AROMAS WATER DISTRICT

CAPITAL IMPROVEMENT PLAN

REVISED DRAFT

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LIST OF ABBREVIATIONS

ADD	Average Daily Demand
ADU	Accessory Dwelling Unit
AFY	Acre-Foot per Year
APN	Assessor’s Parcel Number
asl	Above Sea Level
GAL	Gallons
GIS	Geographic Information System
GPD	Gallons per Day
GPM	Gallons Per Minute
HP	Horsepower
KW	Kilowatt
MDD	Maximum Daily Demand
MG	Million Gallons
MGD	Million Gallons per Day
MGY	Million Gallons per Year
MMD	Maximum Monthly Demand
MMDD	Minimum Month Daily Demand
NFF	Needed Fire Flow
PHD	Peak Hour Demand
PC	Production Capacity
PD	Pumping Demand
psi	Pounds per Square Inch
PVC	Polyvinylchloride
PRV	Pressure Reducing Valve
RRS	Recommended Reservoir Size
TDH	Total Dynamic Head
TM	Technical Memorandum
VFD	Variable Frequency Drive

Section 1. Executive Summary

1.1. System Summary

The Aromas Water District (District) provides water to approximately 970 connections in the unincorporated community of Aromas and unincorporated areas west of the City of San Juan Bautista in Monterey and San Benito Counties. Groundwater is the only water source for the District. The District's distribution system includes approximately 38 miles of transmission lines, 182 fire hydrants, 10 water storage tanks, 8 pump stations, 3 active wells, 1 treatment plant, 1 inactive well, an office building, and an existing storage building at the Marshall Well Site (1 acre parcel).

1.2. Existing and Future Demands

Water usage data was analyzed over a two-year period from February 2020 to January 2022. This date range was selected because the water usage data could be analyzed by associated pressure zone. A summary of water demands for the District is presented in Table 1-1 in both million gallons per day (MGD) and GPM. The District's existing average annual water usage during this period was 306 acre-feet per year (AFY) or approximately 100 million gallons per year (MGY). The average water use per connection was calculated to be 278 gallons per day. For the basis of planning, a 5% increase in water use from current conditions is assumed.

Table 1-1 Summary of Existing and Future System Water Demand

Criteria	Existing Demand (MGD)	Existing Demand (GPM)	Future Demand (MGD)	Future Demand (GPM)
MMDD	0.15	103	0.16	108
ADD	0.27	185	0.28	194
MDD	0.63	435	0.66	457
PHD	0.94	652	0.99	685

1.3. Supply Analysis

The District's existing water supplies consist of three local groundwater production wells. There are no connections to any other water systems and the District is not pursing any sources other than groundwater. The three existing water wells can supply the existing and estimated future annual demand for the system, but there is a lack of redundancy, and an additional water source is recommended. The District is actively looking into drilling a new groundwater well which will provide both short- and long-term water supply reliability, as well as sustainability through changes in climate regimes.

1.4. Storage Analysis

The District owns ten tanks with a total storage capacity of over one million gallons. A storage analysis was conducted to evaluate if the existing storage facilities are sufficient to meet existing and future needs, as well as provide water for fire protection. The recommended reservoir size for four of the pressure zones was determined to be greater than the existing storage reservoirs in each of these zones. To address storage deficiencies, a variety of recommendations have been developed. These recommendations include multiple approaches to best serve the needs of the District and minimize costs; the recommended improvements include tank replacement, combining pressure zones to share storage facilities, and replacement of tanks with pressure reducing facilities.

1.5. Capital Improvement Projects

Capital improvement projects were developed based on the results of the evaluations performed in preparation of this Capital Improvement Plan (Plan). A preliminary estimate of project costs for each of the identified capital projects was developed. As a basis for developing an implementation plan, the recommended projects were assigned a priority number between one and ten based on project necessity; with a priority number of one being the highest priority. Assigned priorities and budgetary project costs are summarized in Table 1-2.

Table 1-2 Capital Project Cost Estimates

Capital Project	Project Priority	Budgetary Implementation Cost Estimate
Project G-1: Rate Study	1	$60,000
Project G-2: Hydraulic Model	1	$80,000
Project G-3: Full System Conditions Assessment and Seismic Evaluation	2	$50,000
Project G-4: New Maintenance Building	2	$1,280,000
Project G-5: Electric Fleet Augmentation	3	$120,000
Project G-6: Facility and Cyber Security Plan	3	$75,000
Project S-1: New Well Development	2	$4,992,000
Project S-2: San Juan Well New Generator and Electrical Improvements	4	$483,000
Project ST-1: Ballantree Tank	4	$2,064,000
Project ST-2: School Road Tank Replacement with Pressure Reducing Valve	1	$440,000
Project ST-3: Pine Tree Tank Replacement and/or Additional Tank	5	$2,720,000
Project P-1: Carr Booster Backup	5	$656,000
Project P-2: Leo Lane Pump Station New Generator	6	$160,000
Project P-3: Upper Oakridge Booster New Generator	6	$160,000
Project P-4: Carr Booster Pump Plant Rehabilitation	8	$256,000
Project D-1: Hydrant and Valve Flushing and Condition Assessment	5	$30,000
Project D-2: Hydrant and Valve Repair and Replacement	6	$608,000
Project D-3: Steel Saddle Replacement	7	$400,000
Project D-4: Annual Water Main Replacement, Year 1 of 4	6	$4,000,000
Project D-5: Annual Water Main Replacement, Year 2 of 4	7	$4,000,000
Project D-6: Annual Water Main Replacement, Year 3 of 4	8	$4,000,000
Project D-7: Annual Water Main Replacement, Year 4 of 4	9	$4,000,000
Project D-8: System Operational Reliability Modifications	3	$216,000
Total		**$30,850,000**

All costs are in 2024 dollars. Budgets for projects in future years should be escalated based on an assumed inflation estimate of 3-6% annually. Capital projects should be implemented over a reasonable schedule to reduce single year expenditures and balanced with District staffing availability.

Section 2. System Description

This Section provides an overview of the existing water production, storage, and distribution facilities in the Aromas Water District (District) potable water system (System). Figure 2-1 shows the locations of water wells, reservoirs, pump stations, and other System elements.

2.1. Setting

The Aromas Water District was formed in 1959 and provides water to the unincorporated community of Aromas and unincorporated areas west of the City of San Juan Bautista in Monterey and San Benito Counties. The area has a varied topography with ground surface elevations ranging from approximately 100 feet above sea level (asl) to 730 ft asl. The District's service area is located approximately 9 miles from the Pacific Ocean coastline, approximately 35 miles south of San Jose, and 14 miles north of Salinas.

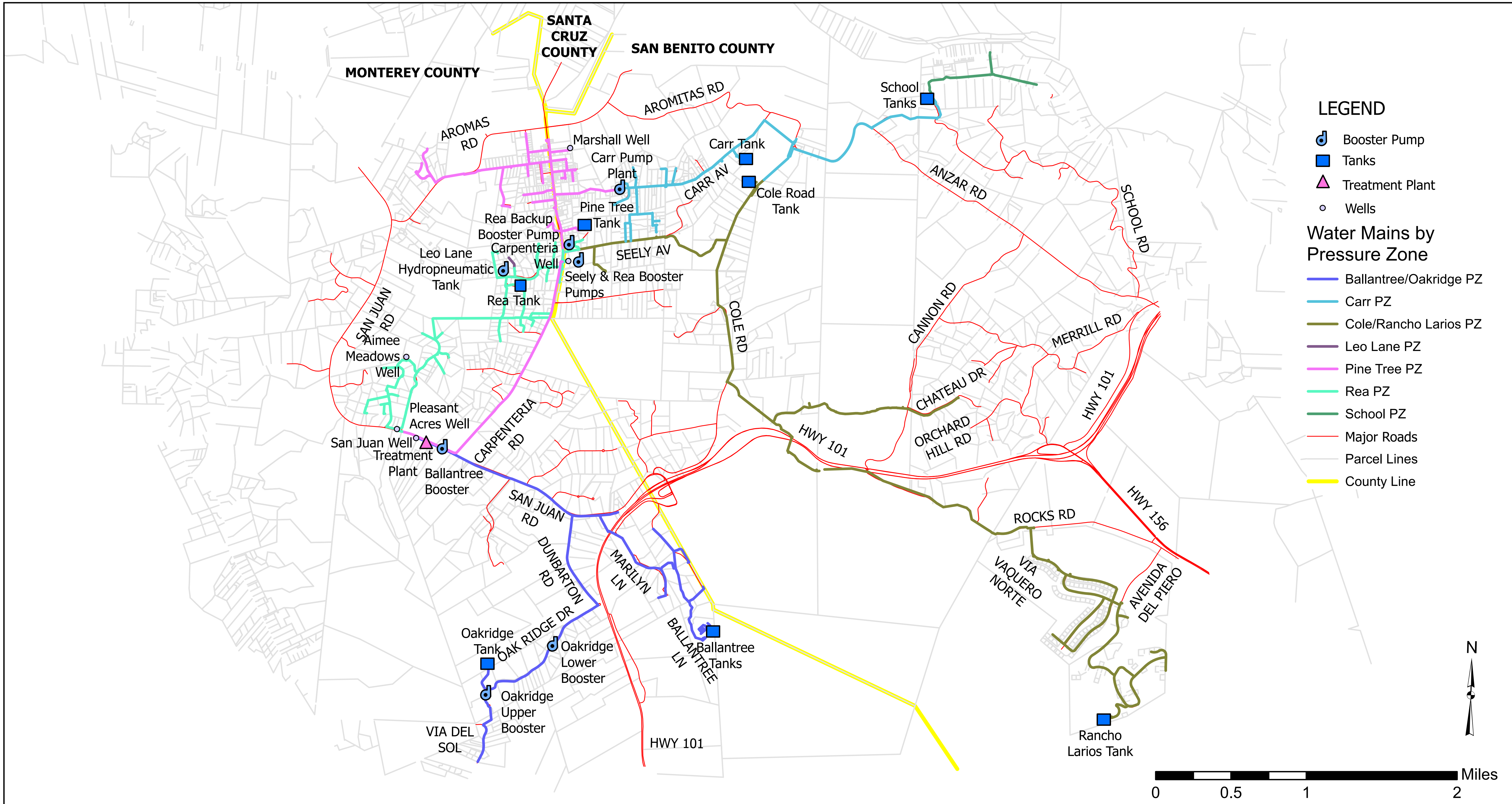
2.2. Hydrogeologic Conditions

The District is in the southeastern portion of the Pajaro Groundwater Basin. The District's wells produce water from a thick sedimentary formation. The hydrogeology of the area is documented in multiple reports, including the *Aromas Water District - Marshall Well Site Assessment* (Feeney, July 2016) (Marshall Well TM), attached to this Plan in Attachment A.

2.3. Water System Overview

The District provides potable water service to approximately 970 connections and is roughly 20 square miles in size (California Division of Drinking Water System CA3510004). Groundwater is the only water source for the District. The District has approximately 38 miles of transmission lines, 182 fire hydrants, 10 water storage tanks, 8 pump stations, 3 active wells, 1 treatment plant, 1 inactive well, an office building, and an existing storage building at the Marshall Well Site (1 acre parcel). Customer meters include single-family residential, multi-family residential, commercial, landscaping/Irrigation, and bulk meters. Residential water connections make up the vast majority of the water connections in the District.

The system component locations are shown in Figure 2-1. A hydraulic profile of the system is provided as Figure 2-2.



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AROMAS WATER DISTRICT

Aromas Water District Asset Map

FIGURE 2-1

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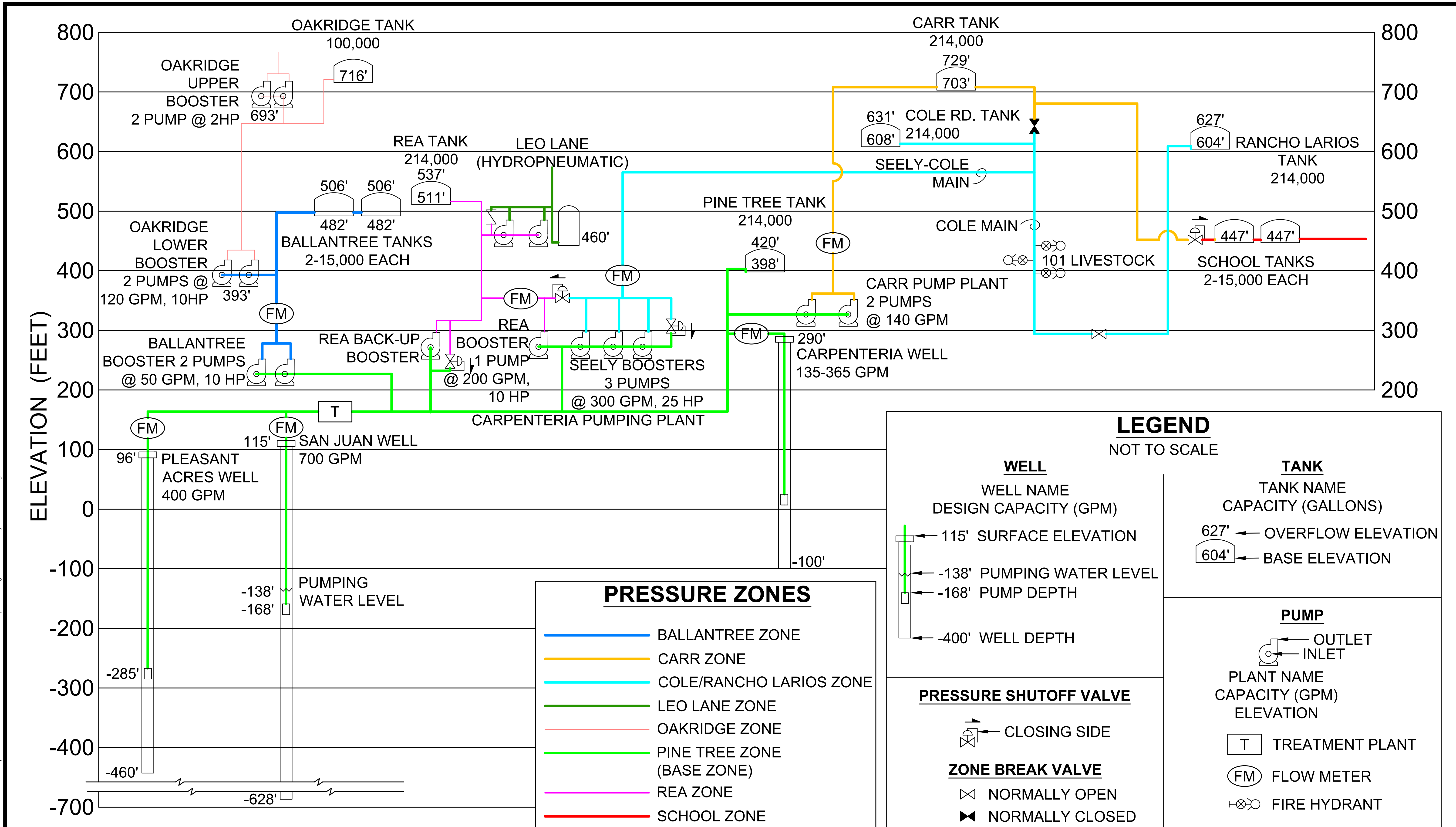

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HYDRAULIC PROFILE
AROMAS WATER DISTRICT

FIGURE
2-2

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2.4. Water Wells

The District owns and operates three groundwater production wells which provide the entirety of the system's supply. The District has one out of service water well located at the Marshall Well Site. The Marshall Well has been inactive for multiple decades due to water quality issues. The District also has a monitoring well, known as the Aimee Meadows Well. Chlorine, in the form of sodium hypochlorite, is dosed to water produced at all three active wells prior to entering water distribution system. To address elevated levels of iron and manganese, water produced from the San Juan and Pleasant Acres Wells discharge to a water treatment system located near the San Juan Wellhead. The Carpenteria Well supplies water directly to the distribution system. The well locations are shown on Figure 2-1, and summarized in Table 2-1. Photographs of the well heads are shown in Figure 2-3, Figure 2-4, and Figure 2-5.

Between 2014 and 2022, the majority of the District's water was produced by the San Juan Well and the Carpenteria Well, while the Pleasant Acres Well only contributed a small fraction of the total supply due to lower quality water produced. All three wells are located in the lowest pressure zone, the Pine Tree Pressure Zone. In 2020, 2021, and 2022, the three wells produced a total of 107.10 million gallons, 102.06 million gallons, and 94.45 million gallons, respectively.

Table 2-1 Well Production Capacities and Locations

Well	Typical Pumping Rate (GPM)	Annual Production, 2022	Percentage of System Production, 2022	Well Address
San Juan Well	700	66.24 MGY	70.1%	2566 San Juan Road
Carpenteria Well	135 to 365	27.71 MGY	29.3%	492.5 Carpenteria Road
Pleasant Acres Well	400	0.55 MGY	0.6%	north of San Juan Road

Figure 2-3 San Juan Well

Figure 2-4 Carpenteria Well

Figure 2-5 Pleasant Acres Well

2.5. Water Quality and Treatment

Water provided to customers of the District meets current, California Title 22 drinking water quality standards. Water produced from all three wells is chlorinated prior to entering the distribution system and a chlorine residual maintained throughout the distribution system.

San Juan Well

Water produced from the San Juan Well has iron and manganese concentrations above drinking water standards. The District reduces these contaminate concentrations using an ATEC Treatment System with iron and manganese decant tanks located at the well site. This treatment system is relatively new and in good condition. There is currently no backup power at this well site and a backup generator is recommended. Photos of the treatment system and backwash reclaim tank are provided in Figure 2-6 and Figure 2-7.

Pleasant Acres Well

The Pleasant Acres Well has the poorest water quality of the three operational wells with high iron and manganese concentrations. The water quality in the well declines during summer months. Water from the Pleasant Acres Well goes through the treatment system located at the San Juan Well Site before entering the distribution system. The poor water quality from this well tends to quickly foul the treatment system filters, requiring frequent backwashing cycles.

Carpenteria Well

The Carpenteria Well is controlled by a variable frequency drive (VFD) regulating pumping capacity from 135 to 365 GPM. The reduced flow rate is used during the summer to avoid pump cavitation. Historically, the Carpenteria Well has had issues related to iron bacteria buildup. A hydro-jetter is used inside the well to remove the buildup on the well casing and annular material. Since cleaning, the well has been operating without issues.

Figure 2-6 San Juan Well and Backwash Reclaim Tank

Figure 2-7 Iron and Manganese Treatment System at the San Juan Well

2.6. Water Distribution System

The water distribution system is composed of a network of pipes, pump stations, valves, and appurtenances which are used to convey water from the groundwater wells to storage tanks and then to customers throughout the service area. These facilities are summarized in the following subsections.

2.6.1. Pressure Zones

The distribution system is currently divided into eight pressure zones. Comparatively, this is a large number of pressure zones relative to the number of customers in the system due to the significantly varied topography of the service area. There are various locations within the distribution system where pressure zones are connected. At most of these locations, pressure reducing valves (PRVs) or tanks are used to maintain the pressure differential between the zones, or a closed valve isolates the zones. The locations of the pressure zones are shown on Figure 2-1 Aromas Water District Asset Map. A summary of the pressure zones is provided in Table 2-2. The three production wells are in the Pine Tree Pressure Zone. This pressure zone has the lowest elevation and is known as the base zone of the water system.

Due to the minimal demand from the Leo Lane Zone and the School Zone, for the demand and reservoir size analyses these zones are considered part of the Rea Zone and the Carr Zone, respectively. A pressure reducing valve between the Cole Road Pressure Zone and the Rancho Larios Pressure Zone was removed and replaced with a zone break valve. The zone break valve is normally open and the two pressure zones are combined into the Cole Road / Rancho Larios Pressure Zone.

Table 2-2 Service Area Pressure Zones

Pressure Zone Name	Zone Ground Elevation Range (feet asl)	Hydraulic Grade Line Range (Feet)	Zone Pressure Operating Range (psi)	Pressure Maintained By	Percentage of Total Demand
Ballantree Zone	110-225	482-506	98-171	Ballantree Tanks and Booster Pumps	3%
Carr Zone	310-674	703-729	13-181	Carr Tank and Pump Plant	14%
Cole Road / Rancho Larios Zone	290-522	608-631	37-148	Cole Tank and Seely Booster Pumps	34%
Leo Lane Zone	478-514			Leo Hydropneumatic Tank and Booster Pumps	Less than 1%
Oakridge Zone	140-705	716-741	5-260	Oakridge Booster Pumps and Oakridge Tank	3%
Pine Tree Zone	95-374	398-420	10-141	Pine Tree Tanks and Well Pumps	25%
Rea Zone	97-502	511-537	4-190	Rea Tanks and Booster Pumps	21%
School Zone	140-377	447-462	30-139	School Tanks	Less than 1%

Table 2-2 Notes:

The Zone Ground Elevation Range is an approximation of the main lines adjacent to the residences at the lowest and highest elevations in each pressure zone. These approximate elevations are from Google Earth.

The Zone Pressure Operating Range is calculated by subtracting the high and low Zone Ground Elevation Range from the Hydraulic Grade Line elevations. The Hydraulic Grade Line Ranges are equal to the maximum and minimum water levels in each zone's tank. Tank elevations are provided on Figure 2-2 Aromas Water District Hydraulic Profile.

The maximum pressure and maximum hydraulic grade line are estimated for the Oakridge and School Pressure Zones based on the estimated height of the associated water tanks.

2.6.2. Distribution System Piping

The distribution infrastructure includes:

- Distribution piping
- Fire hydrants
- Control valves
- System valves
- Blow-offs
- Air release valves

The distribution network includes approximately 38 miles of distribution piping, as summarized in Table 2-3. Pipe material information is referenced from the District's Geographic Information System (GIS). Pipe size and material was not available for all pipe segments. Ages of piping were not available for the preparation of this Plan.

Table 2-3 Pipe Lengths and Materials of Construction in Distribution System

Pipe Material	1.5"	2"	3"	4"	6"	8"	10"	12"	Total Material Length (feet)
Asbestos Cement	-	-	-	-	11,795'	17,426'	20,722'	-	**49,943'**
PVC	-	6,370'	820'	5,466'	52,268'	36,000'	12,035'	10,573'	**123,532'**
Galvanized Steel	417'	-	-	10,700'	3,274'	-	-	-	**14,391'**
Unknown Material and Diameter	-	-	-	-	-	-	-	-	**13,031'**
Total (feet)	**417'**	**6370'**	**820'**	**16,166'**	**67,337'**	**53,426'**	**32,757'**	**10,573'**	**200,897'**

2.6.3. Valves and Hydrants

A summary of the size and type of valves in the system are provided in Table 2-4. Control valves are not included in this summary. The District has approximately 180 fire hydrants.

