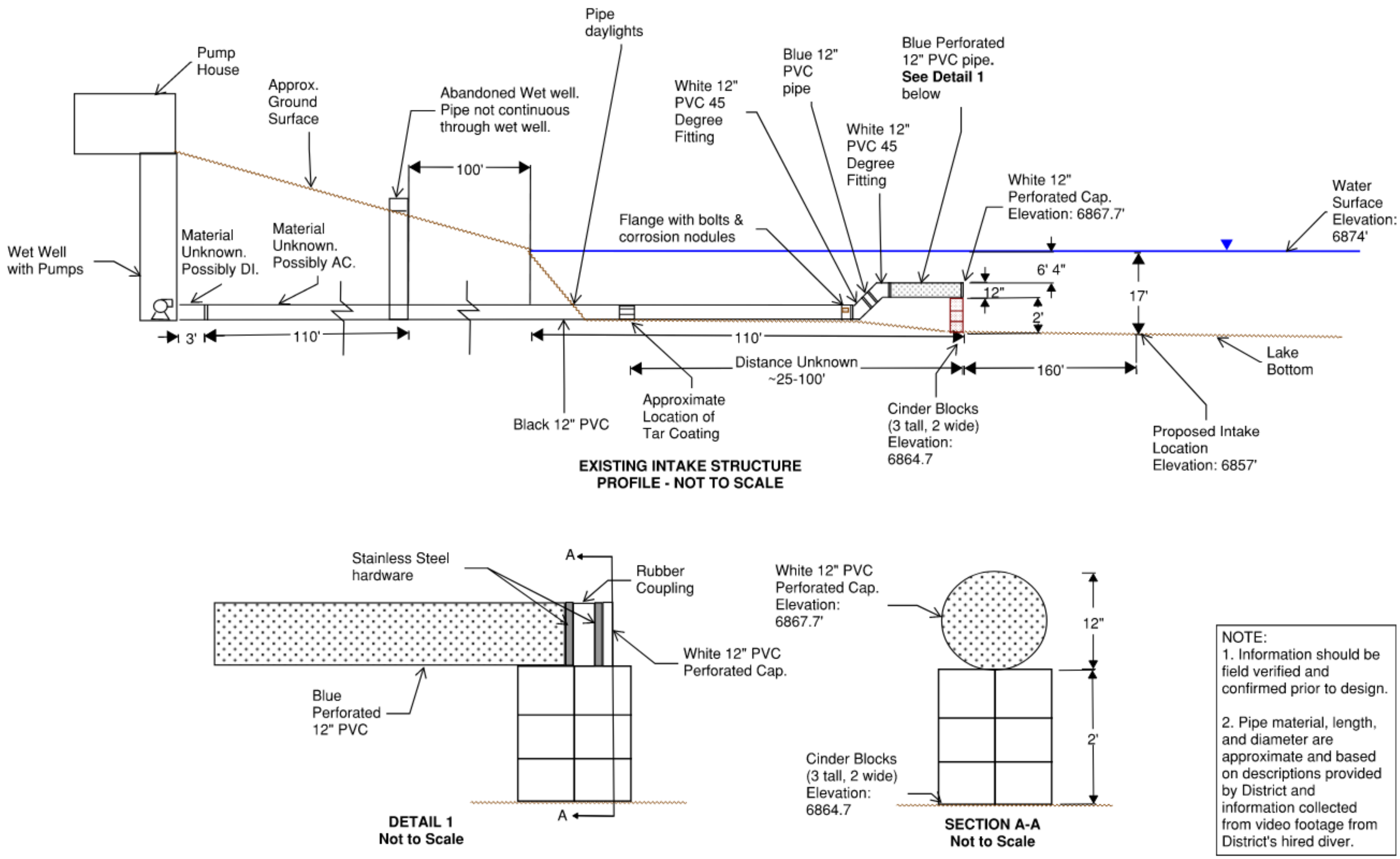


Figure 3: Profile View of Existing Sierra Lakes Intake Structure

3. WATER QUALITY EVALUATION

The District conducted water quality sampling at four locations, measuring: temperature, turbidity, dissolved oxygen, pH, oxidation reduction potential, and other parameters. The District conducted sampling during various seasons over four non-consecutive days: 03/26/2019, 04/18/2019, 04/30/2019, and 07/03/2019. The water quality sampling methods and procedures are unknown. In winter of 2019, the District noted that there was approximately 9 feet of ice measured in the frozen lake. It is unknown how water quality samples were collected under these conditions. Without daily water quality data available for evaluation of every season, W&C used engineering judgement to interpret trends for the absence of data. **Attachment A** contains a map of these sample locations in Lake Serena and graphs of the data for each parameter, illustrating the change in water quality parameters over change in depth below surface.

Based on the water quality data, temperature at the existing intake structure (located at 7.3 feet below the water surface) varies from less than 0°C in the winter to 15.5°C in the summer. The District noted that the existing intake takes in both ice crystals and water due to the shallow depths in the winter, making it a slushy consistency which is difficult for the water treatment to process. The proposed intake should be located deep enough to provide a buffer above freezing temperatures (0°C) to avoid ice crystals formation in the winter.

Turbidity data at the existing intake structure was scattered, without any apparent trends. Turbidity ranges from 0 to 20 NTU at depths less than 10 feet. It is unknown if ice coverage had an affect on this data. W&C recommends an intake location with low turbidity, and placing the intake 2 to 3 feet above the bottom of the lake to avoid sediment from entering the intake structure. Lower turbidity levels could potentially decrease the filter backwash frequency needed and possibly the coagulant/polymer consumption.

Dissolved oxygen (DO) at the existing intake structure ranges from 45% in the winter to 83% in the summer. Generally, deeper levels in the lake tend to have lower dissolved oxygen levels because of less sunshine for aerobic conditions. The District was concerned that a deeper proposed intake would have very low DO levels. The proposed intake site should provide a buffer so DO levels do not drop to 0%, which would result in anaerobic conditions.

The water quality data showed that pH levels range from 5.3 in the spring to 6.9 in the summer, and oxygen reduction potential (ORP) ranges from 171 to 308 mv at the existing structure.

In summary, the existing intake location (located at 7.3 feet below the water surface) experiences freezing conditions during the winter and higher turbidity levels. Therefore, W&C recommends placing the intake at a depth of 14 feet below the water surface, elevated 2 to 3 feet above the lake bottom. At this level, temperatures range from 2.5°C in the winter to 9°C in the summer (avoiding ice crystal formation), DO levels range from 18% in winter to 75% in the summer (above anaerobic conditions), and turbidity levels range from 0 to 2 NTU (lower than at shallower levels). The proposed intake location provides a smaller pH range, of 5.7 to 6.3, which would provide less variations to water treatment. Key findings from the water quality analysis and determination of the proposed intake location are summarized in **Table 1.** See **Figure 4** for the proposed location of the intake.

Table 1: Water Quality Summary for Determination of Proposed Intake Location

Water Quality Parameters	Existing Intake (7.3 feet below water surface)	Proposed Intake (14 feet below water surface)
Temperature	Temperatures range from less than 0°C in the winter to15.5°C in the summer.	Temperatures range from 2.5°C in the winter to 9°C in the summer
Turbidity	Turbidity ranges from 0 to 20 NTU, at depths less than 10 feet.	Turbidity levels range from 0 to 2 NTU. Propose placing the intake 2-3 feet above lake bottom to avoid sediment from entering the intake structure.
Dissolved Oxygen (DO)	DO levels range from 45% in the winter to 83% in the summer.	DO levels range from 18% in the winter to 75% in the summer.
pH	pH ranges from 5.3 in the spring to 6.9 in the summer.	pH ranges from 5.7 in the spring to 6.3 in the summer.
Oxygen Reduction Potential (ORP)	ORP ranges from 171 mv to 308 mv.	ORP ranges from 101 mv to 277 mv.
SUMMARY	**The existing intake location experiences freezing conditions during the winter and higher turbidity levels.**	**The proposed intake location was chosen by taking into consideration all water quality parameters. Placing the intake at a depth of 14 feet below the water surface avoids ice crystals, keeps DO levels above anaerobic conditions, and provides lower turbidity.**

4. ALTERNATIVES ASSESSMENT

An alternatives assessment was conducted to evaluate and compare alternatives for improvements to Serene Lakes intake structure. The assessment determined the feasibility, constructability, ease of maintenance, reliability, and cost of various rehabilitation options, as well as each alternative's effectiveness at addressing raw water quality concerns. Each criterion was then given a weighting based on its importance to the District. Then, each alternative was given a score based on ranking according to each of the criterion. Total weighted and un-weighted scores were calculated.

Three alternatives were evaluated:

Alternative 1: Extend the existing intake pipe, plug the existing intake pipe perforations, and add an engineered intake screen.

Alternative 2: Plug or remove the existing intake pipe perforations, install tee/wye at the terminus of the existing intake, extend two intake pipes and screens from the tee with associated valving, one at the location of the existing intake and one extended to a deeper location.

Alternative 3: Continue operating the existing intake pipe, construct a new, second intake pipe from the existing pump station into a deeper potion of the lake, provide isolation valves or gates on the existing intake pipe and a new intake pipe at the pump station.

4.1 Criteria

Alternatives were evaluated based on seven criteria: cost, long term reliability, water quality, constructability, ease of maintenance, system flexibility, and community impact.

Cost (Weight: 5)

The cost of the intake structure improvements for the various alternatives was based on engineering judgement. The costs for each alternative were rated as high, medium, and low based on materials and appurtenances needed during construction, construction effort, and the potential level of permitting needed. Alternatives that involved more appurtenances, such as valves, air compressors, and more fittings, were valued at a higher cost.

Long Term Reliability (Weight: 4)

Long term reliability in the system represents the ability of the system to consistently perform its intended and required function, on demand, without degradation or failure. Alternatives were evaluated on long term reliability by complexity of the system and likelihood of failure. Alternatives that had various appurtenances operating in unison could have a higher likelihood of failure or malfunction.