Table 2-4 Valve Count by Type and Size

Valve Type	2"	3"	4"	6"	8"	10"	12"	Unknown	Total
Gate	42	3	40	230	79	30	12	42	**478**
Butterfly	1	-	-	-	1	-	-	-	**2**
Unknown	2	-	7	-	1	-	-	22	**32**
Total	**45**	**3**	**47**	**230**	**81**	**30**	**12**	**64**	**512**

The isolation valve between the Carr and Cole Pressure Zones was noted by District staff to be in a deteriorated condition.

2.6.4. Booster Pump Stations

The District utilizes eight booster pump stations to transmit water within and between pressure zones. Table 2-5 includes information for each pump station.

Table 2-5 Booster Pump Stations

Name	Number of Pumps / Pump HP	Pump Capacity GPM	Pump Model	Supply Zone / Discharge Zone
Ballantree Booster	2 / 10 HP	50 GPM	Grundfos B97743827P14480214	Pine Tree Zone/ Ballantree Zone
Carr Pump Plant	2 / 20 HP	250 GPM*	Pump #1: Grundfos A977554246P1104240 / Pump #2: Goulds No model number	Pine Tree Zone/ Carr Zone
Leo Lane Booster	2 / 3 HP	No Flow Meter	Sta-Rite DHH-169	Rea Zone/ Leo Lane Zone
Oakridge Lower Booster	2 / 10 HP	120 GPM	Grundfos B9676571P114470493	Ballantree Zone/ Oakridge Zone
Oakridge Upper Booster	2 / 2 HP	25 GPM	Grundfos A98685101P115240305	Oakridge Zone/ Oakridge Zone
Rea Booster	1 / 10 HP	200 GPM	Goulds 4BF1L5D0	Pine Tree Zone/ Rea Zone
Rea Back-up Booster	1 / 10 HP	100 GPM	Goulds K0212846	Pine Tree Zone/ Rea Zone
Seely Booster (Carpenteria Pumping Plant)	3 / 25 HP	300 GPM	Goulds 3656	Pine Tree Zone/ Cole Road/ Rancho Larios Zone

* The Carr Pump Plant is designed to pump at 250 GPM but is currently only producing 140 GPM with both pumps operating.

The Ballantree Booster, Oakridge Lower Booster, Rea Booster, Rea Backup Booster, Seely Booster, and Carr Pump Plant feed into storage tanks. The Oakridge Upper Booster and the Leo Lane Booster feed directly into the service zone with a hydropneumatic tank to reduce pump cycling.

The efficiency, capacity, and necessity of the booster pump stations were not assessed for this Plan. Some of the known issues, including the reduced flow capacity of the Carr Pump Plant and lack of back-up power at multiple boosters, are included in Section 6, Capital Improvement Recommendations. A hydraulic model and full system condition assessment are recommended prior to implementing major capital improvement projects associated with the distribution system to refine the recommendations of this Plan and refine associated design criteria.

2.7. Water Storage

The District's System includes ten tanks to store water for use in the distribution system. The level of water in the storage tanks controls the system operating pressure in the pressure zone(s) directly served by each tank. All ten storage tanks are above grade welded steel or bolted steel structures. A summary of the existing tanks is provided in Table 2-6. Figure 2-8 to Figure 2-15 show photographs of the storage tanks.

Table 2-6 Storage Tanks

Storage Tanks	Total Capacity (gallons)	Number of Tanks	Base Elevation / High Level Elevation	Manufacture Date	Material	Zone Serviced
Ballantree Tanks	30,000	2	482' / 506'	1980	Steel	Ballantree Zone
Carr Tank	214,000	1	703' / 729'	2010	Steel	Carr Zone
Cole Road Tank	214,000	1	608' / 631'	2003	Steel	Cole Road/ Rancho Larios Zone
Pine Tree Tank	214,000	1	398' / 420'	1988	Steel	Pine Tree Zone
Oakridge Tank	100,000	1	716' /	2015	Steel	Oakridge Zone
Rancho Larios Tank	214,000	1	604' / 627'	1999	Steel	Cole Road/ Rancho Larios Zone
Rea Tank	214,000	1	511' / 537'	2009	Steel	Rea Zone
School Road Tanks	30,000	2	447' /	1993	Steel	School Zone
Total	**1,230,000**	**10**				

Known condition issues with individual existing tanks are discussed in this section. Information on storage tank capacity is discussed in Section 5, Water Storage Analysis. A hydraulic model and full system condition assessment are recommended prior to implementing major capital improvement projects associated with the distribution system.

Ballantree Tanks

The two Ballantree Tanks are located on private property and can only be accessed by a poorly maintained unpaved road. The tanks are in poor condition. The site is inaccessible during wet weather. As discussed later in Section 5, these tanks are undersized to meet the fire demands of the Ballantree Pressure Zone. A prior technical memorandum was prepared evaluating alternatives to replace these tanks, *Evaluation of Improvements to Ballantree Zone Distribution System*, (MNS, February 2022) (Ballantree TM). This memorandum provides recommendations for this zone and is included in Attachment B: Evaluation of Improvements to Ballantree Zone Distribution System.

Carr Tank

The Carr Tank is at one of the highest elevations in the system and can supply water to the other pressure zones via gravity.

Cole Road Tank and Rancho Larios Tank

Since the removal of the Cla-Val between the Cole Pressure Zone and the Rancho Larios Pressure Zone, the pressure zones have combined and the water level in the Ranchos Larios Tank is approximately level with the water level in the Cole Tank. As seen on Figure 2-2 the maximum potential water level in the Cole Road Tank is four feet higher than the maximum water level in the Rancho Larios Tank. During winter months, the Rancho Larios Tank can overflow due to the water level in the Cole Road Tank.

Pine Tree Tank

The Pine Tree Tank is supplied directly from the production wells. The Pine Tree Tank was damaged in an earthquake. This tank is a critical element in the system, if the tank is rendered unusable, water reliability would be challenging throughout the system. Additional redundancy at this tank site would improve system reliability.

Oakridge Tank
The Oakridge Tank is currently in good condition. As discussed later in Section 5, this tank is undersized to meet fire demands of the Oakridge Pressure Zone.

Rea Tank
As discussed later in Section 5, the Rea Tank is undersized to meet the combined maximum daily demand and the fire demands of the Rea Zone.

School Tanks
The School Tanks create a break in the pressure between the Carr Tank and the connections in the School Zone. A PRV on the upstream side of the School Tanks reduces the pressure before water enters these tanks. For the demand and reservoir sizing analyses, the School Zone is considered part of the Carr Pressure Zone. The water demand in the School Zone is low and it is difficult to maintain chlorine residual in the School Tanks during the winter months. These tanks are in poor condition and actively leaking; it is recommended they are replaced with a PRV.

Figure 2-8 Ballantree Storage Tanks

Figure 2-9 Carr Tank

Figure 2-10 Cole Tank

Figure 2-11 Rancho Larios Tank

Figure 2-12 Pine Tree Tank

Figure 2-13 Oakridge Tank

Figure 2-14 Rea Tank

Figure 2-15 School Tanks

2.8. Distribution System Issues

There is limited information available regarding the exact age and condition of existing distribution system piping, valves, and fire hydrants, except documented system leaks discussed in this Section and Section 6. Approximately 12% of distribution piping is less than 6-inches in diameter, constricting available fire flow rates. A program to replace aging, undersized, and deteriorating piping is recommended to improve the condition, capacity, and reliability of the distribution system. Development of a computerized hydraulic model of the system is recommended to identify and prioritize water main replacements, and appropriately size replacement piping.

A basic analysis of the existing and future water demands are presented in Section 3. An assessment of the water supply and storage was conducted based on existing facilities and estimated future water demand. This supply and storage assessment are presented in Section 4 and Section 5, respectively. Capital improvement projects addressing the water system issues are presented in Section 6.

Section 3. Existing and Future Water Demand

This Section discusses the existing and future average and peak demands in the Aromas Water District's system.

3.1. Study Area, Land Use, and Population

The study area for this Plan encompasses served residences, businesses, and water system customers within the Aromas Water District's service area limits. The District is located predominately northwest of Highway 101 at the Monterey County and San Benito County line. Portions of the Ballantree and the Cole / Rancho Larios Pressure Zones are located to the southeast of Highway 101. The majority of land within the Aromas service area is a mix of residential, municipal/public, and open space. Per the California Division of Drinking Water, the population served by Aromas Water District is 2,988. All customers within the service area are equipped with water meters, and the District currently provides service to approximately 970 metered connections. Table 3-1 shows the number of connections per classification type. The service area limit is shown on Figure 2-1.

Table 3-1 Connection Classification

Classification	Number of Connections
Bulk Water	13
Commercial	26
Landscape / Irrigation	7
Multi-Unit	22
Residential	913
Total	**981**

3.2. Existing Water Production and Demand

Historical water demand was calculated based on water usage data received from metered connections. Prior to 2023, California experienced a severe drought for multiple years. As a result of conservation efforts, recent water production and consumption has declined compared to previous years. For the purpose of this study, demands by existing customers are not anticipated to increase to pre-drought consumption levels.

Water usage data was analyzed over a two-year period from February 2020 to January 2022. A summary of water demands for the District is presented in Table 3-2 in both MGD and GPM. The District's average annual water usage during this period was 306 AFY or approximately 100 MGY. The average water use per connection was calculated to be 278 GPD. The minimum, average, and maximum water demand were estimated using the following equations.

The Minimum Month Daily Demand (MMDD) is based on the average daily use during the minimum month.

MMDD = minimum monthly use / number of days in the month

The Average Daily Demand (ADD) is the total usage from the analyzed period divide by the total number of days.

ADD = total demand from February 2020 to January 2022 / total number of days

The Maximum Daily Demand (MDD) was determined by multiplying average daily usage during the maximum month by a factor of 1.5.

MDD = (maximum monthly use / number of days in the month) x 1.5

Peak Hour Demand (PHD) was determined by dividing MDD by 24 hours and multiplying this value by a peaking factor of 1.5.

PHD = MDD x 1.5

Table 3-2 Summary of Existing System Water Demand

Criteria	Demand (MGD)	Demand (GPM)	Month
MMDD	0.15	103	January 2022
ADD	0.27	185	N/A
MDD	0.63	435	August 2020
PHD	0.94	652	N/A

Table 3-3 provides water usage by pressure zone. For the demand and reservoir sizing analysis, the School Zone is considered part of the Carr Pressure Zone, and the Leo Lane Zone is considered part of the Rea Zone. The District has approximately fifteen customers without an associated assessor's parcel number (APN) or pressure zone associated with their account. Demand associated with these customers is identified as the miscellaneous zone in Table 3-3.

Table 3-3 Existing Water Demand by Pressure Zone

Zone	Average Annual Demand (MG)	Minimum Daily Demand (Gal)	Average Daily Demand (Gal)	Max Daily Demand (Gal)	Max Monthly Demand (MG) (Month)	Peak Hourly Demand (GPM)
Ballantree	3.30	5,195	9,050	21,072	0.44 July 2021	22
Oakridge	2.80	4,346	7,667	16,021	0.33 August 2020	17
Carr & School	14.14	23,939	38,732	80,604	1.67 July 2021	84
Cole/Rancho Larios	33.33	36,004	91,325	229,539	4.74 August 2020	239
Pine Tree	25.87	41,796	70,878	159,970	3.30 July 2021	167
Rea/Leo Lane	20.81	32,651	57,026	129,158	2.67 August 2020	135
Misc.	0.25	0	693	5,004	0.10 October 2020	5

3.3. Future Development and Demands

There are no significant development projects planned within the District's service area, and there are no planned expansions to the District's service area; a significant increase in system demand is not expected. Due to recent changes in regulation, construction of accessory dwelling units (ADUs) could increase System demand. For the basis of planning, a 5% increase in water use from current conditions is assumed. An estimate of the anticipated future water demand is presented in Table 3-4.

Table 3-4 Summary of Future System Water Demand

Criteria	Demand (MGD)	Demand (GPM)
MMDD	0.16	108
ADD	0.28	194
MDD	0.66	457
PHD	0.99	685

Future annual water demand is anticipated to increase to 321 AFY or 105 MGY. Table 3-5 provides a summary of estimated future system demands by pressure zone.

Table 3-5 Future Water Use by Pressure Zone

Zone	Average Annual Demand (MG)	Average Daily Demand (Gal)	Max Monthly Demand (MG) (Month)	Max Daily Demand (Gal)	Peak Hourly Demand (GPM)	Minimum Daily Demand (Gal)
Ballantree	3.47	9,503	0.46	22,126	23	5,455
Oakridge	2.94	8,050	0.35	16,822	18	4,563
Carr	14.85	40,669	1.75	84,634	88	25,136
Cole/Rancho Larios	35.00	95,891	4.98	241,016	251	37,804
Pine Tree	27.16	74,422	3.47	167,696	175	43,886
Rea	21.85	59,877	2.80	135,616	142	34,284
Misc.	0.26	728	0.11	5,254	5	0

Section 4. Water Supply Analysis

This section discusses Aromas Water District's existing water supplies, their long-term reliability, and potential future sources of supply.

4.1. Water Supply Sources Overview

The District's existing water supplies consist of three local groundwater production wells. There are no connections to any other water systems and the District is not pursing any additional sources other than groundwater. The District is actively looking into drilling a new groundwater well which will provide both short- and long-term water supply reliability. Basic information about the District's wells is provided in Section 2.4. A hydrogeologic evaluation of the local aquifer and an assessment of the condition, efficiency, and capacity of the District's water wells is not included in this Plan.

4.2. Hydrogeologic Review

The District is in the Pajaro Groundwater Basin. There have been multiple hydrogeologic investigations of the basin, including the Marshall Well TM in Attachment A. In this technical memorandum, the author noted there is limited water quality data from wells in the area. Available water quality data suggests groundwater quality is relatively good, meeting primary drinking water standards for all constituents. However, water produced from groundwater wells in the area typically require treatment to remove iron and manganese to meet secondary drinking water standards. Other wells in the area have also exhibited high concentrations of total dissolved solids above the secondary maximum contaminant level (MCL). Any plan to move forward with a new supply should include consideration for potential water treatment.

4.3. Water Supply

The three existing water wells can supply the existing and estimated future annual demand for the system, but there is a lack of redundancy, and an additional water source is recommended. The District owns a fourth well, the Marshall Well, which has been out of service for multiple decades due to poor water quality. Recommended capital improvement projects to enhance the District's water supplies are discussed in Section 6.

4.4. Water Quality

The water in the system meets current California drinking water quality standards. Capital improvement projects involving additional treatment for the existing wells are not currently necessary. Water produced from a new well would likely need to be treated prior to discharge into the water distribution system.

Section 5. Water Storage Analysis

This section discusses the analysis and associated recommendations regarding water storage volumes in the District's distribution system for meeting existing and future potable service requirements, as well as fire demands.

5.1. Existing Water Storage Facilities

As discussed in Section 2, the District owns ten tanks with a total storage capacity of over one million gallons. The Pine Tree Pressure Zone and Pine Tree Tank is the base pressure zone and all water entering the system is first discharged to the Pine Tree Tank before being transferred to other zones. The hydraulic profile in Figure 2-2 shows how the pressure zones are connected and which tanks are used to maintain pressurize in each zone.

5.2. Fire/Storage Analysis

The quantity of water required to meet fire demands is determined by the 2022 California Fire Code, Appendix B. To ensure sufficient storage is available in the system, an analysis was conducted to determine the recommended fire demand. The recommended fire flow for the system is 1,000 GPM for a period of 2 hours for all pressure zones.

5.3. Storage Analysis

Various criteria are considered for water storage, including storage volume, water quality, and storage tank appurtenances. These criteria are detailed in the following sections.

5.3.1. Water Storage Volume

The minimum recommended storage volume for each pressure zone is determined by the following equation:

RRS = NFF + MDD – PC +PD

Where:

RRS = Recommended Reservoir (tank) Size (gallons, rounded up)
NFF = Needed Fire Flow (120,000 gallons, 1,000 GPM for 2 hours)
MDD = Future Maximum Daily Demand (determined in Section 3)
PC = Production Capacity supplying water to the zone (2 hours of pumping)
PD = Pumping Demand removing water from the zone (2 hours of pumping)

For District, a conservative estimate of storage requirements was used to provide operational flexibility and system reliability. For the demand and reservoir sizing analysis, the School Zone is considered part of the Carr Pressure Zone and the Leo Lane Zone is considered part of the Rea Zone. The pumping demand from both the Leo Lane Zone and the Oakridge Upper Boosters is considered insignificant and not included in the calculation to determine in the pumping demand removing water from a zone. A summary of reservoir sizing is provided in Table 5-1.

Table 5-1 Summary of Reservoir Sizing with Existing Zones and Facilities

	Pine Tree Zone	Ballantree Zone	Rea Zone	Oakridge Zone	Carr & School Zone	Cole / Rancho Larios Zone
Future MDD (gal)	168,000	22,200	135,600	16,900	84,700	241,000
Fire Demand (gal)	120,000	120,000	120,000	120,000	120,000	120,000
Pump Capacity into Zone 2 hrs (gal)	100,000	6,000	24,000	14,400	30,000	36,000
Pumping Demand from Zone 2 hrs (gal)	96,000	14,400	Leo Lane insignificant	Oakridge Upper Booster insignificant	None	None
Recommended Reservoir Size (Rounded, gal)	284,000	150,600	231,600	122,500	174,700	325,000
Existing Reservoir Size (gal)	214,000	30,000	214,000	100,000	244,000	428,000

The recommend reservoir size for the Pine Tree, Ballantree, Rea, and Oakridge Zones is greater than the existing storage reservoirs in each of these zones.

5.3.2. Pine Tree Zone

The Pine Tree Tank is a critical facility in the water distribution system, was damaged in an earthquake, and is undersized. Replacing the existing tank with two 150,000-gallon tanks would create redundancy in the system, meet recommended storage requirements, and address the existing tank condition issues. Alternatively, the existing tank could remain in service, and an additional 100,000-gallon tank could be constructed adjacent to the existing tank.

5.3.3. Oakridge Zone

The Oakridge Tank is currently in good condition and is sufficiently sized to meet existing and future maximum daily demands but is slightly undersized to meet fire demands of the Oakridge Pressure Zone. A recommended capital improvement project is to add a fire booster pump with a flow rate of 200 GPM at the Oakridge Lower Booster Pump Station to address this deficiency. This fire pump would only operate during fire conditions and would increase the pumping capacity of the Oakridge Lower Booster Pump Station from 120 GPM to 320 GPM. As shown on Table 5-2 this new fire pump reduces the recommended reservoir size to less than the existing tank size.

Table 5-2 Reservoir Sizing for the Oakridge Zone with Proposed Backup Booster Pumps

	Oakridge Zone
Future MDD (gal)	16,900
Fire Demand (gal)	120,000
Pump Capacity, 2 hrs (gal)	38,400
Recommended Reservoir Size (Rounded, gal)	98,500
Existing Reservoir Size (gal)	100,000

5.3.4. Rea-Ballantree Zone

The Ballantree TM, included in Attachment B, provides a detailed assessment of storage conditions in the Ballantree Zone. The Ballantree TM recommends a capital improvement project to combine the Rea and Ballantree Pressure Zones and create a new Rea-Ballantree Zone. Connecting the zones would allow the new combined zone to access water stored in both the Ballantree Tanks and the Rea Tank.

Table 5-3 demonstrates the storage capacity of a combined Rea-Ballantree Zone, incorporating the proposed improvements to replace the Ballantree Tanks with a single 100,000-gallon tank at a higher elevation, is sufficient to meet the recommended reservoir size. Adding a pressure reducing valve at the Oakridge Booster Pump Station will also improve system redundancy. The new tank could be located at the existing Ballantree Tank Site. Table 5-3 shows this larger tank will enable the new Rea-Ballantree Zone to meet the recommended reservoir size. Table 5-3 also shows that with the additional flow rate withdrawn from the combined zone by the new backup Oakridge Booster Pump, recommended above, the total combined zone storage meets the recommend storage volume for the proposed Rea-Ballantree Zone.

Table 5-3 Recommend Reservoir Sizing for proposed Rea-Ballantree Zone

	Rea-Ballantree Zone with new larger Ballantree Tank	Rea-Ballantree Zone with new larger Ballantree Tank and new Oakridge Backup Boosters
Future MDD (gal)	157,800	157,800
Fire Demand (gal)	120,000	120,000
Pump Capacity, 2 hrs (gal)	30,000	30,000
Pumping Demand from Oakridge Zone	14,400	38,400
Recommended Reservoir Size (Rounded, gal)	262,200	286,200
Proposed Reservoir Size (gal)	314,000	314,000

5.3.5. Carr and School Zone

The water demand in the School Zone is low and it is difficult to maintain a chlorine residual in the School Tanks during the winter months due to excessive residence time, internal corrosion, and microbial growth on the tank interior. These tanks are leaking, and it is recommended they are replaced with a PRV. Table 5-4 shows the existing Carr Tank is of sufficient size to meet the recommend reservoir size without the School Tanks

Table 5-4 Recommended Reservoir Sizing for a Carr Zone without the School Tanks

	Carr & School Zone
Future MDD (gal)	84,700
Fire Demand (gal)	120,000
Pump Capacity, 2 hrs (gal)	30,000
Recommended Reservoir Size (Rounded, gal)	174,700
Existing Reservoir Size (gal)	214,000

5.3.1. Proposed Reservoir Residence Time

An analysis was also conducted to determine the days of system demand stored in each reservoir for MDD and MMDD, incorporating recommended storage modifications. The calculations for reservoir residence time are summarized in Table 5-5.

Table 5-5 Summary of Reservoir Days Storage

	Pine Tree Tank	Rea - Ballantree Tanks	Oakridge Tank	Carr & School Tanks	Cole / Rancho Larios Tanks
Recommended Reservoir Sizing	284,000	314,000	100,000	214,000	428,000
Future MDD (gal)	168,000	157,800	16,900	84,700	241,000
Future MDD Days Storage	1.7	2.0	5.9	2.5	1.8
Reservoir MMDD (gal)	41,800	37,900	4,400	24,000	36,000
MMDD Days Storage	6.8	8.3	22.7	8.9	11.9

Due to the large differential between MDD and MMDD, during low demand periods, there is a risk of chlorine residual loss due to extended residence time. Typically, greater than 3 days' storage can result in a loss of chlorine residual.

During winter months the residence times in the Oakridge Tank and the Cole / Rancho Larios Tanks exceed recommendations. Increased chlorine dosing, installation of a disinfectant maintenance system, and/or reduced operating levels in these reservoirs should be considered during low flow periods to reduce the risk of chlorine residual loss.

Section 6. Capital Improvement Recommendations

This section discusses recommended capital improvement projects for the Aromas Water District.

Recommended Capital Improvement Projects

Capital improvement projects were developed based on the findings of this Plan and discussions with the District. The projects were divided into several categories including:

General (G-X):	General projects include planning projects, and other projects which do not fit into the other categories.
Supply (S-X):	Supply projects include work associated with drilling a new water well and maintenance of existing wells.
Storage (ST-X):	Storage projects include modifications to system storage facilities.
Pumping (P-X):	Pumping projects include work associated with improvements to new or existing pump stations.
Distribution (D-X):	Distribution projects include work to improve the potable water distribution system, not including pump stations.

Each project is described in the following subsections.

6.1. General Projects

Projects discussed in this section include planning projects, and other projects which do not fit into the other categories.

6.1.1. Project G1 – Rate Study

The most recent Rate Study for the Aroma Water District was completed in June 2019. Based on the recommendations of this Plan, the current rates are insufficient to fund projected capital needs.

6.1.2. Project G-2 – Water System Hydraulic Model

This project includes preparation of a water system hydraulic model using computerized modeling software. The model will be developed and calibrated using water system data and fire hydrant flow testing. The model will be used to evaluate current and future performance of the water system, verify operation of pumps, verify recommended pipe sizes for water main replacements, and to estimate fire flow availability and operating pressures throughout the System.

6.1.3. Project G-3 – Full Condition Assessment and Seismic Evaluation

In addition to project G-2, a full condition assessment and seismic evaluation of the District's above ground facilities, including an electrical and mechanical field testing and observation, is needed to provide a comprehensive assessment of the water system. A complete condition assessment was not included in this Plan. Some known condition issues are discussed and addressed by the recommendations of this Plan, other known and unknown issues are not addressed due to the relative uncertainty of the issue. One such project is determining the reason the Carr Pump Booster is only pumping 125 GPM, when it is designed for 250 GPM.

6.1.4. Project G-4 – New Maintenance Building

This project consists of the construction of a new single story maintenance building for the District located at the District's operations yard, a property currently owned by the District. Site improvements associated with this project include, site grading and paving, septic tank and leach field, new maintenance building, rehabilitation of the existing maintenance building, abandonment of the out-of-service Marshall Well, and miscellaneous site improvements. The new maintenance building will incorporate onsite power generation in the form of roof mounted solar panels and electric vehicle charging stations. A draft layout of the new maintenance building is provided in Attachment D.

6.1.5. Project G-5 – Electric Fleet Augmentation

This project consists of purchasing two electric vehicles (EVs) and the necessary infrastructure for charging EVs. The new maintenance building, project G-4, and the existing District office will be outfitted with level II charging stations.

6.1.6. Project G-6 – Cyber Security Improvement Project

This project includes enhancement the of cyber security for the District's computer systems. The District will retain a cyber security firm to assist in implementing an updated cyber security system.

6.2. Supply Projects

Projects to enhance water supply availability and reliability are discussed in this section.

6.2.1. Project S-1 – New Well Development

The three existing operational wells meet current system demands but the District needs another well to provide supply redundancy and improve system reliability. This project includes land acquisition for the well site just to the northeast of the intersection of Quarry Road and Rogee Lane, a test well, a 1,000 GPM production well, an iron and manganese treatment system, and a 600-foot pipeline connecting the new production well to the existing water distribution system, including a crossing under the Union Pacific Railroad track. The District has previously considered drilling a new production well near the existing out-of-service Marshall Well. A 2022 pilot boring was drilled at the Marshall Well Site, and it was determined there was insufficient available groundwater at this location.

6.2.2. Project S-2 – San Juan Well New Generator and Electrical Improvements

The Ballantree Pump Station is the only source of water for the Ballantree and Oakridge Zones. Currently there is no emergency power supply for the Ballantree Booster Pump Station. In the event of an electrical power outage, the pump station is unable to supply water to the zones. This project consists of installing an emergency 250KW generator, or larger, to operate this facility under the load conditions noted in the Ballantree TM, included in Attachment A. In addition, this project includes minor electrical improvements to bring the site up to date.

6.3. Storage Projects

Projects to repair or replace existing water storage reservoirs are discussed in this section. These projects should be carefully coordinated with respect to temporary storage to minimize associated costs.

6.3.1. Project ST-1 – Ballantree Tank

The two Ballantree tanks are located on private property and can only be accessed by a poorly maintained unpaved road. The site is inaccessible during some rain events. As discussed in Section 5, these tanks are undersized to meet fire demands of the Ballantree Pressure Zone, and it is recommended the existing Ballantree Tanks be replaced by a new 100,000-gallon tank. Details of this project are discussed in the Ballantree TM, included in Attachment A.

6.3.2. Project ST-2 – School Road Tank Replacement with Pressure Reducing Valve

The School Road Tanks provide a break in pressure for the School Zone service, which is part of the Carr Pressure Zone. A PRV located upstream of the tanks reduces the pressure going into the School Tanks. The School Road Tanks are showing signs of wear and are a continuing target for vandalism. In this project, the School Road Tanks will be replaced with a new pressure reducing valve. Due to low water demand in the School Zone, storage in the School Tanks is not required.

6.3.3. Project ST-3 – Pine Tree Tank Replacement and/or Additional Tank

The Pine Tree tank was damaged in an earthquake. As one of the most critical elements in the system, if this tank was rendered unusable, maintaining water supply would be challenging throughout the System. Section 5 also demonstrates the Pine Tree Tank is undersized. This project is to replace the existing tank with two 150,000-gallon tanks which would create redundancy in the system, meet recommended storage requirements, and address the existing tank condition issues. Alternatively, the existing tank could remain in service, and an additional 100,000-gallon tank could be constructed adjacent to the existing tank; to reduce project costs; a budget for this reduced scope project is not included. Based on the hydraulic profile, an altitude valve could be used on the Pine Tree Tank to avoid overflow when utilizing the PRV to move water from higher zones down into this lower zone.

6.4. Pumping Projects

This section discusses capital projects associated with improvements to water pumping facilities.

6.4.1. Project P-1 – Carr Booster Backup

This project includes a new backup pump station between the Cole Tank and the Carr Tank. It is assumed this facility would consist of a package booster pump station. A Backup generator is not included. The new pump station would add redundancy and enable water to be transferred directly from the Cole Tank to the Carr Tank. Currently, when the Carr Pumping Plant is offline, there is no way for water to reach the Carr Tank. The new pump station could be located at the Cole Tank Site. This project needs to be verified by the hydraulic model and full system condition assessment, Projects G-2 and G-3. A pump station with a pumping capacity matching the existing Carr Pump Plant of 250 GPM is used as the basis for budgeting for this project.

6.4.2. Project P-2 – Leo Lane Pump Station New Generator and Electrical Upgrade

The Leo Lane Pump Station does not currently have back-up power. A power outage results in reduced pressure or loss of service for the Leo Lane Zone. This project includes a new permanent generator and an automatic transfer switch at the Leo Lane Pump Station. The current electrical system for the pumping station is in an underground vault. The electrical system will be moved above ground.

6.4.3. Project P-3 – Upper Oakridge Booster New Generator

The Upper Oakridge Booster Pump Station does not currently have back-up power. A power outage results in reduced pressure or loss of service for the Upper Oakridge Zone. This project includes a new permanent generator and automatic transfer switch at the Upper Oakridge Booster Pump Station.

6.4.4. Project P-4 – Carr Pump Plant Rehabilitation/Upgrade

The two pumps at the Carr Pump Plant are designed for a combined flow rate of 250 GPM. Currently, the flow rate is approximately 125 GPM with one pump operating and 140 GPM with both pumps operating. The pump station hydraulic and pumping efficiency need to be evaluated as a basis for rehabilitation or replacement. The addition of a PRV at the Carr Pumping Plant would enable water to be moved from the Carr Zone into the lower zones. Based on the results of the hydraulic model and full system condition assessment, Projects G-2 and G-3, increasing the pumping capacity of this pumping plant should be considered.

6.5. Distribution System Projects

This section discusses capital projects associated with improvements to water distribution pipelines and appurtenances.

6.5.1. Project D-1 – Hydrant and Valve Flushing and Condition Assessment

This project consists of contracting with a firm to complete a field assessment of existing fire hydrants and hydrant valves within the distribution system. The firm will flush each hydrant and exercise all valves in the system to determine operability and document the equipment's performance as well as provide recommendations for repairs. This project should include recoating and basic hydrant and valve maintenance as part of the field assessment. This is the first phase of work to evaluate and upgrade system valves and hydrants prior to repairs completed as Project D-2.

6.5.2. Project D-2 – Hydrant and Valve Repair and Replacement

The project includes replacement and repairs of existing fire hydrants and valves based on the results of the work completed by Project D-1. As part of this project, breakoff check valves will be installed on all hydrants. Due to the unknown scope required, an assumed value has been designated for the cost of replacement and repairs.

6.5.3. Project D-3 – Steel Saddle Replacement

The project is to replace steel saddles on existing mains which have reached the end of their useful service life. The District owns laterals from the main line to the customer's meter including the service saddle. There are many steel saddle failures in the Rea Zone. The saddles near the Carr Booster Station should also be replaced to avoid failures due to increased pressure from the proposed new high flow pump recommended for the Carr Booster Station. The project includes budget to replace 100 steel service saddles.

6.5.4. Project D-4 to D-7 – Annual Water Main Replacement, Year 1 to Year 4

The project includes replacing a minimum of 2% of the water mains in the system each year for a total replacement every 50 years. There are approximately 200,000 linear feet of main in the District. The replacement should be prioritized based on condition (leaks and failures), age, amount of water and number of connections affected, and hydraulics including fire flow capacity, with a goal to initially replace all 4" and smaller mainline pipes. The piping on Pleasant Acres Lane is known to be in poor condition, has non-standard pipe types, and should be replaced. This project needs to be verified by the hydraulic model and full system condition assessment, Projects G-2 and G-3 to confirm prioritization and pipe sizing.

6.5.5. Project D-8 – System Operational Reliability Modifications

This project consists of several smaller projects focused on improving system operational reliability.

6.5.5.1. Project D-8A – Carr-Cole Isolation Valve Replacement

The isolation valve between the Carr and Cole Pressure Zones is showing signs of aging and needs to be replaced. A new combination backpressure sustaining and pressure reducing isolation valve will be installed in its place.

6.5.5.2. Project D-8B – Pressure Reducing Valve at Oakridge Pump Station

This project is to install a new PRV on a bypass line at the Oakridge Pump Station. This will allow for water from the Oakridge Tank to enter the Ballantree Pressure Zone and help achieve the fire flow requirements in the Ballantree Zone. Details of this project are discussed in the Ballantree TM, included in Attachment A. Prior to execution, this project needs to be verified by the hydraulic model and full system condition assessment, Projects G-2 and G-3.

6.5.5.3. Project D-8C – Pressure Reducing Valve at Rea Booster Pump

This project is to replace the existing below ground PRV between the Rea and the Pine Tree Pressure Zones with a new above ground PRV. The existing PRV, between these zones, was constructed in the 1940's, has not been used since 1979, and is in poor condition. This project will allow for water from the Rea Tank to enter the Pine Tree Pressure Zone and help achieve the required fire flow and recommended storage for the Pine Tree Zone. The new PRV could be located on a bypass line on the Rea Booster Pump or in place of the Rea Backup Booster. As part of this project, the Rea Backup Booster will be removed. The Rea Backup Booster is redundant and has not been used in recent memory. Prior to execution, this project needs to be verified by the hydraulic model and full system condition assessment, Projects G-2 and G-3.

6.6. Capital Improvements Costs

A preliminary estimate of project costs for each of the identified capital projects was developed. Detailed breakdowns of the costs of each project are included in Attachment E: Capital Project Cost Estimates. A summary of project costs is provided in Table 6-1.

Cost estimates assume work will be completed by a third-party contractor.

A 30 percent construction contingency factor was applied to the total construction cost of each construction project, as well as an additional 30 percent of construction costs to cover project engineering, construction management, permitting, and administration. These mark-ups were omitted from projects not involving construction.

All costs are in 2024 dollars. Budgets for projects in future years should be escalated based on an assumed inflation estimate of 3-6% annually.

Table 6-1 Capital Project Cost Estimates

Capital Project	Project Priority	Budgetary Implementation Cost Estimate
Project G-1: Rate Study	1	$60,000
Project G-2: Hydraulic Model	1	$80,000
Project G-3: Full System Conditions Assessment and Seismic Evaluation	2	$50,000
Project G-4: New Maintenance Building	2	$1,280,000
Project G-5: Electric Fleet Augmentation	3	$120,000
Project G-6: Facility and Cyber Security Plan	3	$75,000
Project S-1: New Well Development	2	$4,992,000
Project S-2: San Juan Well New Generator and Electrical Improvements	4	$483,000
Project ST-1: Ballantree Tank	4	$2,064,000
Project ST-2: School Road Tank Replacement with Pressure Reducing Valve	1	$440,000
Project ST-3: Pine Tree Tank Replacement and/or Additional Tank	5	$2,720,000
Project P-1: Carr Booster Backup	5	$656,000
Project P-2: Leo Lane Pump Station New Generator	6	$160,000
Project P-3: Upper Oakridge Booster New Generator	6	$160,000
Project P-4: Carr Pump Plant Rehabilitation	8	$256,000
Project D-1: Hydrant and Valve Flushing and Condition Assessment	5	$30,000
Project D-2: Hydrant and Valve Repair and Replacement	6	$608,000
Project D-3: Steel Saddle Replacement	7	$400,000
Project D-4: Annual Water Main Replacement, Year 1 of 4	6	$4,000,000
Project D-5: Annual Water Main Replacement, Year 2 of 4	7	$4,000,000
Project D-6: Annual Water Main Replacement, Year 3 of 4	8	$4,000,000
Project D-7: Annual Water Main Replacement, Year 4 of 4	9	$4,000,000
Project D-8: System Operational Reliability Modifications	3	$216,000
Total		**$30,850,000**

6.7. Capital Project Prioritization and Implementation Schedule

As a means to establish a schedule for capital project implementation and associated annual budgets, a priority was assigned to each capital project. Priorities were assigned with a score of 1-10 based on project sequencing, severity of need, and to spread projects over a reasonable implementation period. Table 6-2 shows the project prioritization and planned implementation schedule. 30% of the total project cost for each construction project was allocated to the prior year to cover design, permitting, and administrative costs.

Table 6-2 Capital Project Budget Implementation Schedule

Capital Project	Priority	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project G-1	1	$60,000									
Project G-2	1	$80,000									
Project G-3	2		$50,000								
Project G-4	2		$1,280,000								
Project G-5	3			$120,000							
Project G-6	3			$75,000							
Project S-1	2		$4,992,000								
Project S-2	4				$483,000						
Project ST-1	4				$2,064,000						
Project ST-2	1	$440,000									
Project ST-3	5					$2,720,000					
Project P-1	5					$656,000					
Project P-2	6						$160,000				
Project P-3	6						$160,000				
Project P-4	8								$256,000		
Project D-1	5					$30,000					
Project D-2	6						$608,000				
Project D-3	7							$400,000			
Project D-4	6						$4,000,000				
Project D-5	7							$4,000,000			
Project D-6	8								$4,000,000		
Project D-7	9									$4,000,000	
Project D-8	3			$216,000							
Total		$580,000	$6,322,000	$411,000	$2,547,000	$3,406,000	$4,928,000	$4,400,000	$4,256,000	$4,000,000	

Attachment A: Aromas Water District – Marshall Well Site Assessment

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Martin B. Feeney
Consulting Hydrogeologist

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TECHNICAL MEMORANDUM

To:	Aromas Water District	**Date:**	July 11, 2016
From:	Martin Feeney, PG, CHg		
Subject:	Aromas Water District – Marshall Well Site Assessment		

INTRODUCTION:

This technical memorandum (TM) presents an evaluation of the opportunities that exist for Aromas Water District (District) to utilize the Marshall Well Site as a way of improving the District's overall water supply and redundancy. Specifically, the TM focuses on an assessment of the physical condition of the existing well at the site and confirmation of its water quality. The TM also presents a "reconnaissance-level" estimate of the cost to treat water from the existing well for use as water supply. Finally, the TM evaluates the potential to repurpose the well site as a site for a new and deeper well that may have increased yield and improved water quality.

The scope of work for the evaluation included:

- Video survey of the well
- Installation of a test pump
- Performance of a pumping test and collection of water samples
- Evaluate water quality/assess treatability and costs
- Evaluate hydrogeologic conditions as to potential for deeper well
- Preparation of this tm documenting findings and presenting conclusion and recommendation as to the future use of the well and the well site

BACKGROUND:

The Marshall well is located in the community of Aromas at the eastern end of Marshall Lane. The well was reportedly drilled in 1954 to a depth of 237 feet and is 12-inches in diameter perforated from 219 to 224 feet. Available well performance data documents the well discharge rate at one time to be as much as 200 gpm with a specific capacity[1] of about 8 gpm/ft. The depth to water at the site in the 1970s/1980s ranged between approximately 50 feet and 70 feet below ground surface. Based on available data and interpretation of relevant hydrogeologic references, the well is perforated in the upper portion of the Purisima Formation. There is no documentation as to whether there is a sanitary seal.

Historical water quality data available for the well documents poor water quality from the Marshall Well, with excedences of drinking water quality standards for total dissolved solids (TDS), iron, and manganese. Additionally, previous reports document the presence of hydrogen sulfide in water produced from the well. The conclusion of a previous water treatment feasibility report from 1983 stated that the water was difficult and expensive to treat, primarily because of the elevated total dissolved solids (TDS) and hardness. Because of the poor water quality, the well has not been used in decades. The existing pump installed in the well is inoperable.

[1] Specific Capacity is the ratio of discharge to drawdown. The conventional units are gallons per minute to feet of drawdown (gpm/foot). Specific capacity is useful to compare well performance between wells and individual well performance over time.

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WELL ASSESSMENT - WORK PERFORMED

Video Inspection – After removal of the pump from the well by the District, the well was video surveyed to assess the well's condition and confirm the reported construction details. Video survey was performed on January 12, 2016 by Newman Well Surveys, Inc. of Salinas California. Prior to video survey, water was introduced into the well to improve clarity. The video was successfully completed to a depth of 221 feet, below ground surface (bgs). The original construction records state the original well depth as 237 feet, bgs, suggesting approximately 16 feet of fill. As also reported on the construction records, vertical slot perforations, although barely visible, were confirmed below a depth of 219 feet bgs and bottom. The general condition of the well was poor with significant visible corrosion and encrustation. Observed encrustation was predominately black in color, indicative of elevated manganese concentrations. A summary of the video survey is attached.

Well Testing/Sampling – After completion of the video survey, a 20-HP submersible pump was installed in the well to allow assessment of well performance and the collection of representative water quality samples. The pump was installed to a depth of approximately 200 feet. After installation, the well was pumped for a period of 4.2 hours at an average discharge rate of approximately 60 gallons per minute (gpm). The initial discharge rate was close to 200 gpm, but pumping water level quickly approached the pump and discharge was reduced to approximately 60 gpm through the remainder of the pumping period. At the completion of pumping, a total of approximately 14,700 gallons had been pumped or approximately 18 casing volumes.

Water Quality Sampling – Water quality samples were collected at approximately 10 minutes and 180 minutes after start up and at the conclusion of the pumping period (254 minutes). All samples were taken to Monterey Bay Analytical Laboratory for analysis. The first two samples were analyzed for only iron and manganese ion concentrations, the final sample for a full inorganic Title 22 analysis. Table 1 presents the time-series data. The results of the water quality analysis are presented graphically in Figures 1 and 2. Figure 1 presents the available historical data. Figure 2 presents the recent Title 22 results. The laboratory reports are attached.