Water Quality (Weight: 4)

Water quality for each alternative was ranked based on ability to meet water quality objectives described in the Water Quality Assessment in **Section 3**. Alternatives were evaluated based on ability to avoid ice crystals at the intake during winter months, provide low turbidity, and maintain aerobic conditions.

Constructability (Weight: 4)

Constructability of each alternative was ranked by the level of potential difficulty and risk during installation. All alternatives included installation of a new pipe beneath the water level in Lake Serena. One alternative involved installation of a new pipe, extending from the lake to the existing pump house. This alternative was considered construction heavy due to the extensive amounts of excavation and shoring between the pump house and the shore. District staff noted that construction access to the intake location should not be a problem, and construction equipment could be transported through the adjacent lot to the pump house and the dividing fence could be dismantled for vehicle access.

Ease of Maintenance (Weight: 3)

Different levels of maintenance are associated with each alternative to ensure the intake structure remains operable and preserved during various seasons. Alternatives were scored on ease of maintenance associated with maintaining operability of the appurtenances and other features of the system. Valving that requires routine lubrication and inspection would be more tedious.

System Flexibility (Weight: 2)

Flexibility of the system would allow the District to operate separate intake pipes over different seasons. Since water quality information varies over various depths, two intake pipes at various depths would allow the District to alternate which intake to draw water from, depending on water quality characteristics. Additionally, two intake structures allow for redundancy if one fails, allowing the other to possibly still be operable.

Community Impact (Weight: 2)

Potential impact to the Serene Lakes community was scored for each alternative. Impact and disruption to the community was evaluated for each alternative with the assumption that construction would not be a component of this criterion. This criterion focuses on long-term community impacts such as lake aesthetic, boat/fishing accessibility, and other potential influences.

4.2 Alternative Evaluation

Alternative 1:

Alternative 1 proposes to extend the existing intake pipe deeper into the lake and to plug the existing intake pipe perforations, replacing the inlet with an engineered intake screen. W&C recommends removal of pieces of the existing intake pipe that may show extensive wear, such as the location of the tar coating. For this alternative, it is recommended that everything after the section of the tar-coating on the existing pipe is removed and replaced (i.e. a section of 12-inch pipe, the two 45-degree fittings, the perforated 12-inch pipe, and the cinder blocks). This alternative would include replacement and extension of the existing 12-inch pipe resting on the lake bottom, and would include the installation of a Johnson passive intake screen at the inlet, raised off the lake bottom. A passive intake screen would produce fewer potential head loss concerns compared to the current perforated intake pipe. At the location of the engineered intake screen at the end of the pipe, the structure would be secured to a concrete pad resting on the lake bottom. Optimum pipe material has not been selected for the new intake pipe.

The extension of the existing intake pipe deeper into the lake alleviates the problem of the existing intake structure resting in shallow waters, where it has been noted that there are freezing temperatures during the winter. As mentioned in the water quality analysis, W&C recommends the intake pipe extend to a depth of 14 feet from the water surface to the intake structure, resting 3 feet above lake bottom, resulting in a lake depth of about 17 feet from water surface to lake bottom. Length of the extension would be determined during preliminary design based on the bathymetry of the lake. A potential location for the intake is shown in **Figure 4**. This location avoids excessive exposure from ice and does not compromise water quality. This alternative does not provide system flexibility with multiple intake structures located at different depths in the lake. Due to these conditions, Alternative 1 scored low with system flexibility and high with water quality.

This alternative is the most simplistic alterative, requiring few appurtenances and the least amount of construction. There is minimal maintenance associated with this proposed system. There is high long-term reliability because there is no associated valving, compressors, or other appurtenances that would increase complexity and potentially malfunction. For these reasons, Alternative 1 scored high with ease of maintenance, long-term reliability, constructability, and cost.

There is minor community impact regarding lake aesthetic and accessibility. The intake structure extends deep enough into the lake to not affect boats and fisherman in Lake Serena.

Alternative 2:

Similar to Alternative 1, Woodard & Curran recommends removal of pieces of the existing intake pipe that may show extensive wear, such as the location of the tar coating. Alternative 2 removes and replaces everything after the section of the tar-coating on the existing pipe (i.e. a section of 12-inch pipe, the two 45-degree fittings, the perforated 12-inch pipe, and the cinder blocks

0. This alternative would include replacement of the existing 12-inch pipe resting on the lake bottom. A tee/wye would be installed at the terminus end of the existing intake pipe, which would branch to two intake pipes, one extending to the same location of the existing intake structure, and one extending to a depth of 17 feet in the lake (from water surface

to lake bottom). The necessary valving would be secured to concrete pads resting on the lake bottom. Both intake pipes would require new intake screens at the inlet. At the location of the engineered intake screen at the end of the pipes, the structures would secure to concrete pads resting on the lake bottom.

The two intake pipes at various depths would allow the District to operate various intakes depending on seasonal variability of water quality. Associated valving would be installed at the tee/wye that would allow the valves to open and close based on which intake pipe the District wishes to use.

Like Alternative 1, the extension of the existing intake pipe deeper into the lake alleviates the problem of the existing intake structure experiencing freezing conditions during winter months. Alternative 2 provides system flexibility with multiple intake structures located at different depths in the lake and was scored with high system flexibility. Water quality is not compromised since either intake pipe can be operated during different seasons and water quality conditions. For this reason, Alternative 2 scored high with water quality.

The following valves were assessed for Alternative 2: butterfly valves and knife gate valves with pneumatic actuators. Fully stainless steel knife gate valves were determined to be the best option despite certain drawbacks. The knife gate valves and corresponding fully linear actuators placed on top are tall and may impact usage of the lake in their vicinity and are more expensive than the corresponding butterfly valves. However, knife gate valves have no obstructions to the flow within the pipe, which will greatly reduce the chance of snagging and clogging. In the less likely event that something does get caught in the valve, closing the valve will likely cut the obstruction. If something gets caught in a butterfly valve, it may not close properly, threatening the very functionality of the dual intake system. Additionally, the rotationally actuated butterfly valve will require a larger, more powerful actuator and a submerged gear box containing lubricant to convert rotary to linear movement. The knife gate valve and corresponding linear actuator provide a simpler, more effective mechanism, which better accomplishes the objective of the alternative.

The valves will be under water on the lake bottom and will be operated from a control station where the compressor is located approximately 320 feet away inside the pump house. It is necessary to have the air compressor accessible and serviceable during winter months, thus, it will be kept inside the pump house instead of near the lake.

The valves would need to be reliable to be operable in a frozen lake, although they would likely to be inaccessible to staff during winter months due to frozen lake conditions. This alternative shows to be more complex, containing appurtenances that would require more operation and maintenance. Both pneumatic actuators would need to be inspected intermittently for ice damage that may occur during the winter. The valves would also require periodic inspection to ensure no debris is present in the body, which could impair operation. Alternative 2 was scored with low ease of maintenance. Long-term reliability was scored as moderate because there is associated valving, compressors, and other appurtenances that would increase complexity. System flexibility scored high because the two intake structures allow for redundancy in the system.

This alternative is construction heavy, with the installation of a tee/wye, pneumatic valves and actuators, a compressor, and two concrete pads beneath each of the valves and beneath the inlet structures for each pipe. Alternative 2 was scored has being a high-cost alternative.

If knife gate valves were selected, the 8-foot-tall valve/actuator combo, located near the existing intake structure, would only have approximately 6-inches of cover and require a metal cage to protect the valves from boat traffic. Buoys or floats may be needed above the valve cage to notify boaters and fisherman of its location. This would affect lake aesthetic and affect boater accessibility in Lake Serena. Swimming is not allowed on Lake Serena, so danger to swimmers is not a problem with this selection. For these reasons, Alternative 2 was scored with high community impact due to lake aesthetic and accessibility.

Alternative 3:

Alternative 3 includes continued operation of the existing intake pipe and construction of a new, second intake pipe from the existing pump station into deeper portions of the lake. The District could alternate which pipe to operate during seasonal variations to temperature and water quality. Isolation valves would need to be installed on the existing intake pipe and the proposed intake pipe.

This alternative evaluates keeping the existing intake pipe in its current condition, unlike the other alternatives which include replacement of the blistering tar-coating on the pipe in the lake, replacement of the high head-loss intake screen, and securement of the pipe to the concrete pad. Note, this is not a preferred approach, as Woodard & Curran recommends replacement of components of the existing intake pipe that may show extensive wear.

Placing the proposed intake pipe deeper into the lake alleviates the problem of the existing intake experiencing freezing conditions during winter months. Since either intake pipe can be operated during different seasons, water quality would not be compromised. Alternative 3 was scored with high system flexibility due to the multiple intake structures and high on water quality.

As mentioned above, both intake pipes would require isolation valves, which would ideally be located inside the pump house. W&C explored the idea of connecting the proposed pipe to the existing pipe at the abandoned wet well, but the associated valving to alternate between intake pipes would need to be accessed during winter months, unless a more costly electronically actuated valve system was installed. The location of the abandoned wet well would likely be covered with many feet of snow during winter months, making it inaccessible. Therefore, the new intake pipe would need to connect to the existing wet well, located in the pump house, which would involve undesirable construction disturbances and expenses.

Installation of a new intake pipe from the existing pump station into deeper portions of the lake would require deep trenching and shoring. The wet well would need to be dewatered to allow the new intake pipe to be connected to the wet well, with removal of a concrete core. This process, including trenching and shoring, can be very costly and would exceed the costs associated with the other alternatives. Alternative 3 was scored with low constructability due to the complexity and difficulty of construction and a corresponding high cost.

Maintenance and operation associated with this proposed system includes open and closing the valves to alternate which intake pipe is online. This alternative otherwise includes few appurtenances that would require little operation and maintenance. Alternative 3 was scored with moderate ease of maintenance and high long-term reliability for these reasons.