Figure 1 - Marshall Well - Historical Water Quality

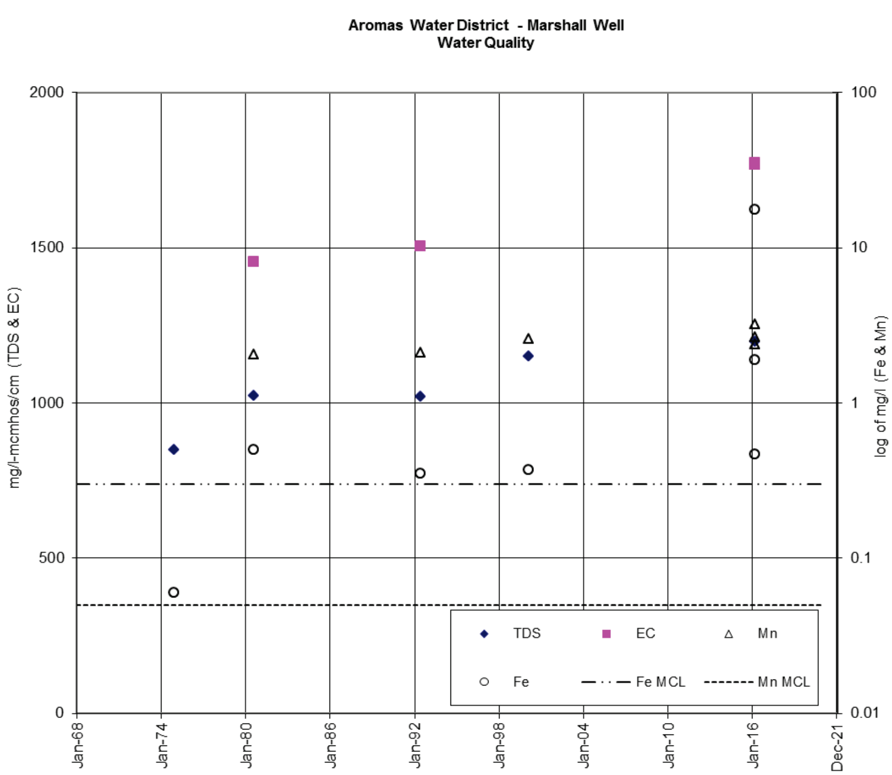
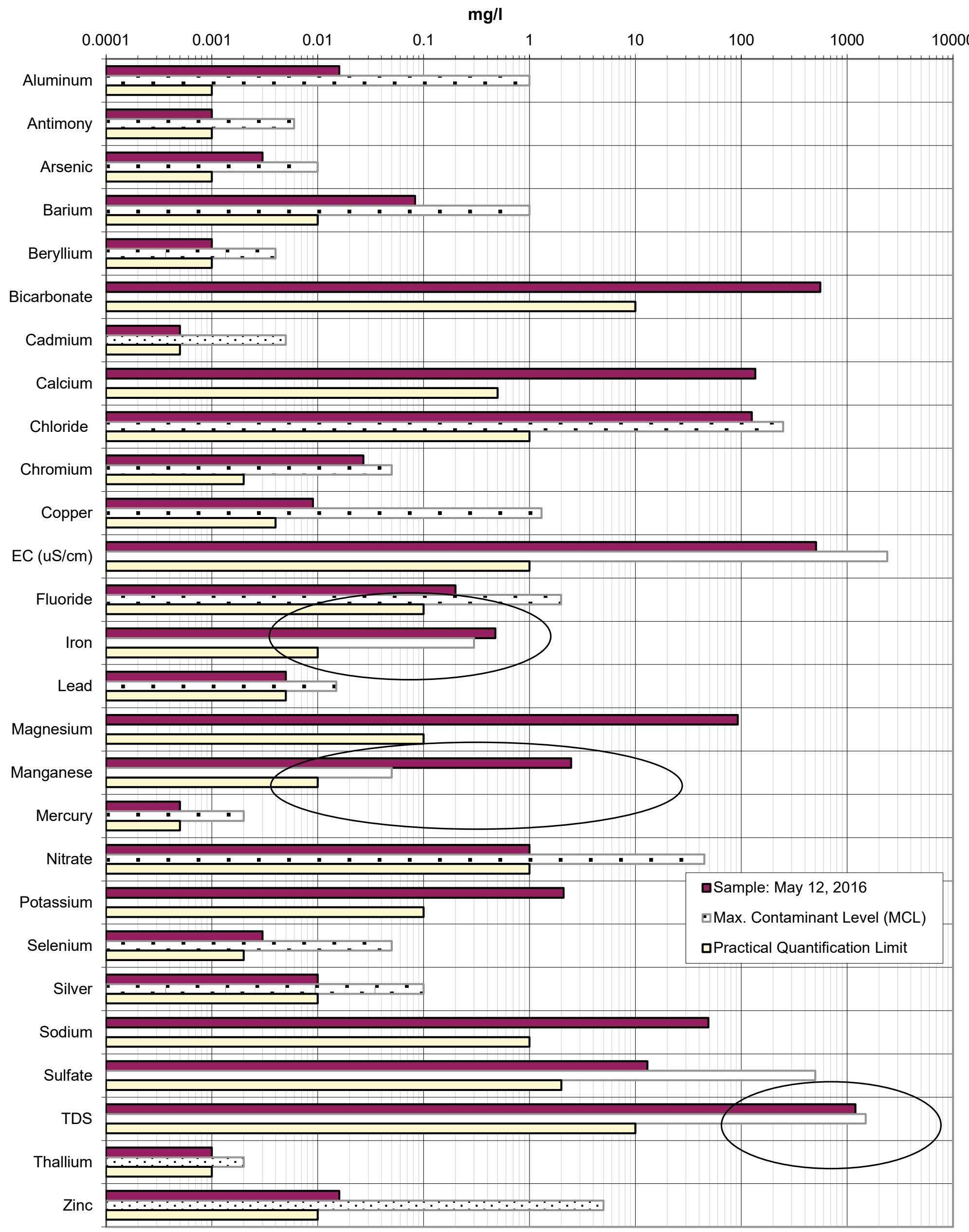


Table 1 - Marshall Well - Time Series Water Quality Data

Sample Time (mins)	Iron (mg/l)	Manganese (mg/l)	Specific Conductance (umhos/cm)
8	17.5	3.2	1773
200	1.9	2.65	1770
254	0.47	2.4	1767

Figure 2 - Marshall Well - Inorganic Water Quality



Stippled MCL = primary standard
Unstippled MCL = secondary (esthetic) standards)
"Not detected" plotted at Practical Quanticification Limit, value is likely lower.

Recent water quality data are generally consistent with the historical data. Data are limited, but compared to previous data, total dissolved solids concentrations appear to have slightly increased. Although water from well meets all primary (health-based) drinking water standards for constituents analyzed, the water exceeds secondary (esthetics-based) drinking water standards for total dissolved solids (TDS), iron and manganese.

Consistent with previous data, manganese level remains exceptionally elevated. Iron concentrations declined significantly during the pumping period falling from approximately 17 milligrams per liter (mg/l) to approximately 0.47 mg/l at the completion of pumping. This decline with the duration of pumping is not uncommon in wells with corrosion which have been idle for long periods. Manganese concentrations were relatively insensitive to pumping duration.

TREATMENT

The water produced from the well has always been of poor quality and recent sampling confirms the historical data. To meet drinking water standards and for customer acceptance, the water would need to be treated to reduce TDS, lower hardness, and reduce iron and manganese concentrations.

Given the water quality, achievement of these improvements would likely require installation of a lime softening facility to treat the water. Lime softening would reduce the hardness, TDS and likely reduce both iron and manganese to below the MCLs. Reverse osmosis or electro-dialysis-reversal technologies cannot be used due to the elevated alkalinity and hardness of the water. Based on discussions with several vendors, cost of such a facility would be on the order of $1M. There would be operational costs associated with disposal of the lime sludge. Design of such a facility would require pilot testing to refine the processes. The cost of a pilot study is estimated at $100,000.

CONCLUSIONS FROM WELL ASSESSMENT WORK:

- The Marshall Well is more than 60 years old, and has significant corrosion and fill. The construction of the well is undocumented, and although it evidently was previous permitted as a water supply source for the District, it is not likely it would be re-permitted as a new source regardless of water quality.

- Treating the water to meet drinking water standards will be very expensive. In addition, to the capital costs associated with the treatment facilities the existing well would need to be replaced to assure the long term operation of the overall facility. Estimated cost of a well of similar depth and of modern design, inclusive of engineering, above ground appurtenances and controls/power, is $800,000.

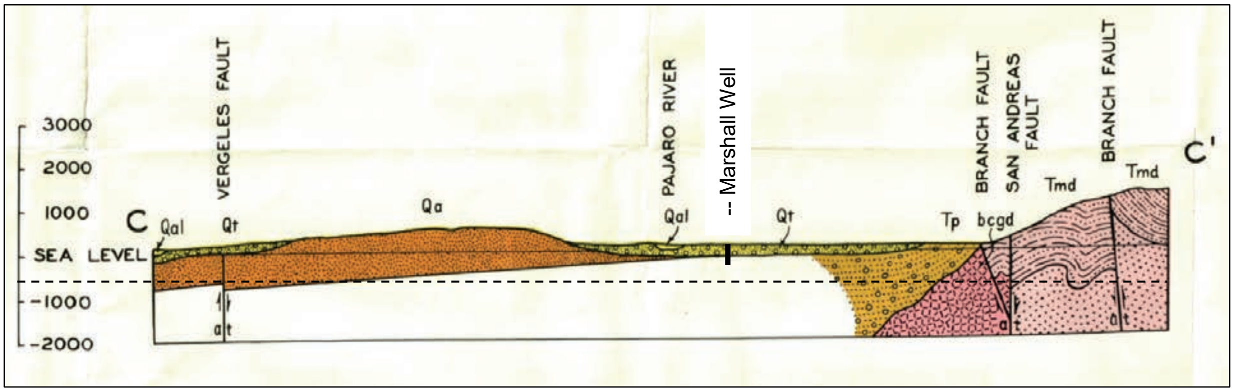
HYDROGEOLOGIC REVIEW:

Hydrogeologic Literature Review – The Aromas area is located in the southeastern portion of the Pajaro Groundwater Basin. The Pajaro Groundwater Basin has been the focus of numerous hydrogeologic investigations. Most useful for purposes of this TM is the work performed by the State of California Water Resources Board (Bulletin 5, 1953) and the more recent work performed by the United States Geological Survey (Survey) in developing the Pajaro Valley Integrated Hydraulic Model (PVIHM). Also useful is the work performed by Luhdorff and Scalimanini (1987)

All of these investigators describe the Aromas area to be underlain by a thick sequence of sedimentary materials. From the surface to depth, these materials include surficial alluvial deposits, underlain by terrace deposits (locally described as Aromas Formation), underlain by the Purisima Formation. The Purisima Formation is a thick sequence of clay/siltstone units interbedded with fine-grained sandstone units. When perforated in the sandstone units the formation can yield significant water to wells. At depth, the Purisima Formation is believed to overlie granitic bedrock.

The work performed by the State in 1953 (Bulletin 5) provides a relevant cross-section which is helpful. The cross-section is presented below as Figure 3 with the Marshall Well added for reference. The cross-section line is shown on Figure 4. This cross-section shows the sequence of materials underlying the site with the Marshall Well extending into the Purisima Formation.

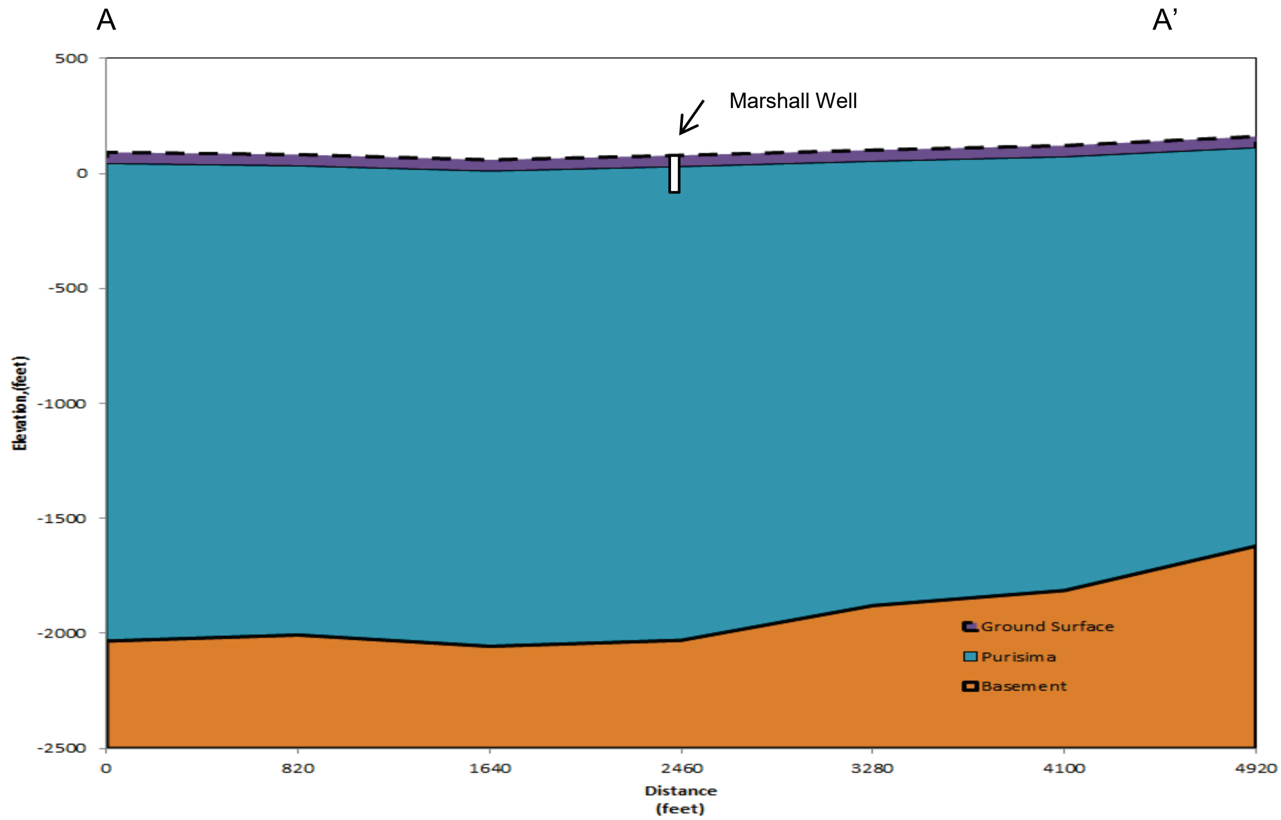
Figure 3 - Cross-Section (from Bulletin 5)

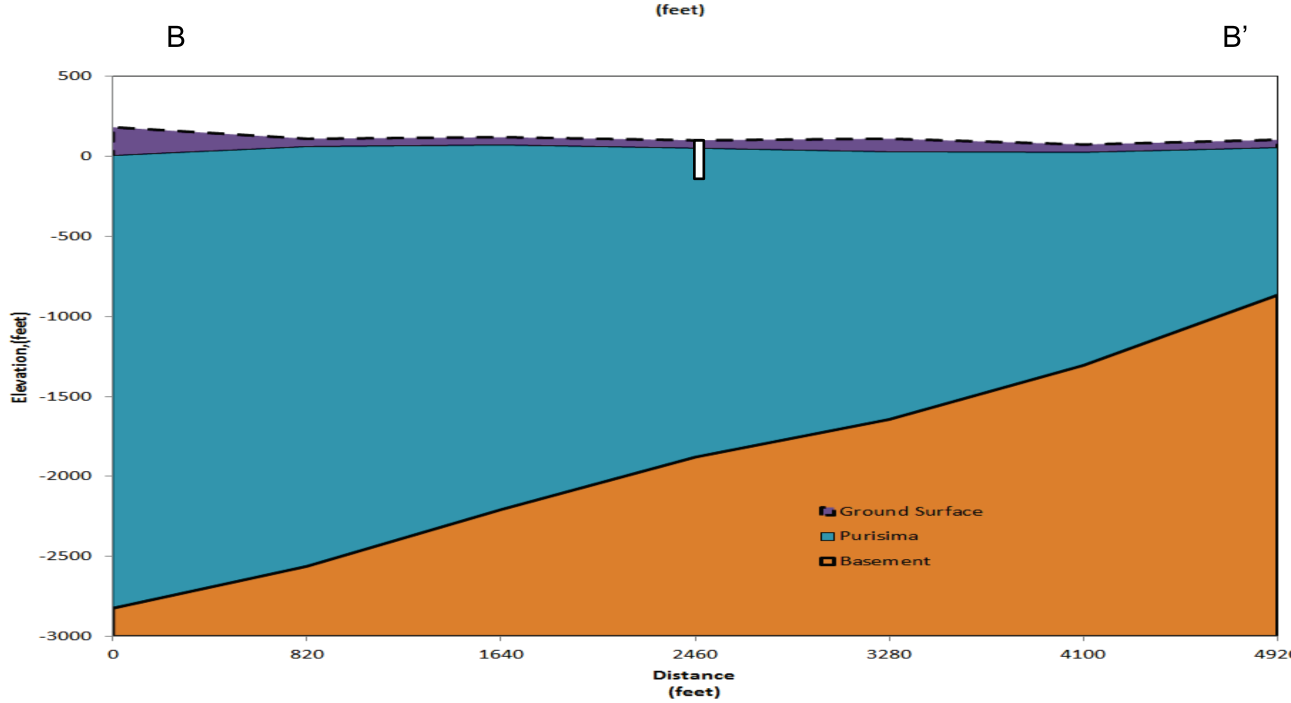


The cross-section shown as Figure 3 does not provide much detail regarding the vertical extent of the Purisima Formation and is of quite a large scale. A more detailed understanding of the site-specific hydrogeology can be derived from the recently developed groundwater model of the Pajaro Groundwater Basin. As part of the development of the model, the 3-D distribution of the various aquifer units was developed. This was accomplished by reviewing all the available well log data, determining the tops and bottoms of each aquifer unit and developing surfaces of the top and bottom of each aquifer unit at every location with the model area. This work was performed by both USGS staff and professional geologists working at the Pajaro Valley Water Management Agency and represents the most detailed understanding of the hydrostratigraphy available.

Data extracted from layering of the groundwater model allows development of more focused cross-sections that trend through the Marshall Well site. These are presented below and the cross-section lines are also shown on Figure 4. Again, the existing Marshall Well has been added for reference.

Figure 4 - Cross-Section Lines



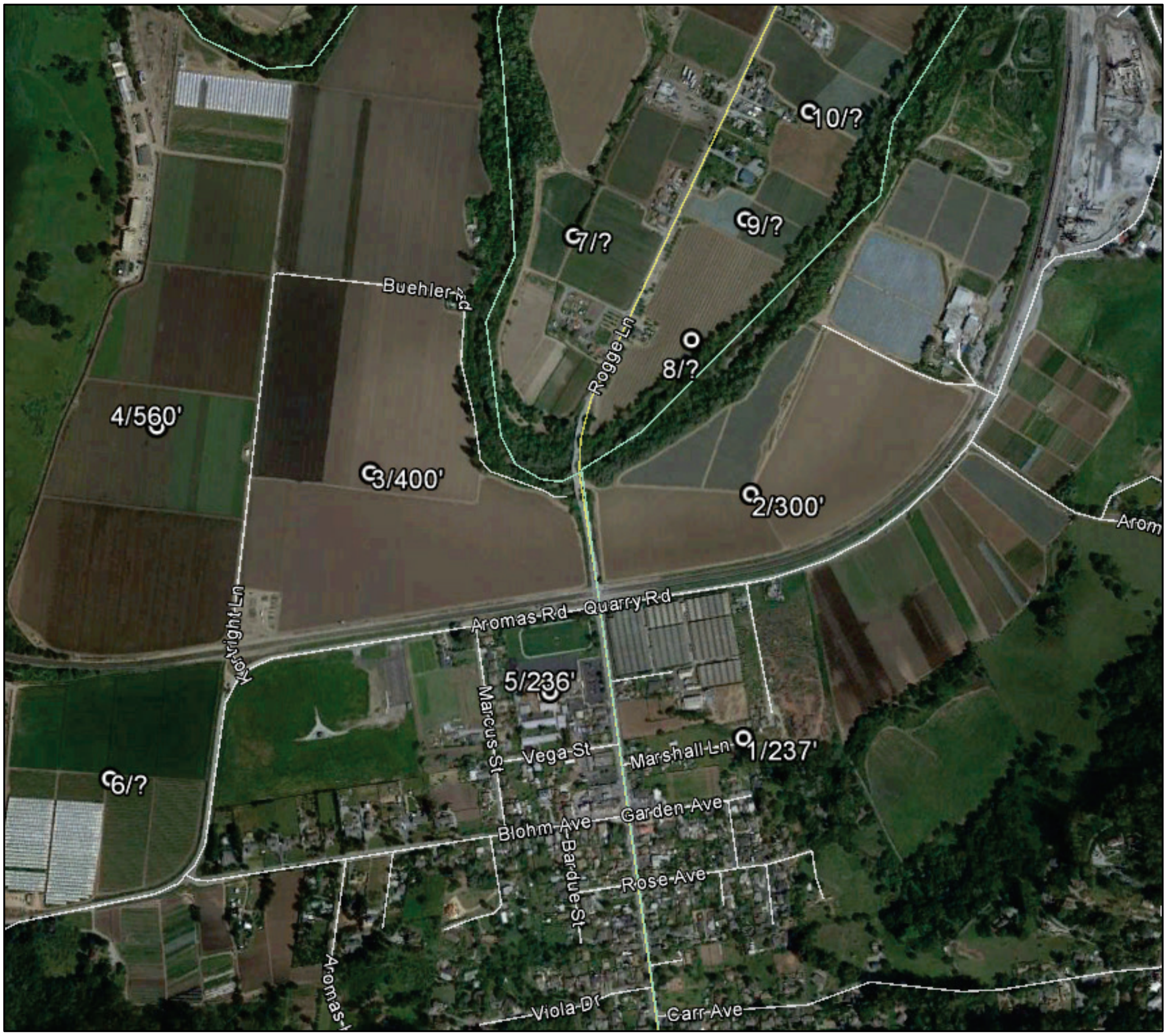


From Pajaro Valley Integrated Hydrologic Model (PVIHM)

Inventory of Proximate Wells- Review of the geologic literature and the cross-sections presented above suggest that below the thin surficial deposits at least 2000 feet of Purisima Formation underlay the subject site. Not all strata within the Purisima Formation are sufficiently productive to merit the development of a municipal well. The Purisima Formation is used as a primary aquifer by the Soquel Creek Water District. In the Pajaro Basin, its use is more limited because there is a significant thickness of highly productive Aromas Sand deposits overlying it in most parts of the basin. The largest concentration of use of the Purisima Formation in the Pajaro Basin is in the foothills and area proximate to the Aromas area.

Figure 5 presents the location of wells proximate to the Marshall Well site known to the PVWMA. Available information on each well is presented in Table 2. Information on the wells is limited – the PVWMA does not have drillers' logs on file for more than half of the wells.

Figure 5 - Proximate Wells



1/237' = Map Number/Well Depth in feet

Table 2 - Summary of Proximate Wells

Map Number	Name	Year Drilled	Borehole Depth (feet, bgs)	Well Depth (feet, bgs)	Perforations (feet, bgs)	Discharge Rate (gpm)	Producing Aquifer
1	Marshall Well	1954	237	237	219-237	200?	Purisima
2	Granite Rock	1992	520	300	60-300	3500	Purisima
3	Driscoll	1983/2006*	500	400	200-390	2200	Purisima
4	Driscoll	1996	715	560	220-560	3020	Purisima
5	Aromas School	1952	236	236	170-230	700	Purisima
6							
7				No Data			
8							
9							
10							

*liner installed

Although limited, several things can be inferred from these data. Firstly, high capacity wells have been successfully drilled and operated producing water from the Purisima Formation. Secondly, several proximate wells have attempted to go more than 500 feet into the Pursima Formation; however, most were completed as a shallower well implying that materials encountered below 500 feet were deemed not suitable to perforate. Thirdly, there may be better materials available at greater depth in the Purisima Formation. At other locations, there are subunits of clay/siltstone in the Purisima Formation that are as much as 300 feet in thickness, underlain by a sandstone unit. Deeper exploration may be worthwhile.

Water Quality – Whereas there are sufficient data to confirm that a high-capacity well completed in the Purisima Formation is probable, there are limited data to characterize probable water quality. Although the PVWMA collects water quality data from several nearby wells, these data are treated as confidential and site-specific data are not available. However, in discussions with the Agency, the water quality in the Purisima Formation in this portion of the basin can be generally characterized as fair. Water typically has chloride ion levels around 120 mg/l, sulfate ions at around 150 mg/l and TDS of about 900 mg/l. The Agency's analytical program does not include analysis for iron or manganese. However, at most locations where the Purisima Formation is used for municipal supply, iron and manganese removal is required.

Well Construction Costs – Data from proximate wells suggest that a 500-foot deep well into the Pursima Formation at the site may be successful; however, it can be assumed that treatment for iron and manganese will be required. Drilling a municipal quality well in a developed area has significant logistical challenges which add to overall construction costs. The most challenging is the legal disposal of drill cuttings, development water and test pumping water. All of these activities must be permitted with the Regional Water Quality Control Board and monitored. Allowing for the cost of these logistical issues and assuming a 500-foot deep, stainless steel 12-inch diameter well construction costs are estimated at $500,000. This estimate is solely for well construction costs, equipping the well would be in addition. It is possible that, after the test hole program, there may be a motivation to construct well to a greater depth, however, given the logistical challenges discussed above, the overall cost of constructing, testing and equipping a well is not very sensitive to increased depth.

CONCLUSIONS

- The quality of water produced from the Marshall Well is of poor quality. Historical data were confirmed with recent sampling. The Marshall Well produces from the upper portion of the Purisima Formation. The reason for the poor quality is unknown.
- Treatment of the water from the existing Marshall Well to drinking water standards would be expensive. Reducing TDS, hardness , iron and manganese to below drinking water standards would likely require a lime softening treatment facility. Cost for such a facility to treat a flow of 500 gpm is estimated at more than $1,000,000.
- Although no structural problems were found with the well, the well is more than 60 years old and significantly past the expected service life for a well built of mild steel casing. Should treatment of the water be considered cost-effective, the existing well would need to be replaced to justify the capital improvements associated with the treatment system
- The existing well meets the legal definition of an "abandoned" well. If the District does not have plans to use the well, the well should be formally destroyed to prevent aquifer contamination. Destruction of the well will entail ripping the casing and pumping the well full of concrete. Cost to destroy the well, including permitting, is estimated at $5,000.
- Although unexplored to any significant depth in the area, available data suggests significant thickness of the Purisima Formation underlying the site. Multiple successful wells have been drilled to depths of approximately 500 feet proximate to the site and these wells are reportedly high producers. The existing well could be replaced with a well designed to produce from the deeper portions of the Purisima Formation.
- There are limited producing wells in the Purisima Formation in Pajaro Basin, so water quality data are sparse. Available water quality data suggest that the water is relatively good, meeting primary drinking water standards for all constituents. However, wells completed in the Purisima Formation typically need treatment to remove iron and manganese to meet secondary drinking water standards. Any plan to move forward with a new supply well in the Purisima Formation should include a consideration for iron and manganese treatment.
- Cost for a new well at the site of modern design completed to a depth of 500 feet is estimated at $500,000. Equipping the well and allowing for iron and manganese treatment overall project cost is estimated at $1.2M.

RECOMMENDATIONS

- To fully understand the potential of the subject site for a water supply well, a test well will be necessary. The most important question to be answered is what would be the water quality of a new, deeper well at the site and the type of treatment that will be necessary. The test well should be a 6-inch diameter well to depth of approximately 1000 feet. The well should be lithologically and geophysically logged. Test well should have screens placed in all water-bearing zones below 300 feet with blank casing between the screened intervals. Bentonite pellets should be placed in the gravel pack behind the blank casing to allow discrete water quality sampling of the isolated zones. For budgetary purposes it can be estimated that this effort would cost $200,000 inclusive of drilling and consulting.
- A variant to the above recommendation would be to move ahead with the construction of a new deeper well designed for municipal use. This would avoid the cost of the test well, but would entail the risk of developing a well with water quality that is difficult or costly to treat to drinking water standards.

- Limited data are available on many of the proximate wells to the project site. It can be inferred from their locations that they are completed and produce from the Purisima Formation. It can also be inferred from their use supporting agricultural operations that most of these wells produce significant amounts of water. What cannot be inferred is the quality of the water produced from these wells. It is recommended that the District coordinate with adjacent well owners to collect and analyze water samples from some of these wells. These data will be essential in estimating the water quality from a deeper well into the Purisima Formation at the site.

REFERENCES

California State Water Resources Board,, 1953 Santa Cruz–Monterey Counties Investigation: California State Water Resources Board, Bulletin No. 5, 230 p.

Hansen, R. T. et al, 2014, Integrated Hydrologic Model of Pajaro Valley, Santa Cruz and Monterey Counties, California: US Geological Survey Scientific Investigations Report 2014-5111

Luhdorff and Scalmanini (LSCE), 1987, Pajaro Valley ground-water investigations—Phase I: Consultants report to Pajaro Valley Water Management Agency by January 1987 [variously paged] 33 p.

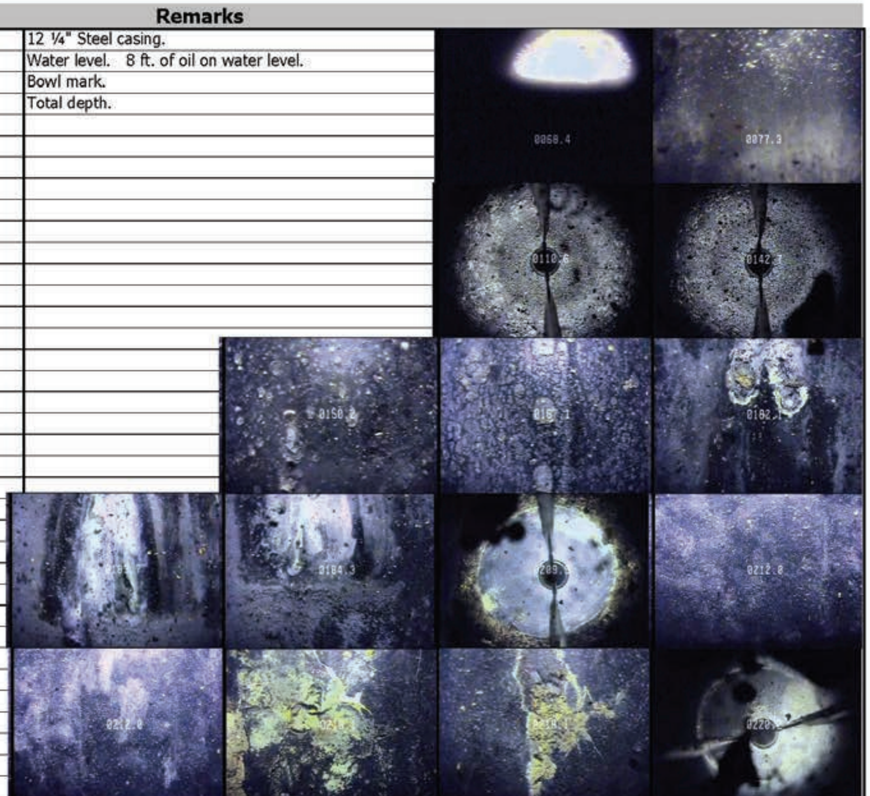
ATTACHMENTS

Newman Well Surveys

Video Survey Report

Company:	Martin Feeney	**Date:**	12-Jan-16
Well:	Marshall Well	**Run No.**	One
Field:	Aromas	**Job Ticket:**	73607
State:	California	**Total Depth:**	221.0 ft
		Water Level:	77.3 ft
Location:	Marshall Ln.	**Elevation:**	114.0 ft
			36° 53' 23.89" N 121° 38' 26.48" W
Zero Datum:	Top of casing	**Tool Zero:**	Side view lens (Add 1.5 ft. to downward view)
Reason for Survey:	General Inspection		

Depth	Remarks
0.0 ft	12 ¼" Steel casing.
77.3 ft	Water level. 8 ft. of oil on water level.
184.0 ft	Bowl mark.
221.0 ft	Total depth.



Notes: Moderate scale throughout well. No perforations were visible. 8 ft. of oil on water level.

Monterey Bay Analytical Services

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P.O. Box 30020
Santa Barbara, Ca 93130

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ELAP Certification Number: 2385

Monday, May 23, 2016

Lab Number: AB47178

Collection Date/Time:	5/12/2016	10:00	Sample Collector:	FEENEY M	Client Sample #:
Submittal Date/Time:	5/12/2016	12:30	Sample ID		Coliform Designation:

Sample Description: Marshall Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Aggressivity Index	Calculation		**12.6**				5/20/2016	MW
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**458**		10		5/13/2016	BS
Aluminum, Total	EPA200.8	µg/L	**16**		10	1000	5/18/2016	SM
Antimony, Total	EPA200.8	µg/L	**Not Detected**		1.0	6	5/18/2016	SM
Arsenic, Total	EPA200.8	µg/L	**3**		1	10	5/18/2016	SM
Barium, Total	EPA200.8	µg/L	**83**		10	1000	5/18/2016	SM
Beryllium, Total	EPA200.8	µg/L	**Not Detected**		1	4	5/18/2016	SM
Bicarbonate (as HCO3-)	SM2320B	mg/L	**559**		10		5/16/2016	LRH
Bromide	EPA300.0	mg/L	**0.5**		0.1		5/12/2016	HM
Cadmium, Total	EPA200.8	µg/L	**Not Detected**		0.5	5	5/18/2016	SM
Calcium	EPA200.7	mg/L	**136**		0.5		5/19/2016	MW
Carbonate as CaCO3	SM2320B	mg/L	**Not Detected**		10		5/16/2016	LRH
Chloride	EPA300.0	mg/L	**126**		1	250	5/12/2016	HM
Chromium, Total	EPA200.8	µg/L	**27**		2	50	5/18/2016	SM
Color, Apparent (Unfiltered)	SM2120B	Color Units	**6**		3	15	5/13/2016	LRH
Copper, Total	EPA200.8	µg/L	**9**		4	1300	5/18/2016	SM
Cyanide	QuikChem 10-204	µg/L	**Not Detected**		5	200	5/16/2016	LRH
Fluoride	EPA300.0	mg/L	**0.2**		0.1	2.0	5/12/2016	HM
Hardness (as CaCO3)	SM2340B/Calc	mg/L	**723**		10		5/20/2016	MW
Hydroxide	SM2320B	mg/L	**Not Detected**		10		5/16/2016	LRH
Iron	EPA200.7	µg/L	**471**		10	300	5/19/2016	MW
Langlier Index, 15°C	SM2330B		**0.57**				5/20/2016	MW
Langlier Index, 60°C	SM2330B		**1.15**				5/20/2016	MW
Lead, Total	EPA200.8	µg/L	**5**		5	15	5/18/2016	SM
Magnesium	EPA200.7	mg/L	**93**		0.5		5/19/2016	MW
Manganese, Total	EPA200.7	µg/L	**2470**		10	50	5/19/2016	MW
MBAS (Surfactants)	SM5540C	mg/L	**Not Detected**		0.05	0.50	5/13/2016	HM
Mercury, Total	EPA200.8	µg/L	**Not Detected**		0.5	2	5/18/2016	SM
Nickel, Total	EPA200.8	µg/L	**Not Detected**		10	100	5/18/2016	SM
Nitrate as NO3	EPA300.0	mg/L	**Not Detected**		1	45	5/12/2016	HM
Nitrate as NO3-N	EPA300.0	mg/L	**0.1**		0.1	10	5/12/2016	HM

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD T = Temperature Exceedance

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Santa Barbara, Ca 93130

Monday, May 23, 2016

Lab Number: AB47178

Collection Date/Time:	5/12/2016 10:00	Sample Collector:	FEENEY M	Client Sample #:	
Submittal Date/Time:	5/12/2016 12:30	Sample ID		Coliform Designation:	

Sample Description: Marshall Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst
Nitrate+Nitrite as N	EPA300.0	mg/L	**0.6**		0.1		5/12/2016	HM
Nitrite as NO2-N	EPA300.0	mg/L	**0.5**		0.1	1.0	5/12/2016	HM
Odor Threshold at 60 C	SM2150B	TON	**2**	H	1	3	5/13/2016	MP
o-Phosphate-P, Dissolved	EPA300.0	mg/L	**Not Detected**		0.1		5/12/2016	HM
pH (Laboratory)	SM4500-H+B	pH (H)	**7.4**		0.1		5/12/2016	MP
Potassium	EPA200.7	mg/L	**2.1**		0.5		5/19/2016	MW
QC Anion Sum x 100	Calculation	%	**117%**				5/16/2016	LRH
QC Anion-Cation Balance	Calculation	%	**1**				5/20/2016	MW
QC Cation Sum x 100	Calculation	%	**119%**				5/20/2016	MW
QC Ratio TDS/SEC	Calculation		**0.68**				5/19/2016	MP
Selenium, Total	EPA200.8	µg/L	**3**	LM	2	50	5/18/2016	SM
Silver, Total	EPA200.8	µg/L	**Not Detected**		10	100	5/18/2016	SM
Sodium	EPA200.7	mg/L	**149**		0.5		5/19/2016	MW
Specific Conductance (E.C)	SM2510B	µmhos/cm	**1767**		1	900	5/12/2016	LJ
Sulfate	EPA300.0	mg/L	**386**		1	250	5/12/2016	HM
Thallium, Total	EPA200.8	µg/L	**Not Detected**		1.0	2	5/18/2016	SM
Total Diss. Solids	SM2540C	mg/L	**1197**		10	500	5/17/2016	MP
Turbidity	EPA180.1	NTU	**2.0**		0.05	5.0	5/13/2016	BS
Zinc	EPA200.7	µg/L	**16**		10		5/19/2016	MW

Sample Comments: Odor:oil; LM: MS and/or MSD above acceptance limits.

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD T = Temperature Exceedance

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Monday, May 23, 2016

Lab Number: AB47179

Collection Date/Time:	5/12/2016 11:00	Sample Collector:	FEENEY M	Client Sample #:	
Submittal Date/Time:	5/12/2016 12:30	Sample ID		Coliform Designation:	

Sample Description: Marshall Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst
Iron	EPA200.7	µg/L	**1932**		10	300	5/19/2016	MW
Manganese, Total	EPA200.7	µg/L	**2650**		10	50	5/19/2016	MW
Specific Conductance (E.C)	SM2510B	µmhos/cm	**1770**		1	900	5/12/2016	LJ

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD T = Temperature Exceedance

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Monday, May 23, 2016

Lab Number: AB47180

Collection Date/Time:	5/12/2016	8:30	Sample Collector:	FEENEY M	Client Sample #:	
Submittal Date/Time:	5/12/2016	12:30	Sample ID		Coliform Designation:	

Sample Description: Marshall Well

Analyte	Method	Unit	Result	Qual	PQL	MCL	Date Analyzed	Analyst:
Iron	EPA200.7	µg/L	**17449**		10	300	5/19/2016	MW
Manganese, Total	EPA200.7	µg/L	**3220**		10	50	5/19/2016	MW
Specific Conductance (E.C)	SM2510B	µmhos/cm	**1773**		1	900	5/12/2016	LJ

Sample Comments:

Report Approved by:

David Holland, Laboratory Director

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD T = Temperature Exceedance

Attachment B: Evaluation of Improvements to Ballantree Zone Distribution System

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Technical Memorandum

REGISTERED PROFESSIONAL ENGINEER
NICHOLAS E. PANOFSKY
C75006
Exp. 12-31-2023
CIVIL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
TYLER N. HUNT
C74580
Exp. 12-31-2023
CIVIL
STATE OF CALIFORNIA

To:	Robert Johnson, General Manager		
Prepared By:	Nick Panofsky, PE, QSD MNS Engineers	**Checked By:**	Tyler Hunt, PE, QSD MNS Engineers
Date:	February 15, 2022		
Project	Ballantree Zone Tanks Elimination Project		
Subject:	Evaluation of Improvements to Ballantree Zone Distribution System		

Acronyms

ADD	Average daily demand
ASL	Above sea level
CEC	California Electrical Code
Dba	Weighted decibels
District	Aromas Water District
FLA	Full load amps
GPD	Gallons per day
GPM	Gallons per minute
HP	Horsepower
KVA	Kilovolt amps
kW	Kilowatt(s)
MDC	Maximum daily consumption
MDD	Maximum daily demand
NEMA	National Electric Manufactures Association
NFF	Needed fire flow
OPC	Opinion of probable cost
PC	Production capacity
PG&E	Pacific Gas and Electric Company
PHD	Peak hourly demand
PSI	Pounds per square inch
PVC	Polyvinyl chloride
SDR	Standard dimension ratio
SSR	Storage supply required
VFD	Variable frequency drive

Objective

The objective of this Technical Memorandum is to describe and evaluate alternative methods for enhancing water supply availability to the Ballantree pressure zone, a part of the District's potable water distribution system.

Background

The District provides potable water service to customers in eight pressure zones:

- Carr Zone: Elevation 729'
- Cole Zone: Elevation 631'
- Rancho Larios Zone: Elevation 627'
- Rea Zone: Elevation 537'
- Pine Tree Zone: Elevation 420'
- Leo Lane Zone: Elevation 500'
- Oakridge Zone: Elevation 716'
- Ballantree Zone: Elevation 506'

A map showing the District's potable water pressure zones is included as Figure 1.

The Ballantree zone is supplied by two pumps, each with a rated capacity of 50 GPM. Potable water storage in the Ballantree zone is limited to two tanks, each with a capacity of 15,000 gallons. The District would like to improve reliability for this zone under normal and high demand conditions.

Existing System

A site visit was completed on January 27, 2022 to document the location and status of select District storage and pumping facilities. This section provides a description of the existing Ballantree zone including piping, tanks, pressure ranges, service demands, and fire flow demand.

The Ballantree zone directly serves approximately 75 residential customers via a 3.5 mile long 6" diameter pipeline. The pipeline is Class 200 SDR 14 PVC material with a maximum rated working pressure of 200 PSI. The pipeline is located within San Juan Road, Marylin Lane, and Ballantree Lane, beginning at the Ballantree Booster Pump Station at 2584 San Juan Road and terminating at the Ballantree Storage Tanks. The Ballantree Storage Tanks are located on a hillside at the end of Ballantree Lane. The tank locations are shown on Figure 1. A photo of the Ballantree Storage Tanks is provided as Photo 1, one tank is mostly obscured behind the other in the photo. A hydraulic profile of the existing distribution system is included as Figure 2.


Photo 1 – Existing Ballantree Storage Tanks

The tanks are located on private property and within a dedicated easement for water service infrastructure, no information on the existing easement was available at the time of preparation of this document. The tanks are undersized for the application. Maintenance for the tanks is difficult due to the limited access. Access consists of an unpaved maintenance road that extends approximately 1,000 feet from a private paved driveway to the tank site. The road is located within a wooded canyon, is generally not maintained, and is impassable during rain events.

Water is supplied to the zone by a connection to the Pine Tree Tank zone which is the backbone of the District's water distribution system. Water is transferred between zones at the Ballantree Booster Pump Station, which includes two 10 HP pumps.

The Oakridge zone is supplied from the Ballantree zone. The connection to the Oakridge zone is made at Dunbarton Road. From this connection, water is conveyed through a 6" diameter PVC pipeline to the Oakridge Booster Pump Station, which increases the pressure and serves the Oakridge zone via two 10 HP pumps. The Oakridge Booster Pump Station and pumps are shown in Photo 2 and Photo 3 respectively.

Photo 2 – Oakridge Pump Station

Photo 3 – Oakridge Booster Pumps

The Oakridge zone includes a single, 100,000 gallon storage tank, located at the end of the zone's pipeline network. A pair of 2 HP pumps are used to service customers located at the higher elevations of the zone. The system does not currently have the ability to automatically transfer water from the Oakridge Zone to the Ballantree Zone.

A summary of the operating pressures, demands, target fire flows, and storage capacities for the Ballantree and Oakridge zones are provided in Table 1.

Table 1: Ballantree and Oakridge System Data

Zone	Pressures (PSI)	Average Daily Demand (GPD)	Maximum Daily Demand (GPD)	Fire Flow (GPM)	Existing Storage Capacity (Gallons)
Ballantree	75-170	10,000	16,000	1,000 for 2 hours	30,000
Oakridge	75-170	8,000	14,000	500 for 2 hours	100,000

Currently, both zones have sufficient capacity to serve existing demands under normal operating conditions; however, the infrastructure is insufficient to supply fire service flows or to serve the Ballantree zone under high flow conditions or a prolonged power outage.

Water Storage

Various criteria are considered for water storage, including storage volume, water quality, and storage tank appurtenances. These criteria are detailed in the following sections.

Water Storage Volume

The minimum recommended storage volume for the Ballantree zone is determined by the following equation:

SSR = NFF + MDC – PC

Where:
SSR = Storage Supply Required (gallons)
NFF = Needed Fire Flow (120,000 gallons, 1,000 gpm for 2 hours)
MDC = Maximum Daily Consumption (30,000 gallons)
PC = Production Capacity (6,000 gallons = 50 GPM for 2 hours)

Based on this calculation, a minimum storage volume of 150,000 gallons is recommended.

Stored Water Quality

As water resides in a storage tank, chlorine residuals decay. If chlorine residuals drop sufficiently, water quality issues can develop. Storage times and chlorine residuals should be considered as part of the detailed design process. Maintaining a reduced quantity of stored water during low demand and low fire risk periods may be appropriate.

Emergency Power

The Ballantree Pump Station is the only source of water for the Ballantree and Oakridge zones. Currently there is no emergency power supply for the Ballantree Booster Pump Station. In the event of an electrical power outage, the pump station is unable to supply water to the zones. The current storage capacity of 30,000 gallons in the Ballantree zone is only adequate to supply water to the zone temporarily but is not adequate for extended outages more than 24 hours. The Oakridge zone has a higher storage capacity but is still limited and cannot be resupplied without back-up power. A fire demand occurring in these zones during a power outage could result in a loss of supply. Adding a back-up generator at this site is recommended to enhance water supply reliability.

MNS retained the services of Fehr Engineering, Inc. to conduct a site visit and develop a conceptual plan for installing a back-up generator at the Ballantree Booster Pump Station site. Background information and conceptual design is provided in the following sections.

Electrical Background Information

The Ballantree Booster Pump Station is served by an underground PG&E 400-amp, 480-volt, 3-phase, 4-wire rated service. The existing transformer is pole mounted and adjacent to the property near San Juan Road. The existing main service switch board is relatively new and is in good condition. The main electrical switch board enclosure is a NEMA 1 rated (i.e. indoor rated). This facility was constructed to include an automatic transfer switch (also NEMA 1 rated) in anticipation of installation of a future generator. The automatic transfer switch is sized and installed to support a full-sized generator that is, a 400-amp, 3-phase, 3-wire feeder from a generator feeding the entire load. The main electrical switch board and the automatic transfer switch are housed in a weatherproof lean-to attached to the main pump house.

The existing load connected to this service is as follows:

- Submersible well pump at 480-volts, 3-phase, 219 FLA, rated at 150 HP.
- Pump in treatment plant at 480-volts, 3-phase, 21 FLA, rated at 15 HP (Ref. CEC Table 430.250).
- Pump in treatment plant at 480-volts, 3-phase, 14 FLA, rated at 10 HP (Ref. CEC Table 430.250).
- Pump in treatment plant at 480-volts, 3-phase, 14 FLA, rated at 10 HP (Ref. CEC Table 430.250).
- Pump in treatment plant at 480-volts, 3-phase, 7.6 FLA, rated at 5 HP (Ref. CEC Table 430.250).
- Panel X1 fed from 25 KVA single phase transformer estimated load at 20 KVA or 42-amps at 480-volts single phase.
- Miscellaneous loads (lights, plugs, controls) estimated at 5 KVA.