There is minor community impact regarding lake aesthetic and accessibility. Although Alternative 3 is very construction heavy, with the installation of a new pipe to the pump house, impact and disruption to the community was evaluated with the assumption that construction would not be a component of this criterion. The intake structure extends deep enough into the lake to not affect boats and fisherman in Lake Serena.

4.3 Alternative Results

An alternative matrix was developed with associated scores for each criterion. Weighting used a scale of 1 to 5 and is used to reflect how important each category is to the District. Numerical weighting is defined as: 5, Extremely important to the District; 4, Important to the District; 3, Important for decision making but not critical; 2, Worth noting but not critical and 1, Not critical – least important criteria. Scores were assigned between 1 and 3, with higher scores being more favorable. The alternative results are shown in **Table 2**.

Alternative 1 was scored with the highest score, and designated as the preferred alternative. The approximate location of the preferred intake location is shown in **Figure 4**.

Table 2: Alternative Matrix Results

		Alternative 1		Alternative 2		Alternative 3	
Criterion	**Weight**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
Cost	5	3	15	1	5	1	5
Long Term Reliability	4	3	12	2	8	3	12
Water Quality	4	3	12	3	12	3	12
Constructability	4	3	12	1	4	1	4
Ease of Maintenance	3	3	9	1	6	2	9
System Flexibility	2	1	2	3	6	3	6
Community Impact	2	3	6	1	2	3	6
TOTAL SCORE		19	68	12	43	16	54

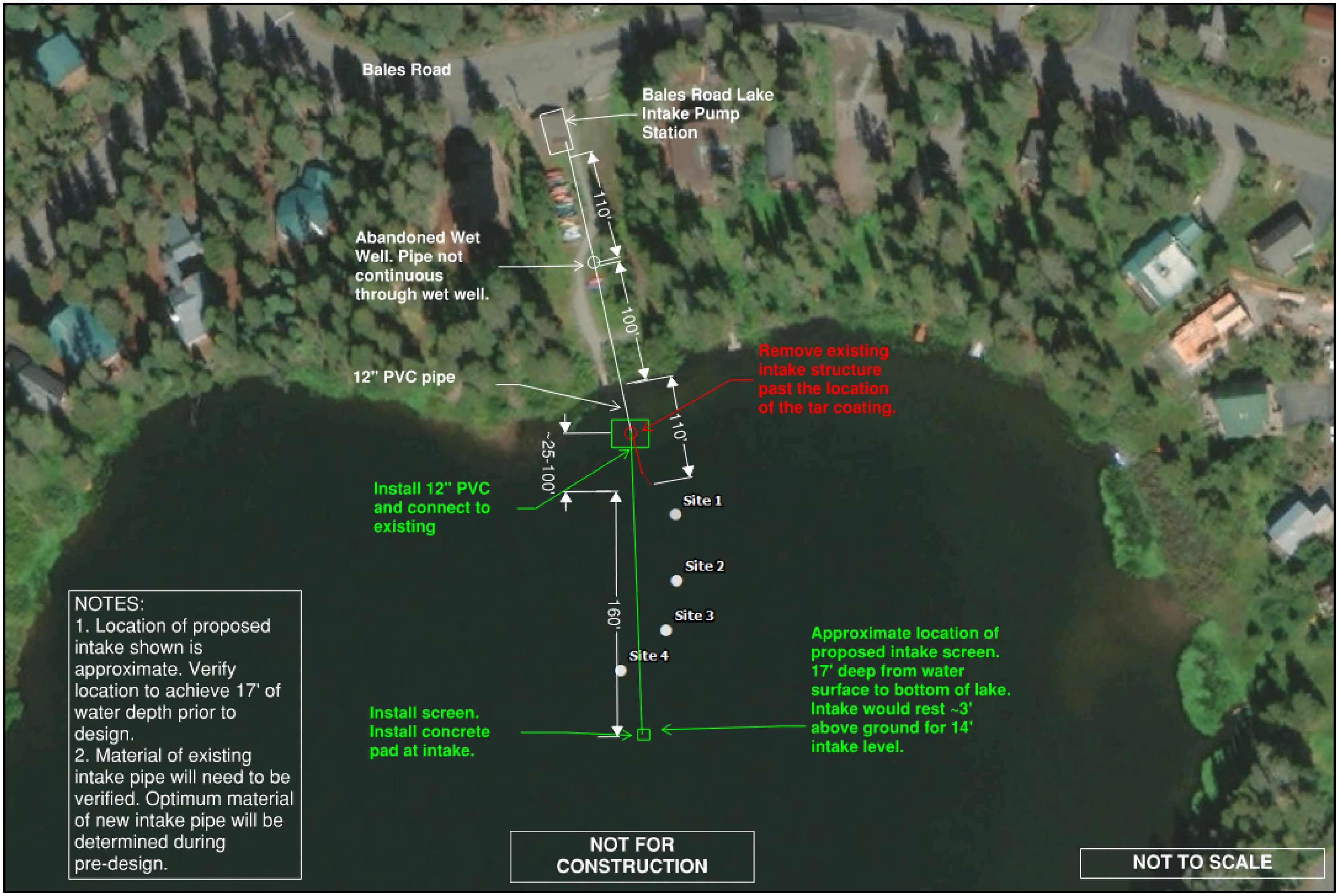


Figure 4: Plan View of Proposed Sierra Lakes Intake Structure (Alternative 1)

5. PREFERRED ALTERNATIVE COST ESTIMATE

Based off the alternative analysis, W&C determined the best scoring alternative to be Alternative 1. **Attachment B** includes a conceptual level of probable construction cost (Class 5 AACE estimate) for this alternative. The cost estimate was based on vendor quotes, RSMeans, local contractor labor quotes, and engineering judgement. The estimated construction cost for Alternative 1 is $100,000. Permitting costs are discussed in **Section 7**, which discusses the permitting strategy.

6. RECOMMENDATIONS

W&C recommends the use of an intake screen rather than a perforated pipe. W&C recommends the use of a stainless-steel S-12HC Johnson Screen to minimize head loss without compromising the design flow rate.

W&C recommends re-evaluating the pump curves associated with the intake pipe to ensure optimal operation of the intake pump(s). With potential decrease in suction headloss due to the intake structure and potential increase in friction losses to the extension of pipe, a new system curve should be established and compared with the pump curve to guarantee ideal operation.

Not related to the intake structure analysis, but of importance, in order to reduce the risk of distribution system main breaks, testing and analysis of AC pipe wall thicknesses in suspected problem areas is recommended. Sections of AC pipe with significant material loss should be replaced.

7. PERMITTING STRATEGY

When implementing the intake improvements, the District will be required to comply with State of California and Federal environmental compliance laws. Because Serene Lakes is in California and the lakes are tributary to the North Fork of the American River it is considered both a “Water of the State of California” and “Water of the U.S.” the following environmental regulations will be the most critical for the project: the California Environmental Quality Act (CEQA), the Federal Clean Water Act, the Porter Cologne Water Quality Control Act, California Fish and Game Code, and the State Federal Endangered Species Act (ESA), and Section 106 of the National Historic Preservation Act. These requirements are described in greater detail in this section and can vary greatly based on selected design and construction methodologies.

First, the District will need to comply with CEQA and determine if the project can be considered Statutorily or Categorically Exempt. Statutory exemptions apply to certain projects that have been determined through statutes to be exempt from CEQA requirements. Categorical exemptions represent types of projects that have been determined to not have significant effect on the environment. W&C anticipates that the Section 15301 Existing Facilities and/or Section 15302 Replacement or Reconstruction exemptions listed in the California Code of Regulations may apply; however, these categorical exemptions do not apply to projects that have a potential to significantly effect the environment or are in certain designated sensitive areas. W&C can work with the District to identify if any of these sensitive areas exist and determine if it is feasible to avoid them. If the project is not exempt, the District would need to prepare an Initial Study checklist and a Mitigated Negative Declaration to evaluate and disclose the potential impacts. W&C recommends completing preliminary environmental studies to support the determination of whether sensitive habitats or other resources are present that would preclude coverage under a Categorical Exemption. W&C also recommends that the CEQA project description tailored to avoid potential impacts to sensitive habitats, presuming the selected construction methods or requirements allow it.

Section 404 of the Clean Water Act requires a permit from United States Army Corps of Engineers (USACE) to discharge dredged or fill material into Water of the U.S., or its tributaries. The intake structure itself is considered “fill” to Lake Serena. Modification in fill includes extension of the existing intake structure, and addition of a concrete pad to the bottom of the lake to secure the pipe. Additionally, the edges of Lake Serena may be considered riparian habitat and may be classified as a wetland. Habitat will need to be protected throughout the construction process and comply with Section 404. W&C recommends the District schedule a consultation appointment with USACE to discuss the opportunity for getting the project covered by a Nationwide Permit (NWP). W&C anticipates that NWP 58 for Utility Line Activities for Water and Other Substances would likely cover the activities proposed by the District since NWP 58 covers construction, maintenance, repair, and removal of utility lines for water and other substances. W&C recommends upfront communication with USACE to discuss the modifications to the existing intake and the anchoring system. The District should not apply for a permit until pre-design when structures fill estimates (square footage of intake pipe and concrete pad) are determined. Once fill estimates are reasonably certain, the District will be required to submit a preconstruction notification to the Sacramento District USACE engineer prior to commencing the activity. The preconstruction notification must include information regarding the original design capacities and configurations of the outfalls, intakes, small impoundments, and canals. As a part of the preconstruction notification, the District will need to provide evidence of compliance with other Federal Laws, namely Section 401 of the Clean Water Act, the Federal Endangered Species Act (ESA), and Section 106 of the National Historic Preservation Act (see further details below).