The total estimated connected load is 254.3 KVA or 306-amps at 480-volts, 3-phase. A conservative 90% demand applied to this service would require that a generator be sized to support a 229 KVA load with a load starting capacity of 619 KVA. The starting capacity assumes that the entire load is running while starting the largest motor using the VFD as a starting aid.

Recommended Electrical Improvements

The minimum recommended standby emergency generator to operate this facility under the load conditions noted is a 250 KW generator. The recommended generator is diesel fuel powered with a base mounted fuel tank sized to run the generator at full load for 24 hours without refuel. The generator would be specified with a steel weatherproof level 2 sound enclosure, limiting sound output in the 75 dbA range. This level of sound enclosure is the highest standard rating available for the recommended generator; if a greater sound suppression level is required, a custom-built enclosure is available. The footprint of the recommended generator is 173” L X 54” W X 118” H and would be installed on an estimated 12” thick concrete pad. Working clearance around the generator would be a minimum of 48” all around. A minimum area of 13’ X 23’ would be necessary to install the recommended generator.

Starting controls for the generator could be designed to start the generator immediately upon loss of power and run continuously until power is restored, or only when there is a loss of power and there is a call for operating the pump station. The latter control scheme is intended to only start the generator as necessary for pumping operations as opposed to starting upon loss of utility power alone. This would require battery back-up systems for on-site controls. Other control parameters could be implemented if deemed appropriate and would be considered based upon the District’s needs.

During our site visit it was observed that access to the main switch board is blocked by a building structural member (a 4” X 4” post supporting the doorway header). This is a CEC violation. CEC Art. 110.26 calls for clear working space in front of the electrical equipment. As part of improvements to this facility we recommend that CEC violations be mitigated to maintain safety around the electrical equipment.

Description of Alternatives

This section describes identified alternatives available to enhance water supply availability and reliability for the Ballantree zone. All options include the addition of a back-up generator at the Ballantree Booster Pump Station.

Alternative 1 - Modifications to the Ballantree Booster Pump Station

This alternative includes upgrades and modifications to the Ballantree Booster Pump Station to improve water supply availability and eliminate the Ballantree tanks. This would require the existing pumps be equipped with variable frequency drives to operate individually or simultaneously. Under normal conditions, the existing pumps would ramp up or down as needed to maintain zone pressure. A new hydropneumatic tank at the Ballantree pump station site would assist in regulating system pressure and allow the existing pumps to turn off periodically during low flow conditions. A new higher flow pump would be added to increase water supply availability during high demand conditions. In concept, these improvements would allow the Ballantree tanks to be eliminated from the system.

Alternative 2A – Addition of Storage with Increased Capacity

This alternative includes replacement of the existing Ballantree tanks with new tanks at the current location or an adjacent site. Two tanks, each with a volume of 75,000 gallons, for a total storage volume of 150,000 gallons are recommended for this alternative.

The access road to the existing tank site would need to be improved to provide reliable access to the site. Improvements would include grading the road, addition of drainage v-ditches on either side of the road to reduce surface erosion, and aggregate road surfacing.

A new easement for siting the tanks and road extension would likely be required to allow the existing tanks to remain in service during construction of the new facilities.

Alternative 2B – Addition of Storage with Increased Capacity and Modification to the Oakridge Booster Pump Station

This alternative is substantially similar to Alternative 2A, with the addition of a pressure reducing valve at the Oakridge Booster Pump Station. A pressure reducing valve, such as a Cla-Val 90-01, would be installed between the suction and discharge piping at the Oakridge Booster Pump Station. When a gate valve is opened, the pressure reducing valve would continuously monitor pressure in the Ballantree zone. If the pressure in the Ballantree zone drops below a set point, the pressure reducing valve will open and allow water from the Oakridge tank to flow into the Ballantree zone, allowing water stored in the 100,000 gallon Oakridge tank to back feed during a high demand condition or pump failure. Gate valves would be provided upstream and downstream of the connection to the pressure reducing valve to allow for valve isolation and maintenance.

The benefit of this connection is that it reduces the storage volume required for the Ballantree zone by effectively combining storage for the Ballantree and Oakridge Zones. A single 100,000 gallon tank would be recommended at the existing Ballantree tank site to meet the storage requirement.

Alternative 3A – Combination with the Rea Zone

This alternative consists of combining the Ballantree zone with the Rea zone. This new zone would be the Rea-Ballantree zone. This connection would allow the new zone to access water stored in both the Ballantree tanks and the 214,000 gallon Rea tank. The zone interconnection would occur at the San Juan Road and Ballantree Booster Pump Station Site.

The Rea tank has a bottom elevation of 511 feet ASL, while the existing Ballantree tanks have a bottom elevation of approximately 482 feet ASL. The alternative would require a new tank be installed with bottom elevation and full elevation matching the Rea Tank. A single tank with a volume of 150,000 gallons is recommended to replace the existing Ballantree tanks. The new storage tank would be constructed just uphill from the existing storage tank site and will require a retaining wall with a height of approximately 15-feet to retain soil surrounding the tank. Pressures in the Ballantree zone would increase by approximately 12 PSI, which has a slight potential to negatively impact existing customers. The need for pressure reducing valves on individual service connections should be evaluated during detailed design.

The access road to the existing Ballantree tank site would need to be improved to provide reliable access to the site. Improvements would include grading the road, addition of drainage v-ditches on the uphill side of the road with regularly spaced culverts to convey stormwater away from the road, aggregate road surfacing, and extension of the road to the new storage tank site.

A new easement for siting the proposed tank would be required to allow the existing tanks to remain in service during construction of the new facilities.

Combining the Rea zone and Ballantree zones without a storage tank in the Ballantree area was not considered, as the long distance from the Rea tank to the Ballantree area would severely limit flows under high demand conditions.

Alternative 3B – Combination with the Rea Zone and Modification to the Oakridge Booster Pump Station

This alternative is substantially similar to Alternative 3A, with the addition of a pressure reducing valve at the Oakridge Booster Pump Station. With this addition, the storage volume in the Ballantree tank can be reduced to 100,000 gallons. A pressure reducing valve, such as a Cla-Val 90-01, would be installed between the suction and discharge piping at the Oakridge Booster Pump Station. When a gate valve is opened, the pressure reducing valve would continuously monitor pressure in the Rea-Ballantree zone. If the pressure in the Rea-Ballantree zone drops below a set point, the pressure reducing valve will open and allow water from the Oakridge tank to flow into the Rea-Ballantree zone, allowing water stored in the 100,000 gallon Oakridge tank to back feed during a high demand condition or pump failure. Gate valves would be provided upstream and downstream of the connection to the pressure reducing valve to allow for valve isolation and for maintenance.

Alternatives Analysis

This section provides a discussion of each identified alternative.

Alternative 1 - Modifications to the Ballantree Booster Pump Station

During development of this alternative, a fatal flaw was identified which eliminates this alternative from consideration. The existing 6-inch PVC piping in the Ballantree zone has a maximum rated working pressure of 200 PSI. The static pressure in the Ballantree zone is approximately 170 psi. Adding a larger pump to the Ballantree Pump Station would increase pressures in the 6-inch PVC piping due to friction losses. The maximum flow which could be conveyed into the Ballantree zone from the from the Pine Tree Tank zone is estimated to be 300 gpm, which is insufficient to meet any fire demands. As a result, this alternative was not further evaluated.

Alternative 2A, 2B, 3A and 3B Comparison

Alternative 2A, 2B, 3A and 3B all include common elements, including new storage facilities at the Ballantree tank site and access improvements to the Ballantree Tank access road.

Alternatives 3A and 3B provide a substantial benefit over Alternatives 2A and 2B in that these alternatives improve available fire flow conditions throughout both the Rea and Ballantree zones. Providing flow from multiple reservoirs in different directions enhances available flows during a high demand event. Having multiple reservoirs in different locations to serve a single zone also provides operational redundancy for maintenance activities. Combining zones also results in redundant pump stations, which provides the District additional operational flexibility.

The addition of a pressure reducing valve at the Oakridge Booster Pump Station included in alternatives 2B and 3B is a relatively low cost strategy to provide operational redundancy to the system and is recommended.

As a result of this analysis, Alternative 3B is the recommended alternative. Additionally, Alternative 3B has a lower construction cost compared to Alternative 2A and 3A, and only a slightly higher construction cost than Alternative 2B for the zone intertie. A hydraulic profile of the system, showing these recommended improvements is provided as Figure 3.

Project Costs

A preliminary OPC estimate was developed for the recommended water system modifications. The OPC estimate and anticipated additional costs incurred by the project are provided in this section.

Opinion of Probable Construction Costs

A detailed OPC estimate was developed for the recommended alternative, Combination with the Rea Zone and Modification to the Oakridge Booster Pump Station. Detailed construction cost estimate is provided in Attachment B. The OPC estimate is $2,100,000. A construction cost contingency of 30 percent is included in the total project costs, as well as an annual escalation factor of 6% per year for a period of 2 years.

Total Project Costs

Additional costs will be incurred as part of the proposed improvements. Additional costs are estimated based on an assumed percentage of the construction cost and included in the total project costs; a total project cost for the recommended improvements is provided in Table 2.

Table 2: Total Project Costs

Item	Percent of Construction Cost	Project Cost
Project Construction	100%	$2,100,000
District Administration	3%	$63,000
Topographic and Boundary Survey	2%	$42,000
Geotechnical Engineering	2%	$42,000
Detailed Design	10%	$210,000
Permitting	2%	$42,000
Land/Easement Acquisition	4%	$84,000
Environmental Permitting	3%	$63,000
Construction Management	15%	$315,000
Total Project Cost		**$2,961,000**

Next Steps

The following next steps are recommended to advance the recommended project.

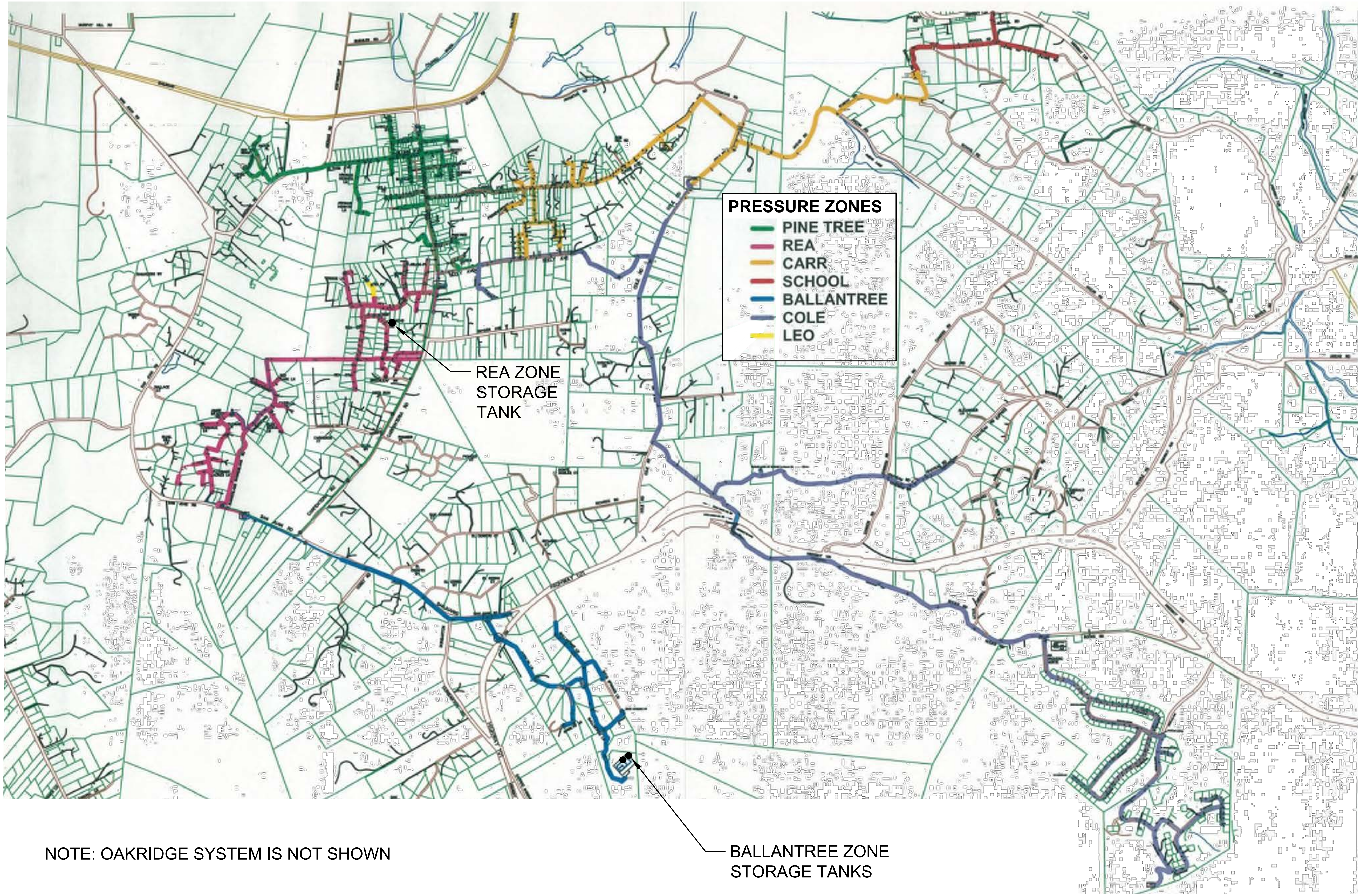
- Identify and acquire an easement adjacent to the existing Ballantree tank site suitable for construction of a new 100,000 gallon potable water storage tank
- Complete a topographic survey, boundary survey, and geotechnical investigation of the tank site to provide a basis for detailed design
- Complete required environmental compliance documents and obtain any required permits
- Develop detailed designs and contract documents for construction of the proposed improvements.
- Obtain project funding

Attachments

Attachment A – Figures

Attachment B – Opinion of Probable Construction Cost Estimate

Attachment A – Figures



NOT TO SCALE

NOTE: OAKRIDGE SYSTEM IS NOT SHOWN

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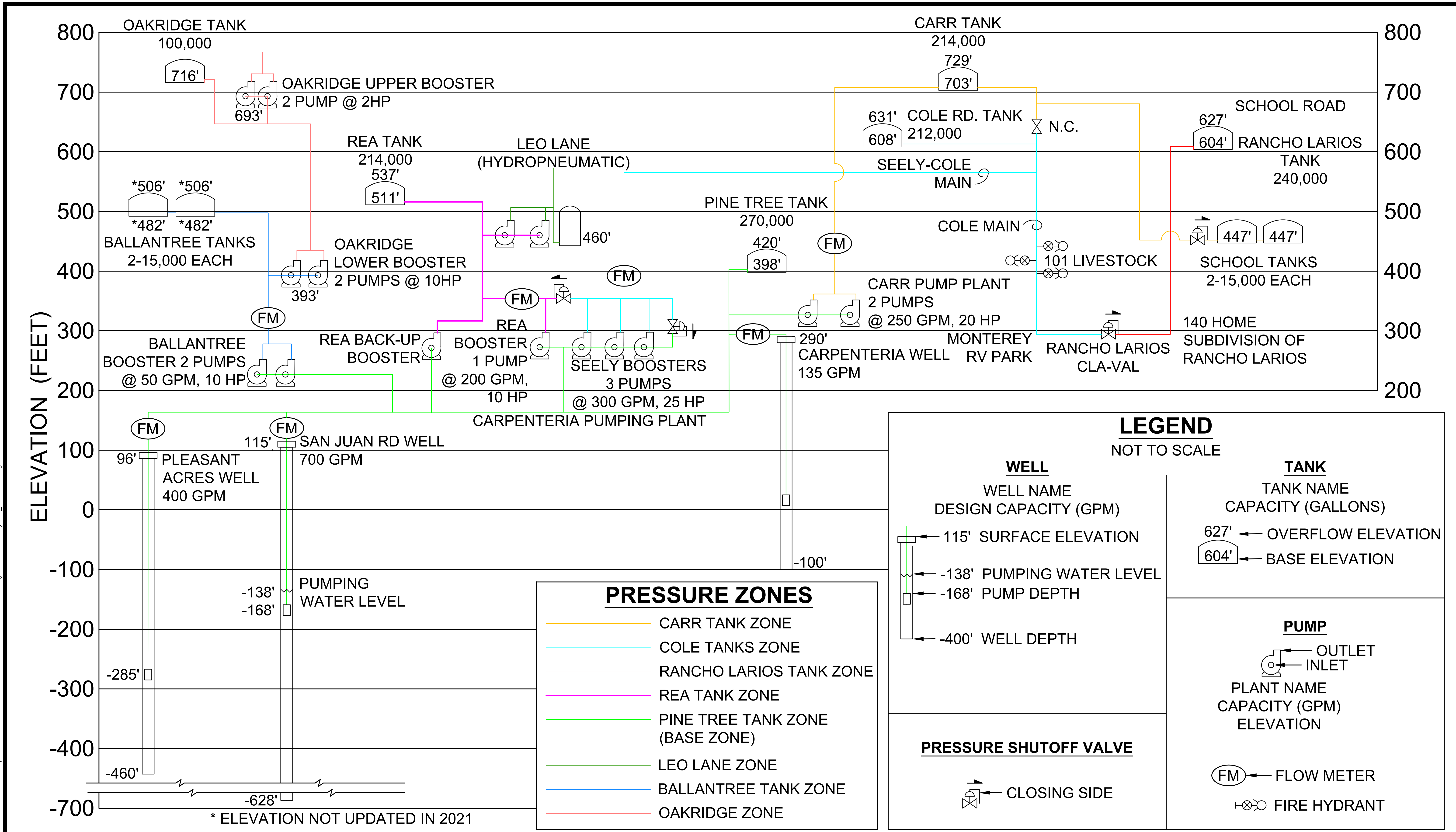
AROMAS WATER DISTRICT

AROMAS WATER DISTRICT PRESSURE ZONES

FIGURE
1

FEBRUARY 2022



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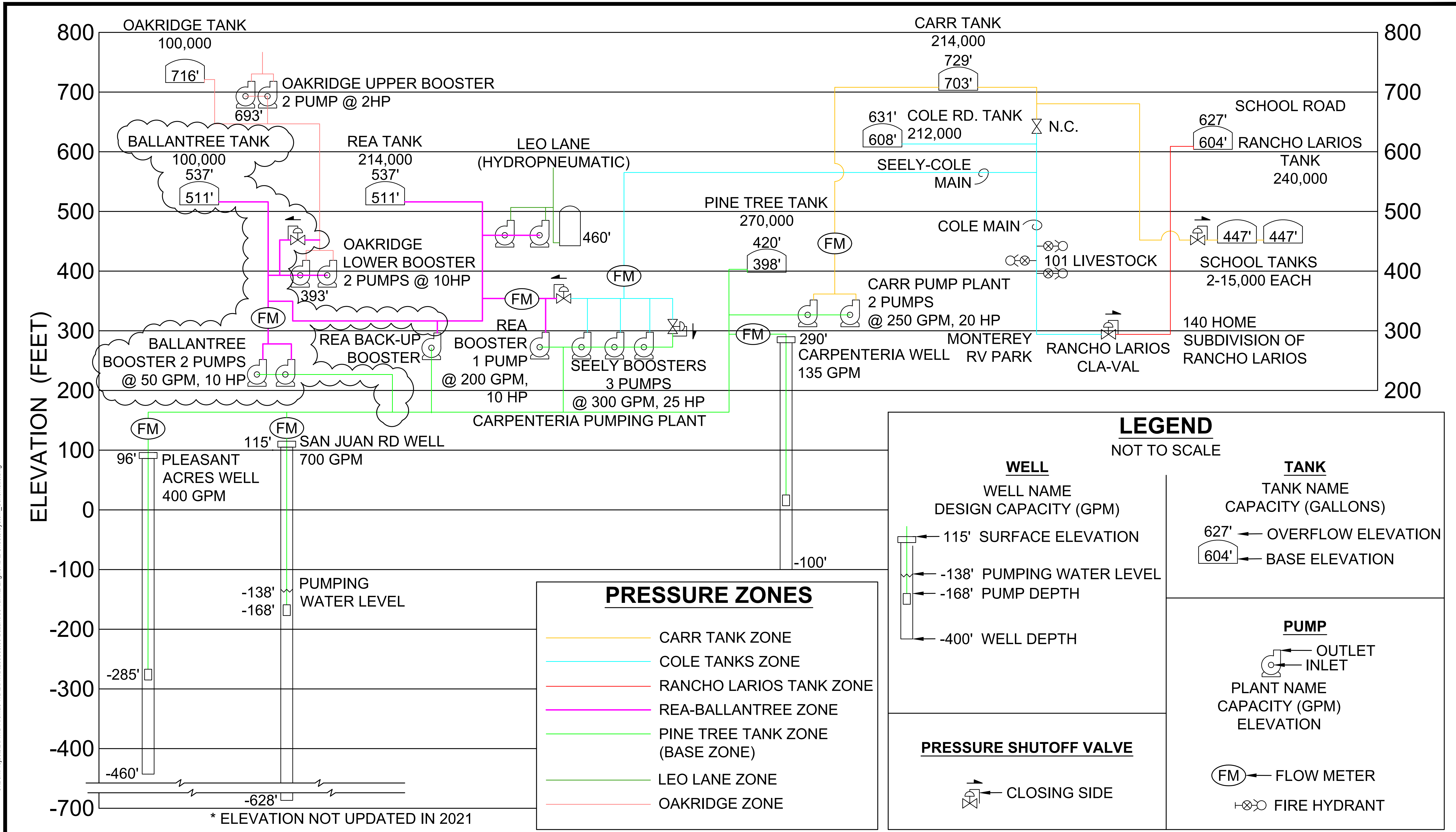
AROMAS WATER DISTRICT

EXISTING SERVICE AREA HYDRAULIC PROFILE
AROMAS WATER DISTRICT

FIGURE
2

FEBRUARY 2022



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AROMAS WATER DISTRICT

PROPOSED SERVICE AREA HYDRAULIC PROFILE
AROMAS WATER DISTRICT

FIGURE
3

FEBRUARY 2022

Attachment B – Opinion of Probable Construction Cost Estimate

OPINION OF PROBABLE PROJECT COST

RECOMMENDED IMPROVEMENTS FOR AROMAS WATER DISTRICT BALLANTREE ZONE

ALTERNATIVE 3B

Work Element	Percent of Construction Cost	Construction Cost
CONSTRUCTION COST	100	$2,100,000
DISTRICT ADMINSTRATION	3	$63,000
TOPOGRAPHIC AND BOUNDARY SURVEY	2	$42,000
GEOTECHNICAL STUDY	2	$42,000
DETAILED DESIGN	10	$210,000
PERMITTING	2	$42,000
LAND/EASEMENT ACQUSITION	4	$84,000
ENVIRONMENTAL PERMITTING	3	$63,000
CONSTRUCTION MANAGEMENT	15	$315,000
Project Cost		**$2,961,000**

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project Cost: Ballantree Zone Tanks Elimination Project - OPC for Recommended Alternative 3B

Estimate Level: Planning

Prepared By: NAB
Checked By: NEP
Date Prepared: 2/10/2022
MNS Proj. No. DIAWD.200553.09

Estimate Type:
- [x] Preliminary (w/o plans)
- [ ] Design Development @
- [ ] Construction
- [ ] Change Order

______ % complete

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	Mobilization	1	LS	$0	$0	$55,000	$55,000		0	$55,000
2	12' Wide Gravel Access Road - Ballantree Tank Access	1	LS	$80,000	$80,000	$120,000	$120,000		0	$200,000
3	100,000-Gal Bolted Steel Water Storage Tank, Foundation, and Appurtenances	1	LS	$250,000	$250,000	$250,000	$250,000		0	$500,000
4	Ballantree Tank Site Development	1	LS	$50,000	$50,000	$50,000	$50,000		0	$100,000
5	Grading and Retaining Wall (15' high)	1	LS	$75,000	$75,000	$75,000	$75,000		0	$150,000
6	Pressure Reducing Valves and Backfeed Connection - Oakridge Booster PS Site	1	LS	$12,000	$12,000	$12,000	$12,000		0	$24,000
7	Piping Connection - Rea and Ballantree Zones	1	LS	$30,000	$30,000	$40,000	$40,000		0	$70,000
8	Standby Emergency Generator - 250 KW	1	LS	$0	$0	$0	$0	$185,000	$185,000	$185,000
9	Site Improvements and Generator Slab	1	LS	$30,000	$30,000	$30,000	$30,000		$0	$60,000
10	Electrical/Communications	1	LS	$5,000.00	$5,000.00	$5,000.00	$5,000.00			$10,000
11	Existing Tank Removal and Disposal	1	LS	$2,500.00	$2,500.00	$20,000.00	$20,000.00			$22,500
	Subtotals				$534,500		$657,000		$185,000	$1,344,000
	Construction Escalation (2 years at 6% per year)	@	12.36%		$66,064		$81,205			$147,269
	Subtotals				$534,500		$657,000		$185,000	$1,491,269
	Division 1 Costs	@	2.00%		$10,690		$13,140			$23,830
	Subtotals				$545,190		$670,140		$185,000	$1,400,330
	Taxes - Materials Costs	@	7.75%		$42,252		$0			$42,252
	Subtotals				$587,442		$670,140		$185,000	$1,442,582
	Contractor Markup for Sub	@	15.00%						$27,750	$27,750
	Subtotals				$587,442		$670,140		$212,750	$1,470,332
	Contractor OH&P	@	15.00%		$88,116		$100,521			$188,637
	Subtotals				$675,559		$770,661		$212,750	$1,658,970
	Estimate Contingency	@	30.00%		$202,668		$231,198			$433,866
	Subtotals				$878,226		$1,001,859			$2,092,835
	Total / Bid Opinion									**$2,100,000**

Attachment C: Orchard Hill Water Main Scoping Evaluation

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Technical Memorandum

To:	Robert Johnson, General Manager, Aromas Water District		
Prepared By:	Nick Panofsky, PE, QSD MNS Engineers	**Checked By:**	Tyler Hunt, PE, QSD MNS Engineers
Date:	June 16, 2022		
Project	Orchard Hill Water Main Scoping Evaluation		

Objective

The objective of this Technical Memorandum (TM) is to document a scoping evaluation to determine a feasible strategy and associated costs to extend the existing Aromas Water District (District) potable water distribution system to service individual residences on and near Orchard Hill Road (Project). This TM includes a basic hydraulic evaluation to approximate available fire flow rates and service pressure ranges, lists anticipated permitting and easement acquisition requirements, provides a conceptual opinion of probable cost of construction, and documents a conceptual total Project implementation cost.

Project Background

The Project study area is in San Benito County (County), approximately 3 miles east of Aromas and 3 miles west of San Juan Bautista, near the intersection of Highway 101 and Highway 156. Currently, there are approximately 25 existing residences and 3 empty lots on and near Orchard Hill Road which are supplied with potable water from individual or shared private wells in the area. During dry summers, the area has experienced water tables dropping below the pump bowl depth in these private wells, resulting in a loss of water service. Residents in the area are interested in connecting to the District's potable water distribution system to enhance service reliability.

Properties to be Served

As of May 6th, 2022, 28 parcel owners have informed the District of their interest in connecting to the District's potable water distribution system. These owner's addresses are provided in Table 1 and on Figure 1 in Attachment A. The parcels are divided into three sub-areas, Area #1, Area #2, and Area #3, based on location and distance from the District's water system.

Table 1: Addresses of Properties Interested in Connecting to District Water System

Area #1		Area #2		Area #3
352 Orchard Hill Rd.		230 Chateau Dr.		100 Merrill Rd.
360 Orchard Hill Rd.		237 Chateau Dr.		115 Merrill Rd.
363 Orchard Hill Rd.		110 Orchard Hill Rd.		120 Merrill Rd.
366 Orchard Hill Rd.		210 Orchard Hill Rd.		215 Merrill Rd.
368 Orchard Hill Rd.*		310 Orchard Hill Rd.		330 Merrill Rd.
375 Oak View Ct.				340 Merrill Rd.
380 Oak View Ct.				350 Merrill Rd.
401 Oak View Ct.				360 Merrill Rd.
410 Oak View Ct.				435 Merrill Rd.
				440 Merrill Rd.
				115 Emerald Way
				220 Emerald Way
				225 Emerald Way
				230 Emerald Way

* The District has been informed, a potential new property owner of 368 Orchard Hill Road is considering splitting the parcel into three parcels. An additional 500-foot extension of the 6-inch water main has been included in this TM to account for this potential parcel splitting.

Additional customers in the vicinity of the Project may be interested in connecting to the proposed water main extension but have not contacted the District.

Existing District Water System

Aromas Water District's closest existing water main to the Project area is a 10-inch diameter polyvinyl chloride (PVC) C900 main in Chateau Drive. The water main is supplied by the Cole Road Water Tank (Cole Tank) and is within the District's Cole Tank pressure zone. The base elevation of the Cole Tank is 608 feet (ft) above mean sea level (amsl) with a maximum water depth of 631 ft amsl.

Proposed Water Main Alignment – Area #1

A conceptually feasible alignment was developed to serve the identified parcels. The proposed water main will connect to the 10-inch District water main at the northeast end of Chateau Drive as shown on Figure 1. From this connection point, the alignment for the proposed 6-inch water main extends to the east-southeast within an existing County public right-of-way along an unnamed and unimproved County road. From the Orchard Hill ridgeline, the proposed 6-inch water main will continue to the south or southeast to Orchard Hill Road. An easement across one or more private parcels will be required between the County right-of way at the ridgeline to Orchard Hill Road. This section of the alignment can vary depending on easement acquisition. The 6-inch water main will continue southwest to the end of Orchard Hill Road and to the south along Oak View Court. This alignment will supply potable water to the nine existing parcels within Area #1 defined in Table 1 and Figure 1. Individual service laterals and meters from the proposed water main would convey water to each residence. The approximate locations of fire hydrants are shown on Figure 1 and are based on San Benito County spacing requirements.

Proposed Water Main Alignment – Area #2

To provide water to the Area #2 as defined in Table 1 and Figure 1, the 6-inch water main will continue from Area #1 to the northeast and east along Orchard Hill Road. The owners of 237 Chateau Drive and the upper house at 210 Orchard Hill Road would likely connect to the proposed main near the Orchard Hill ridgeline.

Proposed Water Main Alignment – Area #3

To provide water to the Area #3 as defined in Table 1 and Figure 1, the 6-inch water main will continue from Area #2 to the southeast and south along Merrill Road, then north on Emerald Way.

Basic Hydraulic Evaluation

A basic hydraulic evaluation was performed based on data provided by the District and publicly available elevation data obtained from Google Earth. Table 2 is a summary of the proposed system's pipe lengths, highest and lowest surface elevations, and static pressure ranges. The Cole Tank will provide sufficient water pressure for domestic service to the majority of the potential additional service connections. Residences at the highest elevations are expected to experience pressures of less than 20 psi, which may require a pressure boosting to achieve desired water pressure. Pressure boosting systems are not considered in this document.

The water main from the Cole Tank to the proposed connection on Chateau Drive travels approximately 17,000 linear feet. The ground elevation at the proposed connection in Chateau Drive is approximately 428 ft amsl.

Table 2: Proposed System Summary

Sub-Area	Number of Existing Parcels	Approximate Length of Proposed 6" Water Main (ft)	Highest Elevation (ft amsl)	Static Pressure Range (psi)	Lowest Elevation (ft amsl)	Static Pressure Range (psi)	Number of Fire Hydrants
Area #1	9	3,700*	570	16-26	428	78-88	7*
Area #2	5	1,100	480	55-65	450	68-78	2
Area #3	14	2,700	494	49-59	384	97-107	5
Total	**28**	**7,500**					**14**

* Includes 500 feet of 6-inch water main and one fire hydrant for proposed splitting of parcel 368 Orchard Hill Road.

Fire Protection System Requirements

San Benito County requires rural domestic water systems to provide water for fire protection demands (San Benito County, California Code of Ordinances 23.27.0005 Fire Protection Supply for Water Systems). These fire protection system requirements are summarized below. An additional 250 gallons per minute (gpm) shall be provided for systems where the CC&Rs do not require Class A roof material, as defined by the Uniform Building Code, on inhabited structures.

Single-family dwellings on more than an acre and single-family dwellings on less than an acre

500 gallons per minute at a minimum 20 pounds per square inch (psi)

660 feet hydrant spacing

330 feet maximum distance from building envelopes

Four-inch mains and valves (one to four lots)

Six-inch mains and valves (five or more lots)

Four-inch riser with a single County standard hydrant or wharf hydrant for existing lots

Six-inch riser with a single County standard hydrant or wharf hydrant (five or more lots)

Two single-family dwellings per acre

750 gpm at a minimum 20 psi

660 feet hydrant spacing

330 feet maximum distance from building envelopes

County standard hydrant

Three or more single-family dwellings per acre

1000 gpm at a minimum 20 psi

660 feet hydrant spacing

330 feet maximum distance from building envelopes

County standard hydrant

Fire flows which would be available to the system extension are unknown. Additional testing and hydraulic modeling will be required to determine if the proposed improvements will provide sufficient fire flow to meet County standards. It is unlikely the proposed system improvements will meet these fire flow requirements for all proposed fire hydrants.

Soil Conditions

The Project area is in the Central California Coast Range. Based on the US Department of Agriculture, National Resources Conservation Services soil survey map, the area has sandy loam and loam soils (Attachment B). The depth to bedrock is unknown. For cost estimate purposes, it is assumed bedrock depth is at least 6 feet below the surface and bedrock will not impact the installation of the proposed water main. Depth to bedrock along the proposed water main alignment will need to be determined prior to final design and construction of the water main.

Pipeline Construction Methods

It is assumed the proposed improvements will be constructed using traditional open trench pipeline installation which requires a trench to be excavated along the entire alignment. Polyvinyl chloride (PVC) C900 pipe is assumed to be the selected pipe material, installed in accordance with District standards. However, a different material, such as ductile iron pipe, may provide additional protection from damage due to wildfire. Trench and roadway repairs would be completed according to County standards within the public right-of-way. Private road repairs would need to be coordinated with the road owners' requirements.

Permitting, Easement, and Procedural Requirements

The water main extension would need to comply with the requirements of various jurisdictions and require several permits to be obtained prior to construction. These requirements are summarized in the following sections.

CEQA Compliance

To comply with the California Environmental Quality Act (CEQA), preparation of an environmental document demonstrating compliance would need to be prepared. An Initial Study and Mitigated Negative Declaration (IS/MND) is anticipated to be the appropriate level of environmental document for this Project.

Jurisdictional Permitting

If the work will result in potential impacts to sensitive plant or animal species, or construction results in impacts within jurisdictional boundaries, individual jurisdictional permits will be required. A more detailed analysis of project impacts will be required to assess required jurisdictional agency permit requirements.

County Encroachment Permit

The proposed work in County roads, including Chateau Drive, the unnamed road from Chateau Drive to the top of Orchard Hill, Orchard Hill Road, Oak View Court, and Merrill Road are public rights-of-way. An encroachment permit from the County will need to be obtained for pipeline construction. Traffic control plans will likely be required as part of the encroachment permit application but can be prepared by the pipeline construction contractor.

Easements within Private Property

An easement across one or more parcels will be required between the County right-of way at the Orchard Hill ridgeline to Orchard Hill Rd.

Conceptual Project Costs

A preliminary opinion of probable cost of construction (OPC) was developed for the proposed water system extension. The OPC and estimated total costs which may be incurred by the Project are provided in this section and in Appendix C. A recommended cost-sharing strategy is also provided. The OPC for the Area #1 only is $960,000. The OPC for the Area #1 and Area #2 is $1,240,000. The OPC for all three Areas, Area #1, Area #2, and Area #3, is $1,910,000.

This TM, including the OPCs, do not include individual lateral connections or other required improvements on private properties.

The Project costs included in this section and Appendix C are based on information obtained from a variety of resources, including cost estimate resource guidebooks, recent bid results, engineer's experience, and publicly available information. In addition, the following mark-ups were applied to the Project costs:

- Division 1 Costs, including bonds and insurance: 2%
- Taxes on materials: 7.63%
- Contractor Markup for subcontractors: 12%
- Contractor Markup for overhead and profit: 12%
- Project Contingency: 30%
- Escalation of Project costs attributed to inflation: 3%

These costs are considered to be conservative and will be refined as the project progresses.

Additional costs will be incurred as part of the Project. Additional costs are estimated based on an assumed percentage of the construction cost and included in the total Project costs; a total Project cost for the recommended improvements is provided in Table 3. Costs associated with land/easement acquisition and environmental permitting are anticipated to be similar regardless of the number of Areas included in the Project.

Table 3: Total Project Costs

Items	Percentage of Construction Cost	Cost Area #1 Only	Cost Area #1 and Area #2 Only	Cost Area #1, Area #2, and Area #3
Project Construction	100%	$960,000	$1,240,000	$1,910,000
District Administration	3%	$30,000	$40,000	$60,000
Topographic and Boundary Survey	1%	$10,000	$10,000	$20,000
Detailed Design	10%	$100,000	$120,000	$190,000
Project Permitting	1%	$10,000	$10,000	$20,000
Land/Easement Acquisition	5%	$50,000	$50,000	$50,000
Environmental Permitting	6%	$60,000	$60,000	$60,000
Construction Management	15%	$140,000	$190,000	$290,000
Total Project Cost		**$1,360,000**	**$1,720,000**	**$2,600,000**

The cost estimates assume construction of the Project would be contracted through the District, and all labor rates would be required to comply with public contracting prevailing wage requirements. A potential cost savings is available if the Project is constructed privately, then ownership turned over to the District at Project completion.

Per-Parcel Project Costs

Design and construction costs are anticipated to be financed through formation of a public assessment district. It is assumed all parcels listed in Table 1 and shown on Figure 1 will fund the initial construction, with future reimbursement from future connections within a period of 20 years from construction completion. With estimated total Project costs for Area #1 of $1,360,000, the per-parcel cost for the existing 9 parcels within Area #1 is anticipated to be approximately $151,000. The potential splitting of parcel 368 Orchard Hill Road with the 500 feet of water main and one additional fire hydrant increases the estimated total Project cost for Area #1 only from $1,220,000 to $1,360,000. The estimated total Project costs for Area #1 and Area #2 only is $1,720,000, the per-parcel cost for the 14 parcels is anticipated to be approximately $123,000. The estimated total Project costs for Area #1, Area #2, and Area #3 is $2,600,000, the per-parcel cost for the 28 parcels is anticipated to be approximately $93,000.

In addition to costs associated with construction of the conveyance infrastructure, the per-parcel cost to install a residential service lateral and onsite piping connections is estimated to be $5,000 to $10,000.

Operation and Maintenance Costs

Once the water main extension infrastructure construction is completed and the system begins conveying water, continual operation and maintenance (O&M) costs will be incurred by the District. O&M costs for the water main will be the responsibility of the District. O&M of piping on residential properties will be the responsibility of each property owner. A detailed analysis of O&M costs is not included in this TM.

Next Steps

- Determine interest of residents in moving forward with the proposed water main extension. Discuss financing options for spreading capital costs out over a longer period, low interest loans, grants, or including proposed improvements in a larger, externally funded project.
- Verify hydraulic assumptions and average system pressures at the proposed connection point of the water main in Chateau Drive. MNS recommends the District preform a flow test on the highest hydrant on Chateau Drive to provide a basis for fire flows for the system expansion.
- Initiate discussions with private landowners for obtaining easements.
- Prepare a detailed preliminary design document.
- Parcels to be serviced will need to be transferred from the District's sphere of influence to the District's annexed area, which will need to follow LAFCO processes and procedures.
- Prepare a CEQA document and associated environmental permits based on a completed preliminary design document.
- Initiate design, permitting, and construction of the proposed improvements.

Attachments

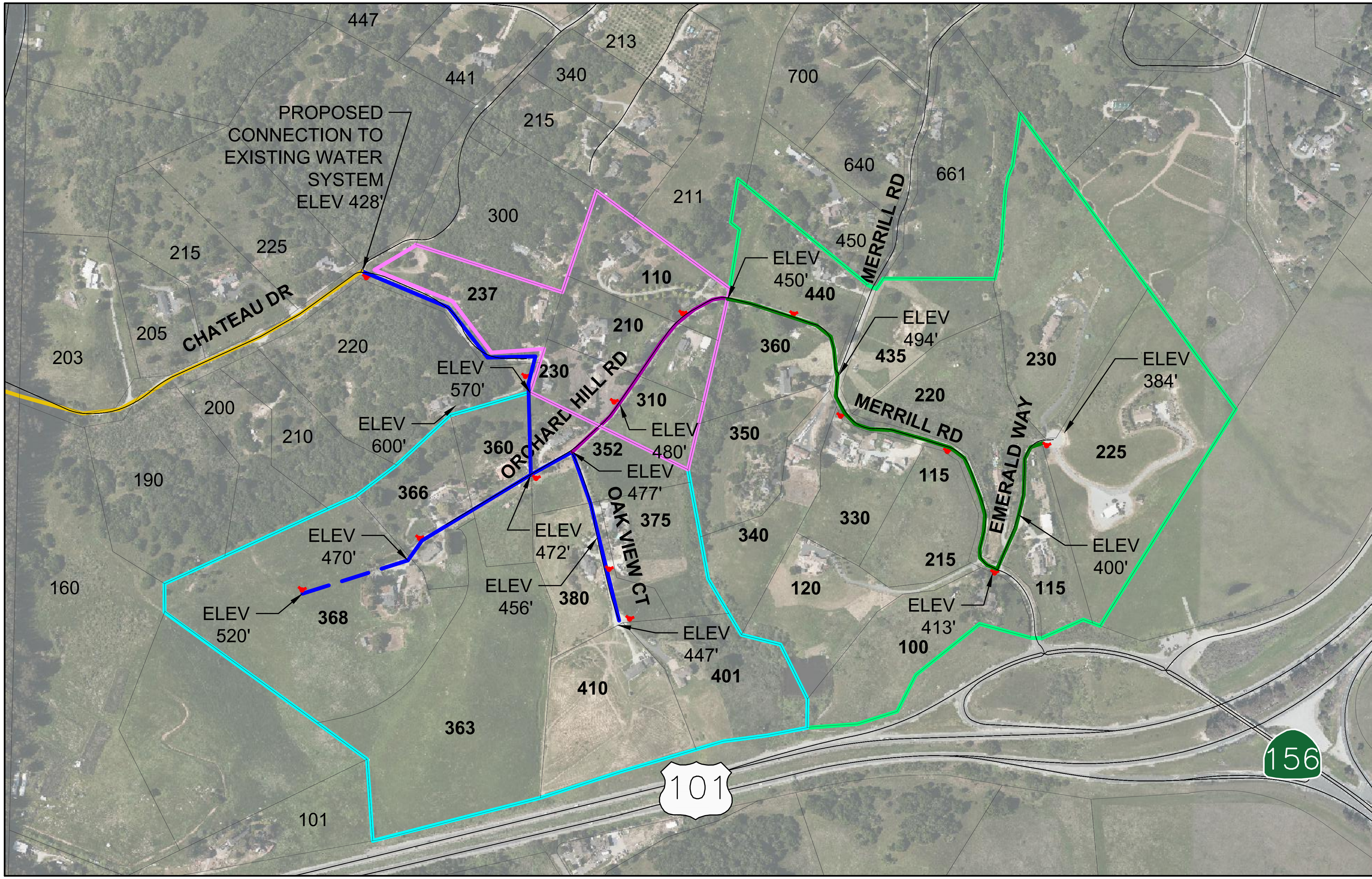
Attachment A – Figure 1 Orchard Hill Scoping Evaluation

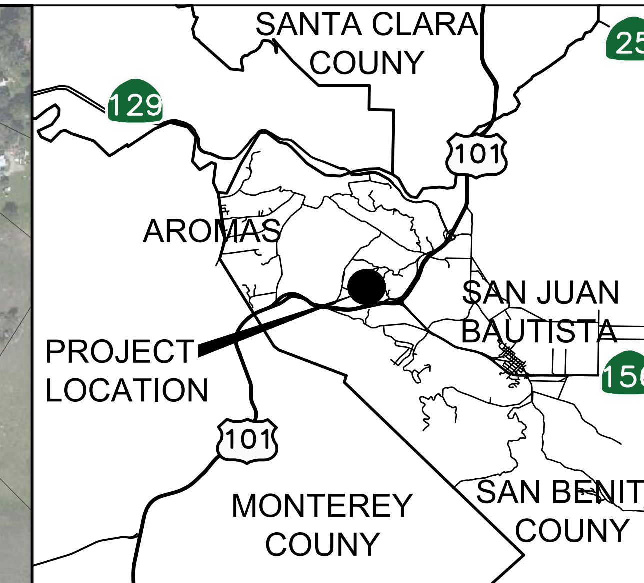
Attachment B – Soil Survey Map of Project Area

Attachment C – Opinion of Probable Costs

ATTACHMENT A – FIGURE 1

ORCHARD HILL SCOPING EVALUATION





LEGEND

- EXISTING 10" WATER MAIN
- PROPOSED 6" WATER MAIN FOR AREA #1
- PROPOSED 6" WATER MAIN FOR AREA #2
- PROPOSED 6" WATER MAIN FOR AREA #3
- PROPOSED 6" WATER MAIN EXTENSION FOR AREA #1
- ROAD
- ### PARCEL BOUNDARY WITH ADDRESS NUMBER
- AREA #1
- AREA #2
- AREA #3
- PROPOSED FIRE HYDRANT

500' 0' 500'

1 in. = 500 ft.