The California Water Boards oversee the implementation of Sections 303, 401, and 402 of the Clean Water Act, the Porter-Cologne Water Quality Control Act, the State Wetland Definition and Procedures for the Regulation of Discharges of Dredged or Fill Material to Waters of the State (Procedures), and the California Code of Regulations, Title 23, Section 3856. The Water Quality Certification (WQC) program regulates removal or placement of materials in wetlands and waterways in the State. This certification process is overseen by the Central Valley Regional Water Quality Control Board (RWQCB). The District will need to have coverage under a WQC prior to initiating construction and for the Section 404 permit to go into effect. To initiate the process, the District would be required to request a "pre-filling" meeting with the Central Valley RWQCB at least 30 days prior to submitting the application for WQC. It is recommended that a draft application be submitted at this point to discuss the nature of the proposed project and potential water quality effects. The Water Board staff will review the application within 30 days of receipt and provide a completeness determination. A completeness determination may include a request for additional information for a complete application. Application fees must be paid before an application is determined complete.

California Fish and Game Code section 1602 requires any person, state or local governmental agency, or public utility to notify CDFW prior to beginning any activity that may do one or more of the following: divert or obstruct the natural flow of any river, stream, or lake; change the bed, channel, or bank of any river, stream, or lake; use material from any river, stream, or lake; or deposit or dispose of material into any river, stream, or lake. The District will need to notify CDFW to apply for a Lake or Streambed Alternation Agreement with the California Department of Fish and Wildlife (CDFW) to ensure fish and wildlife resources and their associated riparian habitats are protected. CDFW has 30 days to respond and 60 days to make a determination and submit a Draft Agreement to the District, or the application is automatically deemed complete, meaning that if CDFW does not submit a Draft Agreement, the District may proceed without an agreement, provided they conduct the project activities as described in the notification, including any measures in the notification intended to protect fish and wildlife resources.

Under Section 7 of the ESA, USACE must consult with the U.S. Fish and Wildlife Service (Service) when they authorize the District's action by issuing the NWP if the action may affect a listed endangered or threatened species. The District should begin the process by requesting informal consultation to start a conversation about the scope of project activities and listed species that may occur in the area (such as Sierra Nevada yellow-legged frog and willow fly catcher). The District will need to undertake a study comprised of a desktop review and field survey combined with the assessment of the proposed activities to work with the USACE and the Service to determine if species or their habitat will be affected by the project. W&C anticipates that there is a good chance consultation would be complete with a no effect determination at this point, however, the Service may request preparation of a Biological Assessment to assist in the determination of the project's effects.

Similarly, the District must also comply with the California ESA (CESA) which prohibits the take of any species of wildlife designated by the California Fish and Game Commission as endangered, threatened, or candidate species. As mentioned under CEQA, the District will need to conduct an assessment for the potential to impact State listed species. If state listed species are determined present and to be potentially affected, CDFW may authorize the take of any such species through issuance of an Incidental Take Permit. If habitat or species are identified in the project area, the District may want to set up an early consultation meeting with CDFW to discuss the project activities and ways to avoid impacting species. CDFW may request a preliminary site inspection of Lake Serena.

Finally, as a part of the USACE permitting process the District must demonstrate compliance with Section 106 of the National Historic Preservation Act, and if not exempt from CEQA, Assembly Bill 52 Tribal Compliance. This compliance will likely include a record search, a field survey, and a Section 106 compliant report. Given the nature and extent of construction it is likely a no effect determination can be reached; however, this cannot be determined until the evaluation is complete. The results of the evaluation can be used to guide design for avoidance to support the no effect determination. Also, of note, given the active participation of the Washoe Tribe in the area, they may request a meeting and/or request tribal monitors during construction.

In summary, the District compliance with the following laws and regulations will be required with anticipated compliance documentation denoted based on general assumptions associated with Alternative 1:

1. **California Environmental Quality Act** – Categorical Exemption Class 1 and/or 2
2. **Section 404 of the Clean Water Act** – Nation Wide Permit 58 for Utility Line Activities for Water and Other Substances
3. **Section 401 of the Clean Water Act** – Notice of Intent for coverage under General Order NO. 2020-0039-EXEC
4. **Section 402 of the Clean Water Act** – Anticipate low threat discharge coverage under General Order NO. 2020-0039-EXEC
5. **Porter-Cologne Water Quality Control Act** – Coverage under General Order NO. 2020-0039-EXEC
6. **California Fish and Game Code Section 1602** – Lake and Streambed Alteration Agreement
7. **Federal Endangered Species Act** – Informal Consultation with “no effect” determination
8. **State Endangered Species Act** – no incidental take permit required
9. **Section 106 National Historic Preservation Act** – no effect determination

A high-level consulting fee was estimated based on the strategy described above. For the acquisition of the described permits, including a biological survey and cultural survey, W&C estimates between $40,000 and $150,000 worth of consulting fees. The large difference depends on agency interpretation and reaction to the materials presented and the presence or lack of endangered species and cultural resources.

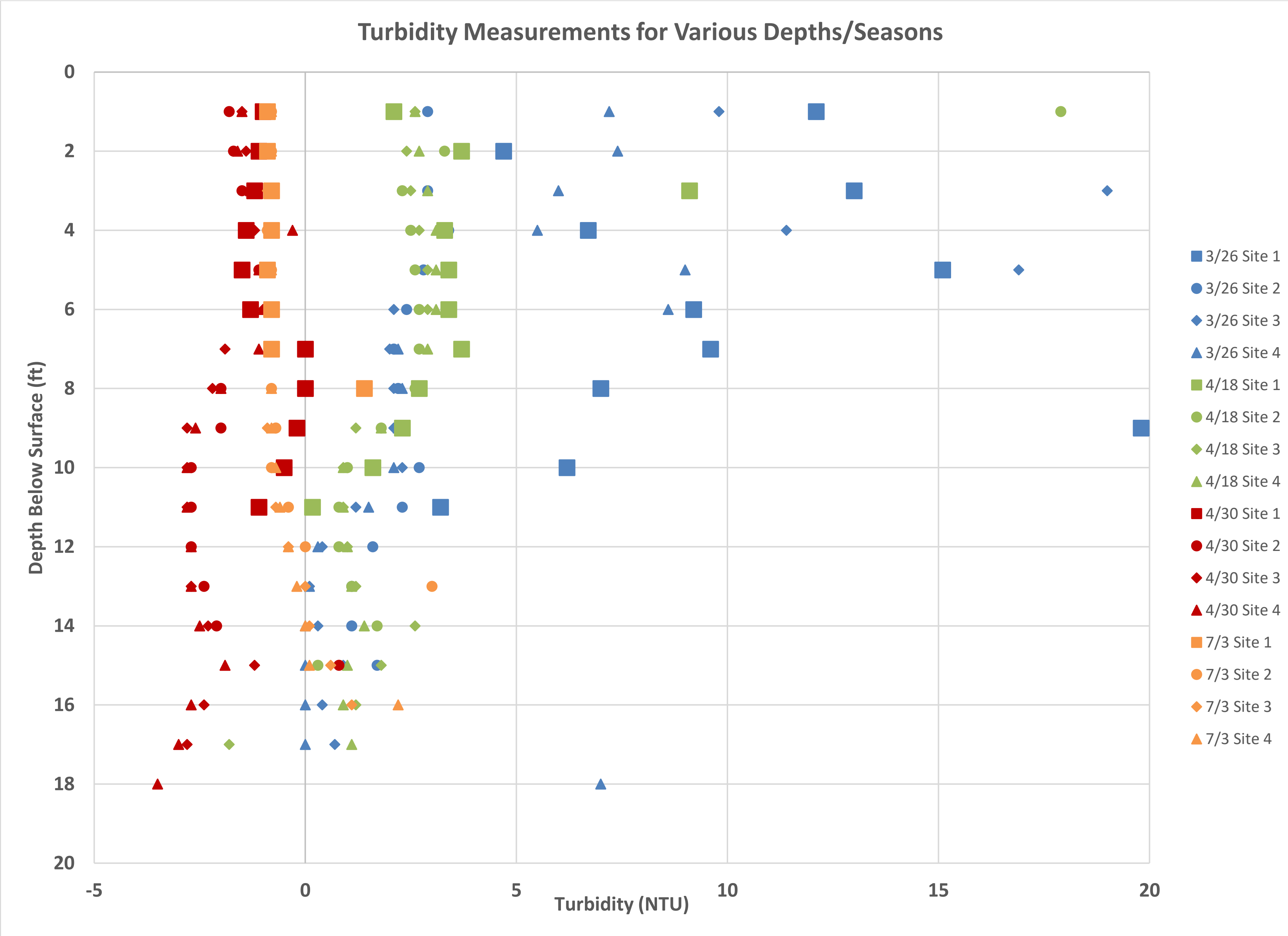
8. PROJECT SCHEDULE

The project schedule, in **Attachment C**, includes the timelines for design, permitting, bidding, and construction. The schedule may be impacted by the permitting process with the USACE, which could in turn delay subsequent tasks.