ELEVATIONS ARE APPROXIMATED FROM GOOGLE EARTH

C:\Box\Projects\DIAWD Aromas WD\DIAWD 200553.08 Orchard Scoping\2 Engr\CAD\Exhibits\Figure Site Map.dwg

Thu 16.Jun.22 10:13:58 AM

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CONSTRUCTION MANAGEMENT
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THIS BAR IS 2 INCHES AT FULL SCALE. IF NOT 2 INCHES, THEN SCALE ACCORDINGLY.

AROMAS WATER DISTRICT

FIGURE 1

JUNE 16, 2022

ORCHARD HILL SCOPING EVALUATION

PARCELS TO BE SERVED

AROMAS WATER DISTRICT

ATTACHMENT B – SOIL SURVEY MAP OF THE PROJECT AREA

Soil Map—San Benito County, California
(Aromas Orchard Hill Soil Map)

Map Scale: 1:11,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Benito County, California
Survey Area Data: Version 21, May 29, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 16, 2019—Jun 15, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AtD	Arnold loamy sand, 9 to 20 percent slopes, MLRA 15	8.6	1.3%
AtE2	Arnold loamy sand, 15 to 30 percent slopes, eroded, MLRA 15	22.7	3.5%
CuC	Corralitos loamy sand, 2 to 9 percent slopes	4.1	0.6%
CvD2	Cotati loam, 9 to 15 percent slopes, eroded	68.8	10.6%
CvE2	Cotati loam, 15 to 30 percent slopes, eroded	143.0	22.0%
LvE	Los Gatos clay loam, 15 to 30 percent slopes	11.7	1.8%
LwF2	Los Gatos rocky clay loam, 15 to 50 percent slopes, ero ded	36.0	5.5%
SmE2	Soper sandy loam, 15 to 30 percent slopes, eroded	77.3	11.9%
SmF2	Soper sandy loam, 30 to 50 percent slopes, eroded	222.8	34.3%
SsE2	Sween rocky clay loam, 15 to 30 percent slopes, eroded	37.8	5.8%
SsF2	Sween rocky clay loam, 30 to 50 percent slopes, eroded	17.6	2.7%
Totals for Area of Interest		**650.4**	**100.0%**

ATTACHMENT C – OPINION OF PROBABLE COSTS

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Orchard Hill Water Main Scoping Evaluation - Area #1 Only

Prepared By: NEP/MWB

Date Prepared: 6/16/2022

Estimate For: Technical Memorandum

MNS Proj. No. DIAWD.200553.08

Estimate Type:

- [x] Conceptual
- [ ] Preliminary (w/o plans)
- [ ] Design Development @ ______ % complete
- [ ] Construction
- [ ] Change Order

Current at ENR ______

Escalated to ENR ______

Months to Midpoint of Construction ______

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	Mobilization	1	LS	$ 5,000	$ 5,000	$ 20,000	$ 20,000		$ -	$ 25,000
2	Connection to Existing 10-inch Water Main	1	LS	$ 1,000	$ 1,000	$ 1,500	$ 1,500		$ -	$ 2,500
3	6-Inch PVC Water Main - Area #1 - Unimproved*	900	LF	$ 50	$ 45,000	$ 60	$ 54,000		$ -	$ 99,000
4	6-Inch PVC Water Main - Area #1 - Dirt Road	1100	LF	$ 60	$ 66,000	$ 60	$ 66,000		$ -	$ 132,000
5	6-Inch PVC Water Main - Area #1 - Paved Road	1700	LF	$ 70	$ 119,000	$ 70	$ 119,000		$ -	$ 238,000
6	Fire Hydraunts - Area #1*	7	EA	$ 4,000	$ 28,000	$ 2,500	$ 17,500		$ -	$ 45,500
7	Misc. Appurtenances, ARVs/Blow-offs	1	LS	$ 5,000	$ 5,000	$ 5,000	$ 5,000		$ -	$ 10,000
8	Environmental Mitigation Improvements	1	LS	$ 25,000	$ 25,000	$ 25,000	$ 25,000		$ -	$ 50,000
	Subtotals				$294,000		$308,000		$0.00	$ 602,000.00
	Division 1 Costs	@	2.00%		$5,880		$6,160		$0.00	$ 12,040.00
	Subtotals				$299,880		$314,160		$0.00	$ 614,040.00
	Taxes - Materials Costs	@	7.63%		$22,881					$ 22,880.84
	Subtotals				$322,761		$314,160		$0.00	$ 636,920.84
	Contractor Markup for Sub	@	12.00%						$0.00	$ -
	Subtotals				$322,761		$314,160		$0.00	$ 636,920.84
	Contractor OH&P	@	12.00%		$38,731		$37,699		$0.00	$ 76,430.50
	Subtotals				$361,492		$351,859		$0.00	$ 713,351.35
	Estimate Contingency	@	30.00%							$ 214,005.40
	Subtotals									$ 927,356.75
	Escalation of Project Costs Attrributed to Inflation	@	3.00%							$ 27,820.70
	Subtotals									$ 955,177.45
	Total Estimate									**$ 960,000.00**

* Includes 500 feet of 6-inch water main and one fire hydrant for proposed splitting of parcel 368 Orchard Hill Road.

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Orchard Hill Water Main Scoping Evaluation - Area #2 Only (to be added to Area #1 costs)

Prepared By: NEP/MWB

Date Prepared: 6/16/2022

Estimate For: Technical Memorandum

MNS Proj. No. DIAWD.200553.08

Estimate Type:
- ☑ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @ ______ % complete
- ☐ Construction
- ☐ Change Order

Current at ENR ______

Escalated to ENR ______

Months to Midpoint of Construction ______

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	6-Inch PVC Water Main - Area #1 - Paved Road	1100	LF	$ 70	$ 77,000	$ 70	$ 77,000		$ -	$ 154,000
2	Fire Hydraunts - Area #1	2	EA	$ 4,000	$ 8,000	$ 2,500	$ 5,000		$ -	$ 13,000
3	Misc. Appurtenances, ARVs/Blow-offs	1	LS	$ 5,000	$ 5,000	$ 5,000	$ 5,000		$ -	$ 10,000
	Subtotals				$90,000		$87,000		$0.00	$ 177,000.00
	Division 1 Costs	@	2.00%		$1,800		$1,740		$0.00	$ 3,540.00
	Subtotals				$91,800		$88,740		$0.00	$ 180,540.00
	Taxes - Materials Costs	@	7.63%		$7,004					$ 7,004.34
	Subtotals				$98,804		$88,740		$0.00	$ 187,544.34
	Contractor Markup for Sub	@	12.00%						$0.00	$ -
	Subtotals				$98,804		$88,740		$0.00	$ 187,544.34
	Contractor OH&P	@	12.00%		$11,857		$10,649		$0.00	$ 22,505.32
	Subtotals				$110,661		$99,389		$0.00	$ 210,049.66
	Estimate Contingency	@	30.00%							$ 63,014.90
	Subtotals									$ 273,064.56
	Escalation of Project Costs Attrributed to Inflation	@	3.00%							$ 8,191.94
	Subtotals									$ 281,256.50
	Total Estimate									**$ 280,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

MNS ENGINEERS INC

Project: Orchard Hill Water Main Scoping Evaluation - Area #3 Only (to be added to Area #1 and Area #2 costs)

Prepared By: NEP/MWB

Date Prepared: 6/16/2022

Estimate For: Technical Memorandum

MNS Proj. No. DIAWD.200553.08

Estimate Type:

- ☑ Conceptual
- ☐ Preliminary (w/o plans)
- ☐ Design Development @ ______ % complete
- ☐ Construction
- ☐ Change Order

Current at ENR ______

Escalated to ENR ______

Months to Midpoint of Construction ______

Item No.	Description	Qty.	Units	Materials $/Unit	Materials Total	Installation $/Unit	Installation Total	Sub-Contractor $/Unit	Sub-Contractor Total	Total
1	6-Inch PVC Water Main - Area #1 - Paved Road	2700	LF	$ 70	$ 189,000	$ 70	$ 189,000		$ -	$ 378,000
2	Fire Hydraunts - Area #1	5	EA	$ 4,000	$ 20,000	$ 2,500	$ 12,500		$ -	$ 32,500
3	Misc. Appurtenances, ARVs/Blow-offs	1	LS	$ 5,000	$ 5,000	$ 5,000	$ 5,000		$ -	$ 10,000
	Subtotals				$214,000		$206,500		$0.00	$ 420,500.00
	Division 1 Costs	@	2.00%		$4,280		$4,130		$0.00	$ 8,410.00
	Subtotals				$218,280		$210,630		$0.00	$ 428,910.00
	Taxes - Materials Costs	@	7.63%		$16,655					$ 16,654.76
	Subtotals				$234,935		$210,630		$0.00	$ 445,564.76
	Contractor Markup for Sub	@	12.00%						$0.00	$ -
	Subtotals				$234,935		$210,630		$0.00	$ 445,564.76
	Contractor OH&P	@	12.00%		$28,192		$25,276		$0.00	$ 53,467.77
	Subtotals				$263,127		$235,906		$0.00	$ 499,032.54
	Estimate Contingency	@	30.00%							$ 149,709.76
	Subtotals									$ 648,742.30
	Escalation of Project Costs Attrributed to Inflation	@	3.00%							$ 19,462.27
	Subtotals									$ 668,204.57
	Total Estimate									**$ 670,000.00**

Attachment D: Proposed New Maintenance Building Layout

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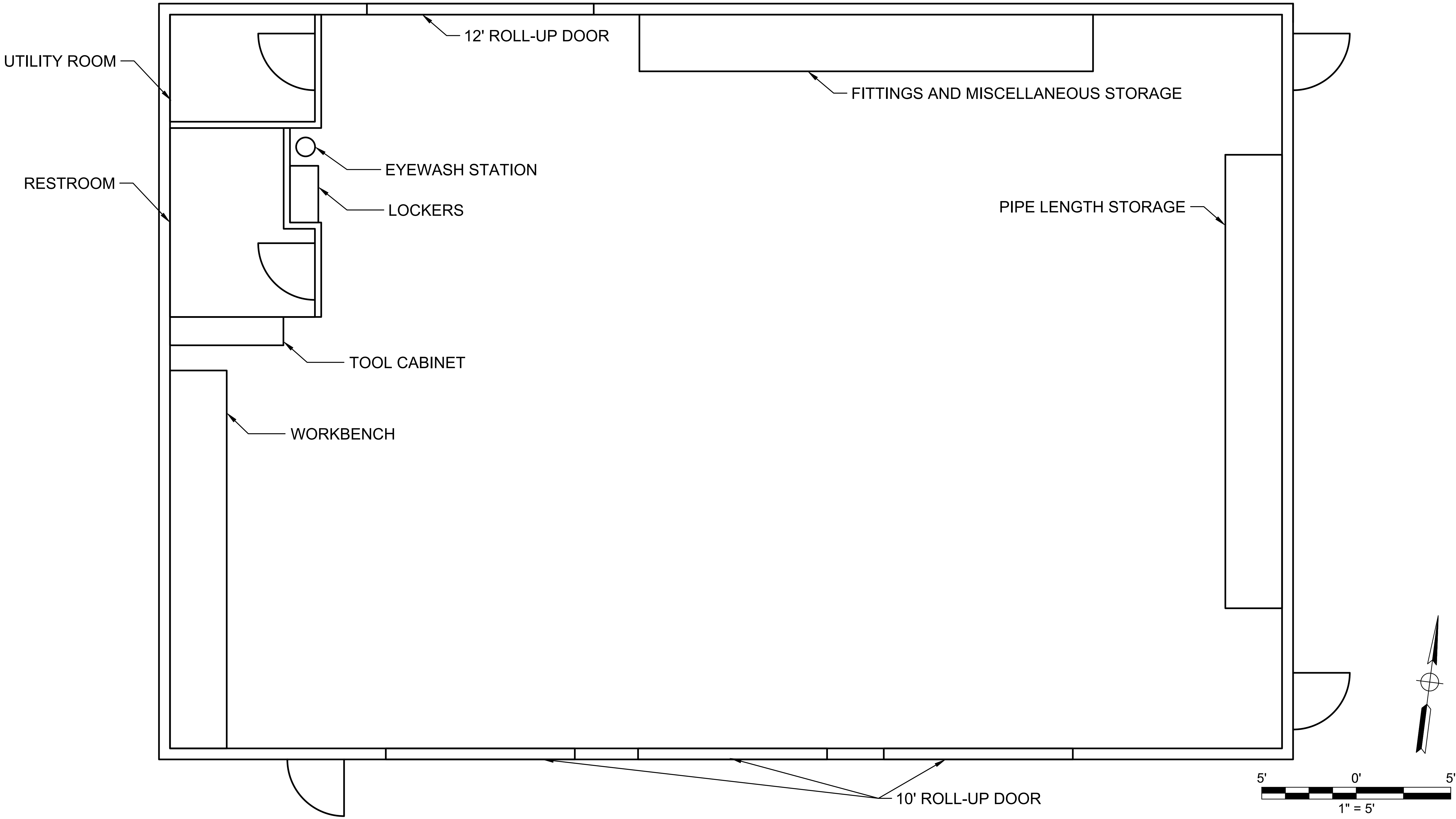

MNS

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SCALE:

1"=5'

AROMAS WATER DISTRICT
PROPOSED SHOP LAYOUT

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Attachment E: Capital Project Cost Estimates

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Project G-1: Rate Study		
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Rate Study	$60,000
	Subtotal	**$60,000**
	Construction Contingency (30%)	**$0**
	Engineering & Administration (30%)	**$0**
	Total	**$60,000**

Project G-2: Hydraulic Model		
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Hydraulic Model	$80,000
	Subtotal	**$80,000**
	Construction Contingency (30%)	**$0**
	Engineering & Administration (30%)	**$0**
	Total	**$80,000**

	Project G-3: Full System Condition Assessment and Seismic Evaluation	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Full Condition Assessment and Seismic Evaluation	$50,000
	Subtotal	**$50,000**
	Construction Contingency (30%)	**$0**
	Engineering & Administration (30%)	**$0**
	Total	**$50,000**

	Project G-4: New Maintenance Building	
Item No.	Item Description	Opinion of Cost ($)
1	Building, Foundation, and Internal Improvements	$600,000
2	Site Improvements	$50,000
3	Septic System	$40,000
4	Water Service	$10,000
5	New Electrical Service and Pole Relocation	$50,000
6	Existing Building Retrofit	$50,000
	Subtotal	**$800,000**
	Construction Contingency (30%)	**$240,000**
	Engineering & Administration (30%)	**$240,000**
	Total	**$1,280,000**

	Project G-5: Electric Fleet Augmentation	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Electric Vehicles (2 x $60,000 each)	$120,000
	Subtotal	**$120,000**
	Construction Contingency (30%)	**$0**
	Engineering & Administration (30%)	**$0**
	Total	**$120,000**

	Project G-6: Facility and Cyber Security Plan	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Facility and Cyber Security Plan	$75,000
	Subtotal	**$75,000**
	Construction Contingency (30%)	**$0**
	Engineering & Administration (30%)	**$0**
	Total	**$75,000**

	Project S-1: New Well Development	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Land Acquisition	$400,000
2	Drilling Test Well	$100,000
3	Drilling Production Well	$1,000,000
5	Well Equipping	$750,000
6	Wellhead Treatment	$600,000
7	Railroad Crossing	$150,000
8	Discharge Pipeline	$120,000
	Subtotal	**$3,120,000**
	Construction Contingency (30%)	**$936,000**
	Engineering & Administration (30%)	**$936,000**
	Total	**$4,992,000**

	Project S-2: San Juan Road Well New Generator and Electrical Improvements	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Emergency 250KW Generator	$225,000
2	Site Improvements and Generator Slab	$65,000
3	Electrical/Communications	$12,000
	Subtotal	**$302,000**
	Construction Contingency (30%)	**$90,600**
	Engineering & Administration (30%)	**$90,600**
	Total	**$483,000**

	Project ST-1: Ballantree Tank	
Item No.	Item Description	Opinion of Cost ($)
1	Repair Road	$280,000
2	100,000-gal Bolted Steel Water Storage Tank	$560,000
3	Site Development, Grading, and Retaining Wall	$280,000
4	Piping Connecting Rea and Ballantree Zones	$80,000
5	Electrical, Communications, and Lighting	$55,000
6	Existing Tank Removal and Disposal	$35,000
	Subtotal	**$1,290,000**
	Construction Contingency (30%)	**$387,000**
	Engineering & Administration (30%)	**$387,000**
	Total	**$2,064,000**

	Project ST-2: School Road Tank Replacement with Pressure Reducing Valve	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Demolish Existing School Road Tanks	$30,000
2	Security Fencing	$15,000
3	Electrical and I&C Improvements	$100,000
4	Supply/Discharge Piping	$50,000
5	Pressure Reducing Valve and Appurtenances	$80,000
	Subtotal	**$275,000**
	Construction Contingency (30%)	**$82,500**
	Engineering & Administration (30%)	**$82,500**
	Total	**$440,000**

	Project ST-3: Pine Tree Tank Replacement and/or Additional Tank	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Excavation and Site Preparation	$150,000
2	Demolish Existing Pine Tree Tank	$50,000
3	Two 150,000-gal bolted Steel Tanks	$1,200,000
4	Electrical, Communications, and Lighting	$50,000
5	Site Piping and Misc. Improvements	$250,000
	Subtotal	**$1,700,000**
	Construction Contingency (30%)	**$510,000**
	Engineering & Administration (30%)	**$510,000**
	Total	**$2,720,000**

	Project P-1: Carr Booster Backup	
Item No.	Item Description	Opinion of Cost ($)
1	Supply & Discharge Piping	$40,000
2	Pump Station Foundation	$30,000
3	Package Pump Station	$300,000
4	Site Improvements	$10,000
4	Electrical and I&C Improvements	$30,000
	Subtotal	**$410,000**
	Construction Contingency (30%)	**$123,000**
	Engineering & Administration (30%)	**$123,000**
	Total	**$656,000**

Project P-2: Leo Lane Pump Station New Generator		
Item No.	Item Description	Opinion of Cost ($)
1	Site Work	$10,000
2	Generator	$60,000
3	Electrical Improvements	$30,000
	Subtotal	**$100,000**
	Construction Contingency (30%)	**$30,000**
	Engineering & Administration (30%)	**$30,000**
	Total	**$160,000**

Project P-3: Upper Oakridge Booster New Generator		
Item No.	Item Description	Opinion of Cost ($)
1	Site Work	$10,000
2	Generator	$60,000
3	Electrical Improvements	$30,000
	Subtotal	**$100,000**
	Construction Contingency (30%)	**$30,000**
	Engineering & Administration (30%)	**$30,000**
	Total	**$160,000**

Project P-4: Carr Pump Plant Rehabilitation		
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Carr Pump Plant PRV	$40,000
2	Carr Pump Plant Pump Replacement and Piping Modifications	$80,000
3	Electrical Improvements	$40,000
	Subtotal	**$160,000**
	Construction Contingency (30%)	**$48,000**
	Engineering & Administration (30%)	**$48,000**
	Total	**$256,000**

Project D-1: Hydrant and Valve Flushing and Condition Assessment		
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Fire Hydrants and Valve Assessment	$30,000
	Subtotal	**$30,000**
	Construction Contingency (30%)	**-**
	Engineering & Administration (30%)	**-**
	Total	**$30,000**

Project D-2: Hydrant and Valve Repair and Replacement		
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Repair / Replace Failed/Broken Fire Hydrants & Valves	$200,000
2	Install 180 Brake-Off Check Valves	$180,000
	Subtotal	**$380,000**
	Construction Contingency (30%)	**$114,000**
	Engineering & Administration (30%)	**$114,000**
	Total	**$608,000**

	Project D-3: Steel Saddle Replacement	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Replace 100 Steel Service Saddles	$250,000
	Subtotal	**$250,000**
	Construction Contingency (30%)	**$75,000**
	Engineering & Administration (30%)	**$75,000**
	Total	**$400,000**

	Project D-4: Annual Water Main Replacement, Year 1 of 4	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Replace 6" or 8" Water Main (10,000 LF @ $250/LF)	$2,500,000
	Subtotal	**$2,500,000**
	Construction Contingency (30%)	**$750,000**
	Engineering & Administration (30%)	**$750,000**
	Total	**$4,000,000**

	Project D-5: Annual Water Main Replacement, Year 2 of 4	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Replace 6" or 8" Water Main (10,000 LF @$250/LF)	$2,500,000
	Subtotal	**$2,500,000**
	Construction Contingency (30%)	**$750,000**
	Engineering & Administration (30%)	**$750,000**
	Total	**$4,000,000**

	Project D-6: Annual Water Main Replacement, Year 3 of 4	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Replace 6" or 8" Water Main (10,000 LF @$250/LF)	$2,500,000
	Subtotal	**$2,500,000**
	Construction Contingency (30%)	**$750,000**
	Engineering & Administration (30%)	**$750,000**
	Total	**$4,000,000**

	Project D-7: Annual Water Main Replacement, Year 4 of 4	
Item No.	**Item Description**	**Opinion of Cost ($)**
1	Replace 6" or 8" Water Main (10,000 LF @$250/LF)	$2,500,000
	Subtotal	**$2,500,000**
	Construction Contingency (30%)	**$750,000**
	Engineering & Administration (30%)	**$750,000**
	Total	**$4,000,000**

Project D-8: System Operational Reliability Modifications		
Item No.	**Item Description**	**Opinion of Cost ($)**
D-8A	Carr-Cole Isolation Valve Replacement	$50,000
D-8B	Pressure Reducing Valve at Oakridge Pump Station	$25,000
D-8C	Pressure Reducing Valve at Rea Booster Pump, Demolish/Abandon Rea Back-up Booster and PRV	$60,000
	Subtotal	**$135,000**
	Construction Contingency (30%)	**$40,500**
	Engineering & Administration (30%)	**$40,500**
	Total	**$216,000**