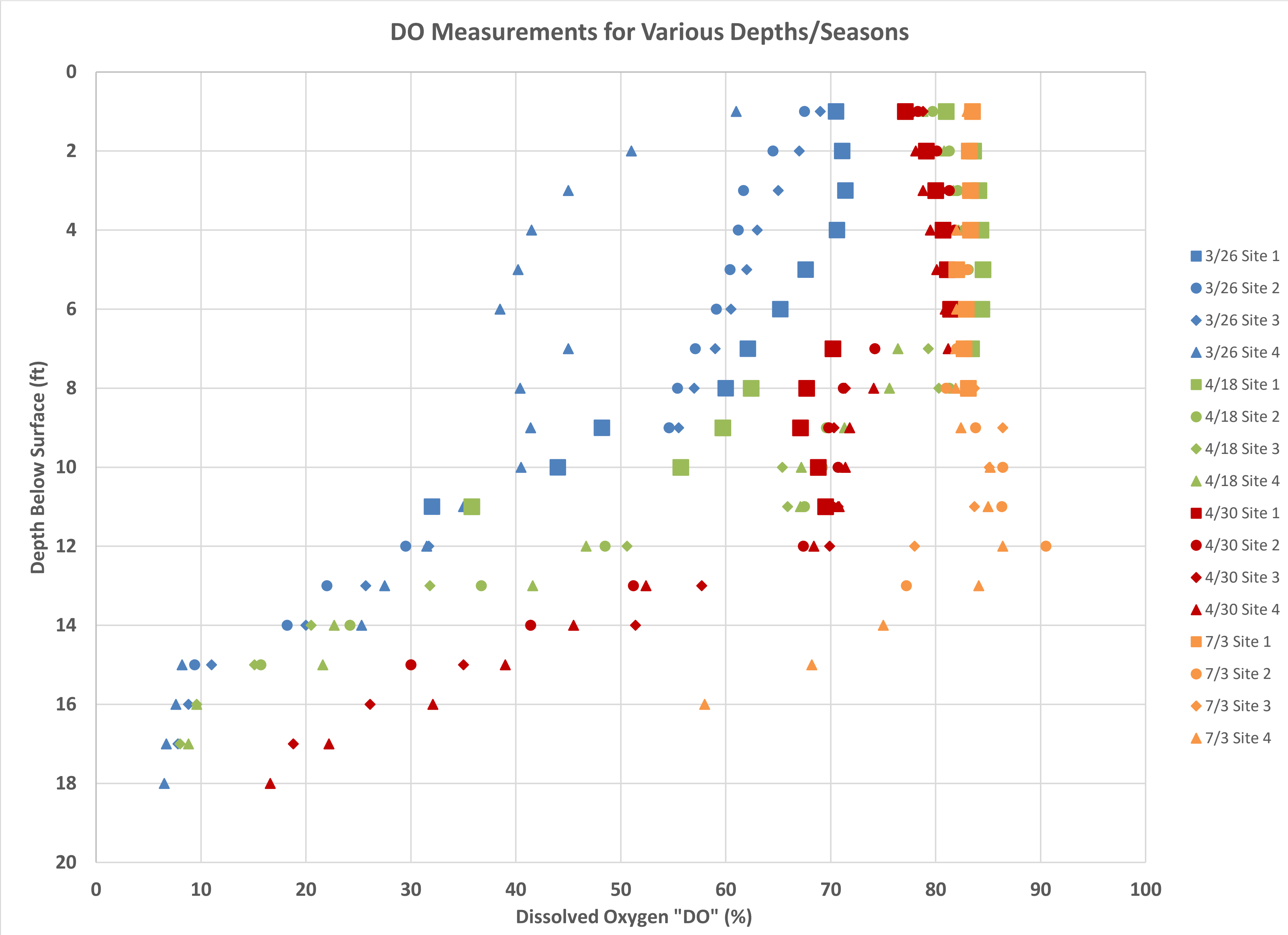
Construction will need to occur during April/May through October when the snow and ice cover on Lake Serena is most likely not present. Impact to the permitting schedule could push the bidding and construction schedule back to the subsequent year depending on the turnaround time of the various permitting entities.

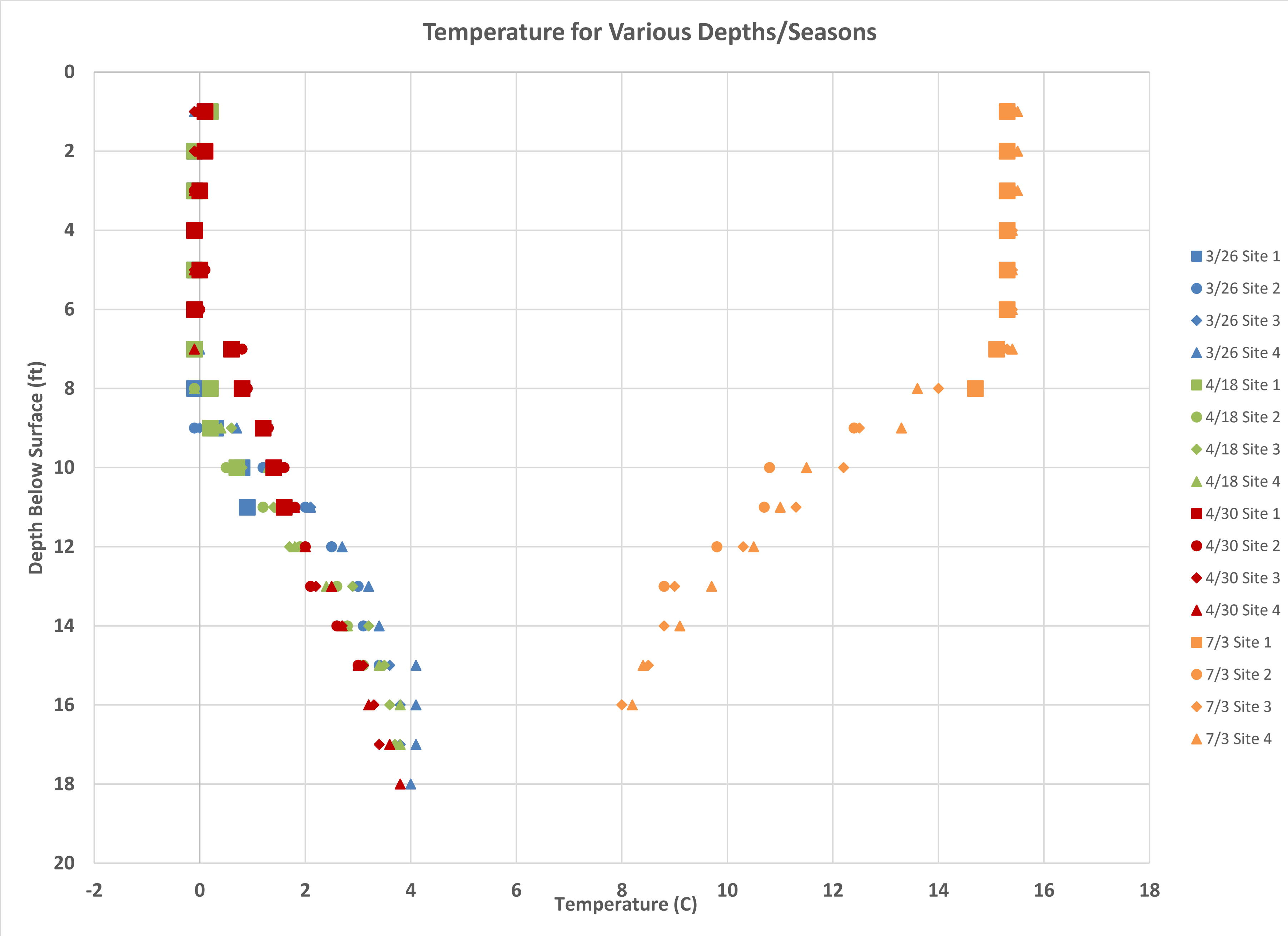
Attachment A: Water Quality Data

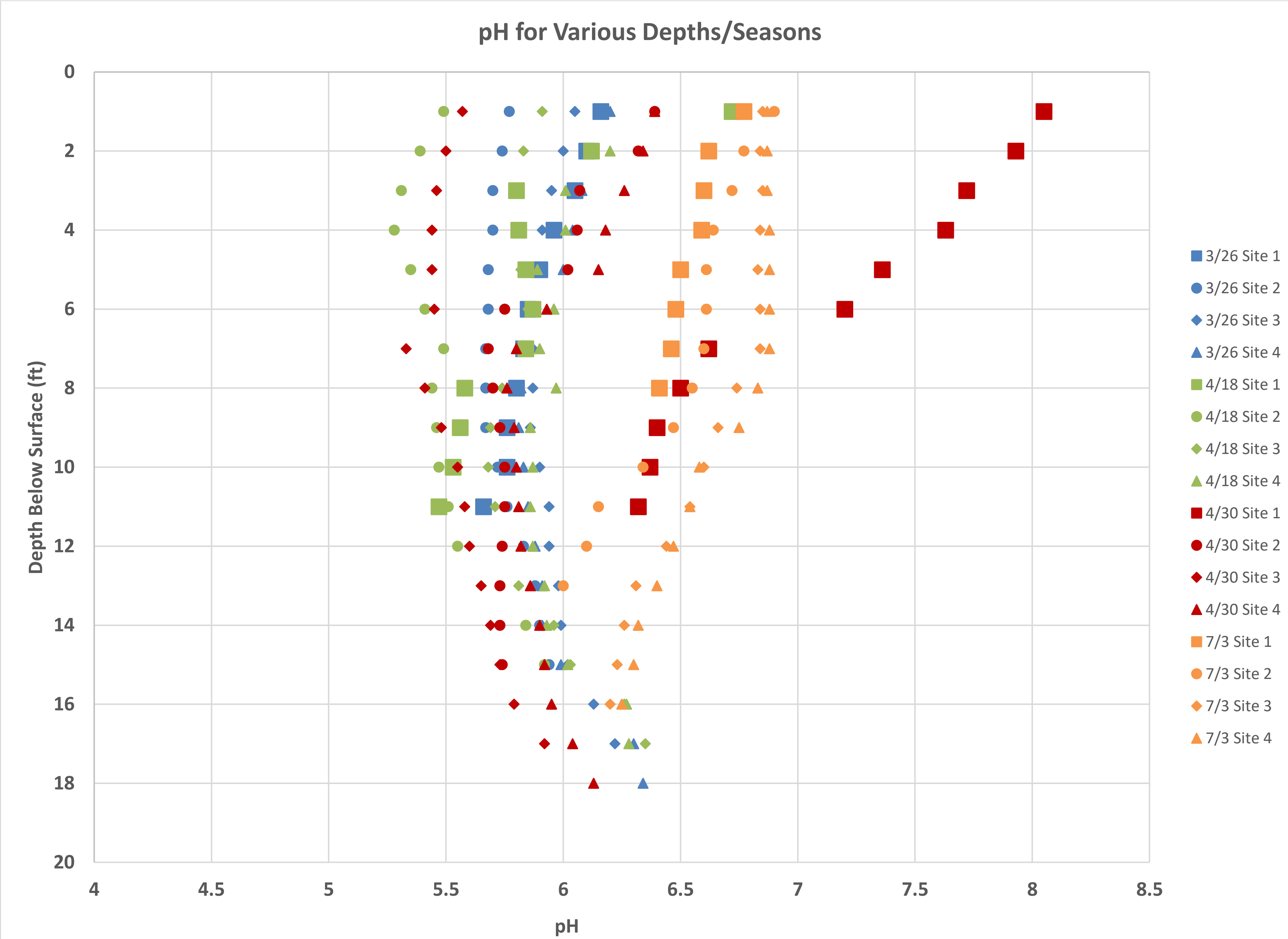
Site	Description
Site 1	Lat/Lon 39°18.198' N 120°23.169' W
Site 2	Lat/Lon 39°18.189' N 120°23.169' W
Site 3	Lat/Lon 39°18.182 N 120°23.171' W
Site 4	Lat/Lon 39°18.177' N 120°23.179'W



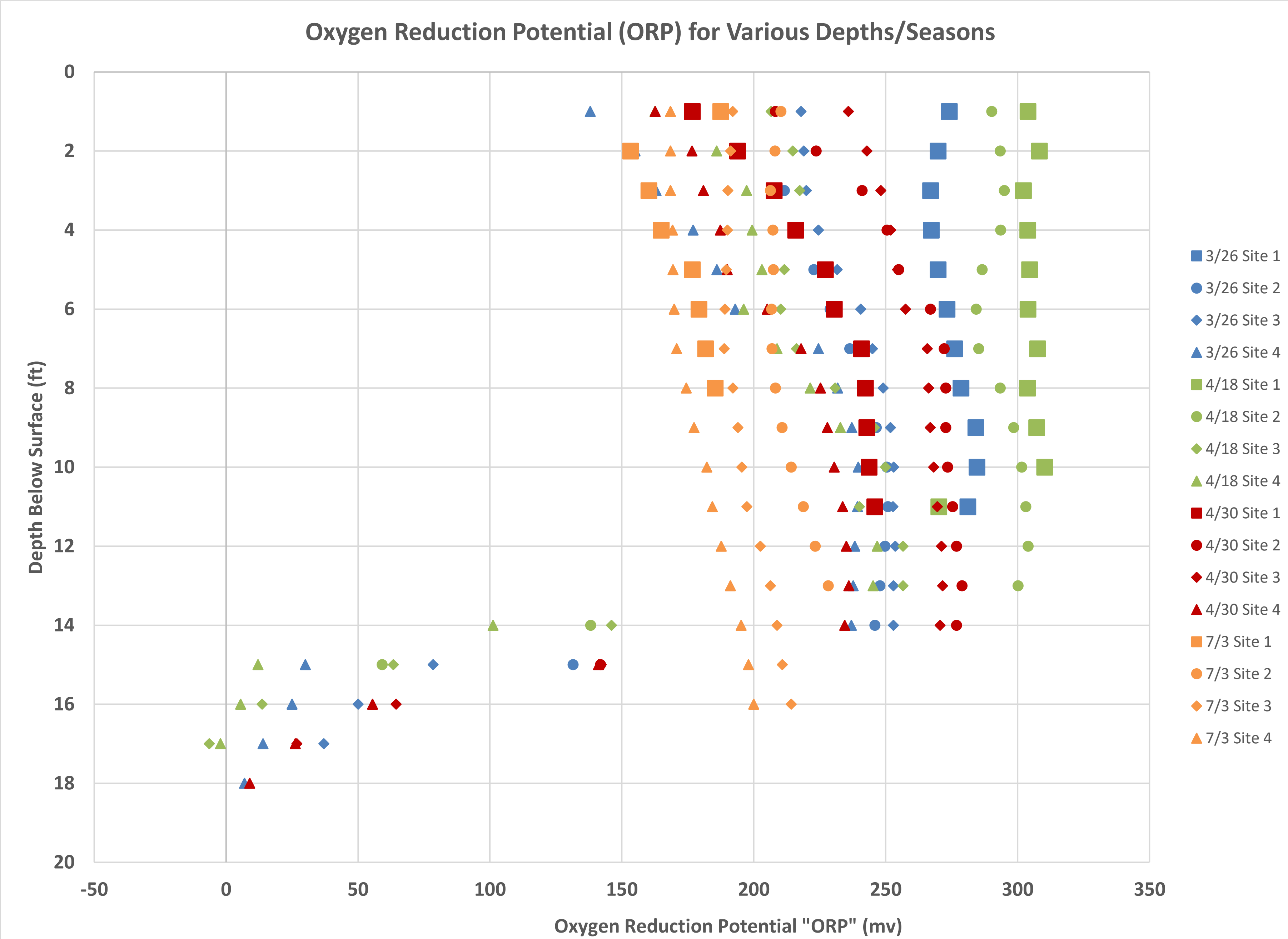
Turbidity Measurements for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
-5
0
5
10
15
20
Turbidity (NTU)
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4


DO Measurements for Various Depths/Seasons
Depth Below Surface (ft)
Dissolved Oxygen "DO" (%)
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80
90
100
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4

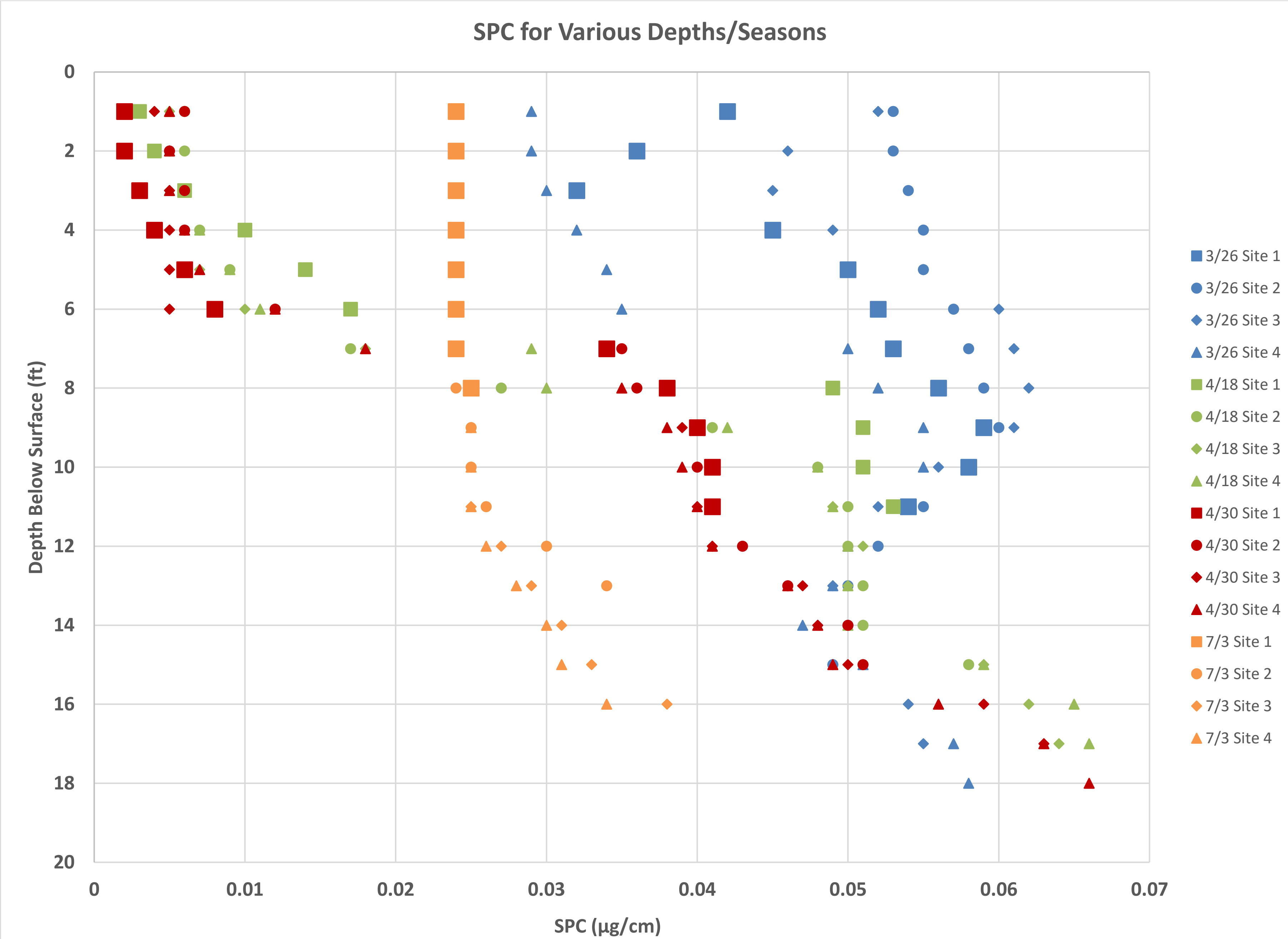

Temperature for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
-2
0
2
4
6
8
10
12
14
16
18
Temperature (C)
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4

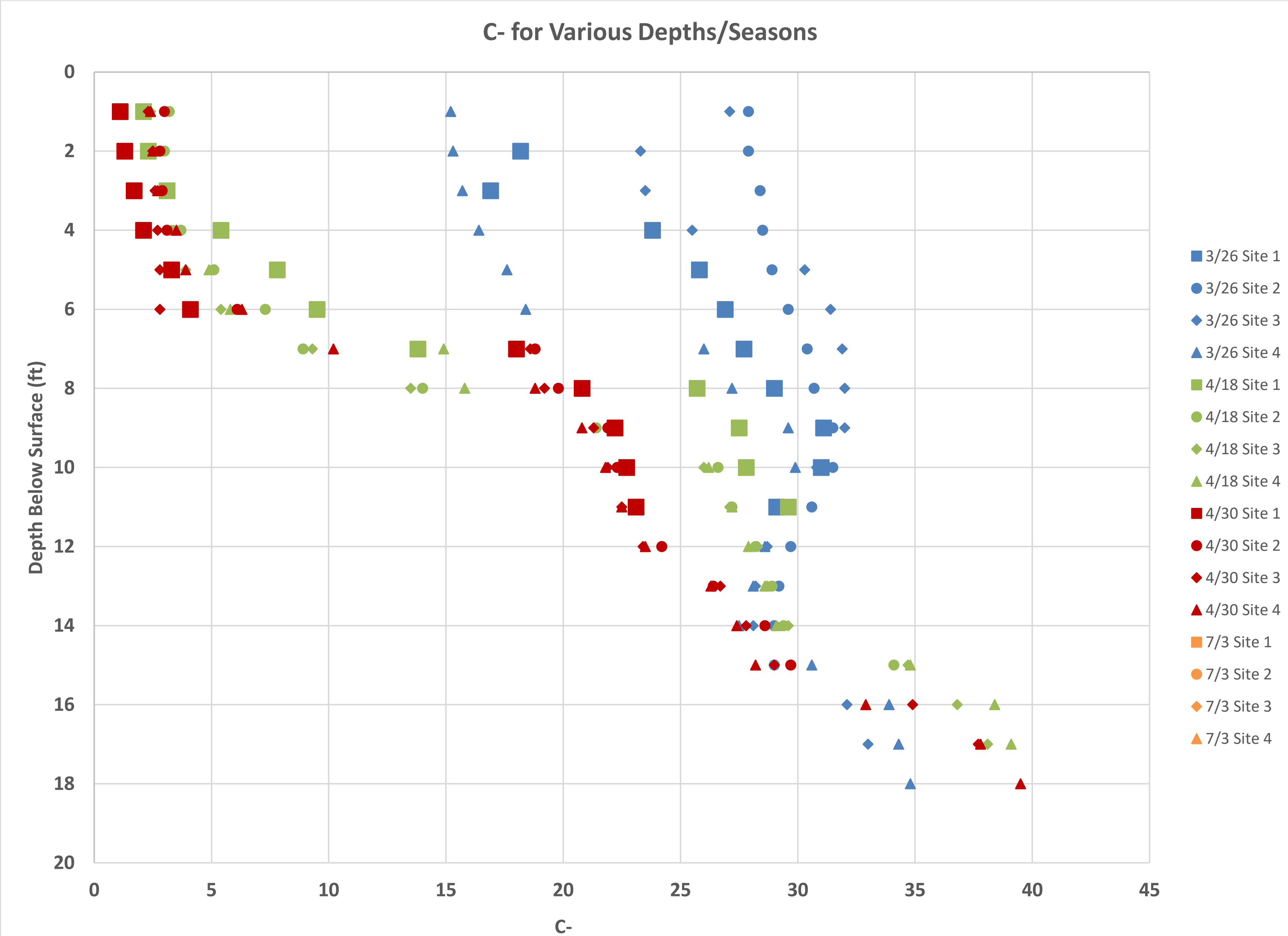


pH for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
pH
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4



Oxygen Reduction Potential (ORP) for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
-50
0
50
100
150
200
250
300
350
Oxygen Reduction Potential "ORP" (mv)
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4


SPC for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
SPC (μg/cm)
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4


C- for Various Depths/Seasons
Depth Below Surface (ft)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
35
40
45
C-
3/26 Site 1
3/26 Site 2
3/26 Site 3
3/26 Site 4
4/18 Site 1
4/18 Site 2
4/18 Site 3
4/18 Site 4
4/30 Site 1
4/30 Site 2
4/30 Site 3
4/30 Site 4
7/3 Site 1
7/3 Site 2
7/3 Site 3
7/3 Site 4

Attachment B: Construction Cost Estimate

Sierra Lakes County Water District
Serene Lakes Intake Improvements and Conceptual Design
Alternative 1 Construction Cost Estimate
Class 5 AACE Estimate

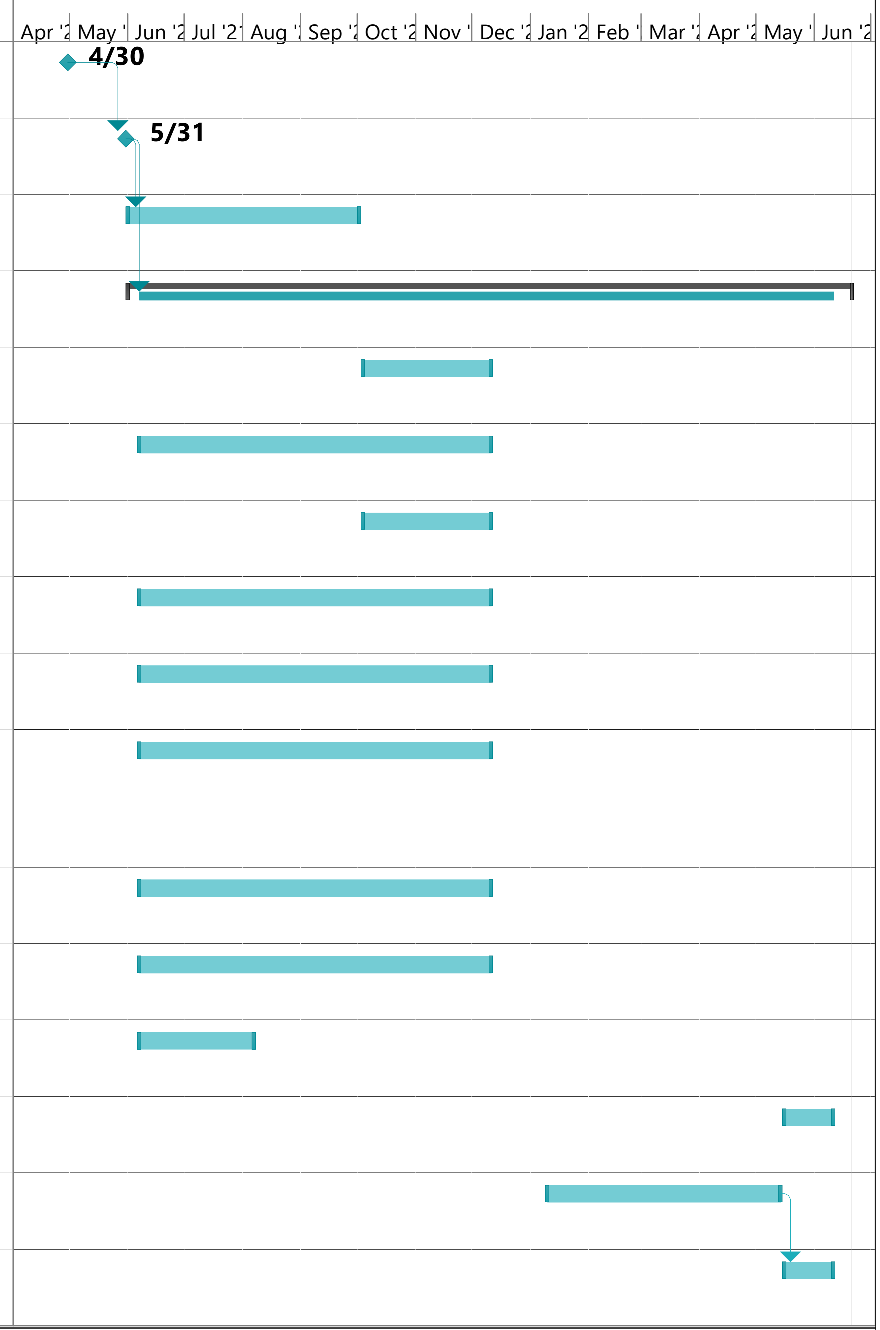
Version Date: March 2021

ITEM	DESCRIPTION	QTY	Unit	UNIT COST	TOTAL	Reference/Notes
1	12" PVC Pipe	260	LF	$ 38	$ 10,008	RSMeans. PVC pipe from existing pipe to proposed intake location - Material only.
2	12" Stainless Steel Coupling	1	EA	$ 6,300	$ 6,300	Vendor quote and recent project experience. Coupling joint for connection of existing pipe to proposed pipe. Material only.
3	Concrete Slab	1	CY	$ 1,000	$ 1,000	Engineer's estimate. Concrete Slab beneate the intake location.
4	Johnson Screen	1	EA	$ 3,000	$ 3,000	Manufacturer. Johnson S-12HC Intake Screen.
5	Installation & Construction Equipment	6	DAY	$ 7,374	$ 44,246	Local Contractor Information. Prevailing wages for Dive Supervisor, Tender, and two Divers. Equipment includes service trucks, dive trailer, vessel, shallow surface-supplied dive package, and tool boxes. Includes removal of exisitng intake.
	Construction Cost Estimate Subtotal				**$ 64,553**	
	Class 5 Contingency[1]			35%	**$ 23,000**	
	Tax on Materials			9%	**$ 2,000**	Pipe, coupling, concrete, and screen
	Overhead and Profit			15%	**$ 9,700**	
	Total Construction Cost				**$ 100,000**	

1. Contingency reflects level of project definition and Contractor favored bid climate.

Attachment C:Project Schedule

ID	Task Name	Duration	Start	Finish
1	District Board Approval of Alternative 1	0 days	Fri 4/30/21	Fri 4/30/21
2	Award of NTP to Design and Permitting Firm	0 days	Mon 5/31/21	Mon 5/31/21
3	Design Phase	89 days	Tue 6/1/21	Fri 10/1/21
4	**Project Permiting Including Contracting**	**275 days**	**Tue 6/1/21**	**Mon 6/20/22**
5	CEQA Exemption	50 days	Mon 10/4/21	Fri 12/10/21
6	Section 401	135 days	Mon 6/7/21	Fri 12/10/21
7	Section 402	50 days	Mon 10/4/21	Fri 12/10/21
8	Section 404	135 days	Mon 6/7/21	Fri 12/10/21
9	Porter-Cologne Water Quality Control Act	135 days	Mon 6/7/21	Fri 12/10/21
10	CDFW Lake and Streambed Alteration Agreement	135 days	Mon 6/7/21	Fri 12/10/21
11	Federal Endangered Species Act	135 days	Mon 6/7/21	Fri 12/10/21
12	State Engdangered Species Act	135 days	Mon 6/7/21	Fri 12/10/21
13	Section 106 - Record Search, Survey, Report	45 days	Mon 6/7/21	Fri 8/6/21
14	Section 106 - Construction Monitoring	20 days	Mon 5/16/22	Fri 6/10/22
15	Bid Phase	90 days	Mon 1/10/22	Fri 5/13/22
16	Project Construction	20 days	Mon 5/16/22	Fri 6/10/22



APPENDIX D:
STORAGE AND SUPPLY CAPACITY CALCULATIONS

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Sierra Lakes County Water District (SLCWD) Water Facilities Master Plan
SLCWD Storage & Supply Calculations

Sizing Analysis Scenarios

1. MDD + Fire Flow with all supply facilities operational
   a. Operating Storage = 30% of Maximum Day Demand
   b. Emergency Storage = 100% of Average Day Demand
2. PHD with all supply facilities operational
   a. Operating Storage = 30% of Maximum Day Demand
   b. Emergency Storage = 100% of Average Day Demand

Demand Data

		Demands (gpm)		
		ADD	MDD	PHD
Existing EDUs	840	41	109	170
Buildout EDUs	181	9	23	37
Total	1,021	50	132	207

Total Supply

Well	Pump Capacity (gpm)
Office BPS	600
Total	600

Fire Flow Demand

	Flow (gpm)	Duration (hr)	Volume (gal)
Fire Demand (gpm)	2,000	2	240,000

Tank Storage Volume (gal)

Hill Tank	300,000
Total	300,000

Table 1. Existing Conditions

	MDD + Fire w/all sources		PHD w/ all sources	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Full Tank		300,000		300,000
Supply		707,068		619,186
Daily Capacity		1,007,068		919,186
Fire Storage	240,000	767,068	240,000	679,186
Operating Storage	47,080	719,988	47,080	632,106
Emergency Storage	58,917	661,071	58,917	573,189

Table 2. Buildout Conditions

	MDD + Fire w/all sources		PHD w/ all sources	
Storage Type	**Storage Requirement (gal)**	**Storage Balance (gal)**	**Storage Requirement (gal)**	**Storage Balance (gal)**
Full Tank		300,000		300,000
Supply		673,252		566,434
Daily Capacity		973,252		866,434
Fire Storage	240,000	733,252	240,000	626,434
Operating Storage	57,224	676,028	57,224	569,210
Emergency Storage	71,612	604,416	71,612	497,598

APPENDIX E:

PROJECT COST ESTIMATES

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Estimate by:	Dallas Jones, P.E.	**Project Maturity:**	0%	
Project Name:	SLCWD Water Master Plan	**Expected Accuracy Range:**	-50% 100%	Low High
Project No.	2502	**Expected Date of Construction:**		January 1, 2024
Date of Estimate:	11/09/23	**Future Cost Inflation Rate:**		3.8%
Estimate Class:	5	**Current ENRCCI:**	13498	
QC Check by:	Alex Stodtmeister, P.E.	**Version:**	1.0	
Date of Review:	11/09/23			

Class 5 Opinion of Probable Cost - Raw Water Intake Extension

Bid Item	Description	Quantity	Unit	Unit Cost	Total Amount
1	Mobilization	1	LS	$ 6,000	**$ 6,000**
2	12" PVC Pipe	260	LF	$ 160	**$ 41,600**
3	12-Inch Stainless Steel Coupling	1	EA	$ 22,100	**$ 22,100**
4	Concrete Slab	1	CY	$ 23,600	**$ 23,600**
5	Intake Screen	1	EA	$ 18,400	**$ 18,400**
				Construction SubTotal:	**$ 111,700**
				Construction Low Estimate:	$ 55,850
				Construction High Estimate:	$ 223,400
				Soft Costs	
				Contingency (20%)	$ 22,000
				Engineering (15%)	$ 17,000
				Permitting	$ 150,000
				Construction Observation and Management (12%)	$ 13,000
				Administration (5%)	$ 6,000
				Soft Costs SubTotal:	**$ 208,000**
				2023 Project Total:	**$ 319,700**
				2024 Projected Project Total:	**$ 332,000**

Estimate by:	Dallas Jones, P.E.	**Project Maturity:**	0%	
Project Name:	SLCWD Water Master Plan	**Expected Accuracy Range:**	-50% 100%	Low High
Project No.	2502	**Expected Date of Construction:**		January 1, 2026
Date of Estimate:	11/09/23	**Future Cost Inflation Rate:**		3.8%
Estimate Class:	5	**Current ENRCCI:**	13498	
QC Check by:	Alex Stodtmeister, P.E.	**Version:**	1.0	
Date of Review:	11/09/23			

Class 5 Opinion of Probable Cost - Well 01 Treatment Relocation and Discharge Line

Bid Item	Description	Quantity	Unit	Unit Cost	Total Amount
1	Mobilization	1	LS	$ 18,000	**$ 18,000**
2	Erosion Control	1	LS	$ 18,000	**$ 18,000**
3	12" PVC Pipe	470	LF	$ 350	**$ 164,500**
4	12" Waterline Connection	1	LS	$ 15,000	**$ 15,000**
5	Arsenic Skid Relocation	1	LS	$ 5,000	**$ 5,000**
6	Treatment Skid Install and Piping	1	LS	$ 75,000	**$ 75,000**
7	Building Expansion	1	LS	$ 100,000	**$ 100,000**
				Construction SubTotal:	**$ 395,500**
				Construction Low Estimate:	$ 197,750
				Construction High Estimate:	$ 791,000
				Soft Costs	
				Contingency (20%)	$ 79,000
				Engineering (15%)	$ 59,000
				Permitting (5%)	$ 20,000
				Construction Observation and Management (12%)	$ 47,000
				Administration (5%)	$ 20,000
				Soft Costs SubTotal:	**$ 225,000**
				2023 Project Total:	**$ 620,500**
				2026 Projected Project Total:	**$ 694,000**

Estimate by:	Alex Stodtmeister, P.E.	**Project Maturity:**	0%	
Project Name:	SLCWD Water Master Plan	**Expected Accuracy Range:**	-50% 100%	Low High
Project No.	2502	**Expected Date of Construction:**		January 1, 2027
Date of Estimate:	12/28/23	**Future Cost Inflation Rate:**		3.8%
Estimate Class:	5	**Current ENRCCI:**	13498	
QC Check by:	Luke Tipton, P.E.	**Version:**	1.0	
Date of Review:	12/29/23			

Class 5 Opinion of Probable Cost - Hill Tank Flow Meter

Bid Item	Description	Quantity	Unit	Unit Cost	Total Amount
1	Flow Meter Purchase and Installation	1	LS	$ 130,000	**$ 130,000**
				Construction SubTotal:	**$ 130,000**
				Construction Low Estimate:	$ 65,000
				Construction High Estimate:	$ 260,000
				Soft Costs	
				Contingency (20%)	$ 26,000
				Engineering (15%)	$ 20,000
				Permitting (5%)	$ 7,000
				Construction Observation and Management (12%)	$ 16,000
				Administration (5%)	$ 7,000
				Soft Costs SubTotal:	**$ 76,000**
				2023 Project Total:	**$ 206,000**
				2027 Projected Project Total:	**$ 239,000**

DOWL

Estimate by:	Dallas Jones, P.E.	**Project Maturity:**	0%	
Project Name:	SLCWD Water Master Plan	**Expected Accuracy Range:**	-50%	Low
			100%	High
Project No.	2502	**Expected Date of Construction:**		January 1, 2043
Date of Estimate:	11/09/23	**Future Cost Inflation Rate:**		3.8%
Estimate Class:	5	**Current ENRCCI:**	13498	
QC Check by:	Alex Stodtmeister, P.E.	**Version:**	1.0	
Date of Review:	11/09/23			

Class 5 Opinion of Probable Cost - Water Main Replacment Program

Bid Item	Description	Quantity	Unit	Unit Cost	Total Amount
1	Mobilization	1	LS	$ 1,563,000	**$ 1,563,000**
2	Traffic Control	1	LS	$ 1,250,000	**$ 1,250,000**
3	Erosion Control	1	LS	$ 1,250,000	**$ 1,250,000**
4	8" PVC Pipe	44,970	LF	$ 250	**$ 11,242,500**
5	10" PVC Pipe	5,950	LF	$ 285	**$ 1,695,750**
6	12" PVC Pipe	1,650	LF	$ 325	**$ 536,250**
7	14" PVC Pipe	290	LF	$ 355	**$ 102,950**
8	Fire Hydrants	106	EA	$ 12,000	**$ 1,272,000**
9	8" Gate Valves	131	EA	$ 5,000	**$ 655,000**
10	10" Gate Valves	15	EA	$ 6,500	**$ 97,500**
11	12" Gate Valves	4	EA	$ 8,000	**$ 32,000**
12	14" Gate Valves	1	EA	$ 9,500	**$ 9,500**
13	Water Services	840	EA	$ 9,500	**$ 7,980,000**
14	3" Patch Paving	50,835	LF	$ 150	**$ 7,625,250**
15					

Construction SubTotal:	**$**	**35,311,700**
Construction Low Estimate:	$	17,655,850
Construction High Estimate:	$	70,623,400
Soft Costs		
Contingency (20%)	$	7,062,000
Engineering (15%)	$	5,297,000
Permitting (5%)	$	1,766,000
Construction Observation and Management (12%)	$	4,237,000
Administration (5%)	$	1,766,000
Soft Costs SubTotal:	**$**	**20,128,000**
2023 Project Total:	**$**	**55,439,700**
2043 Projected Project Total:	**$**	**116,887,000**