

INITIAL STUDY/MITIGATED NEGATIVE DECLARATION
CLEARLAKE OAKS COUNTY WATER DISTRICT
WATER INFRASTRUCTURE REHABILITATION PROJECT

February 2026

Prepared For:

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Table of Contents

Section 1 | Introduction 1
1.1 Project Summary 1
1.2 Background and Purpose of Study 2
1.3 Incorporation by reference 2
1.4 Summary of Findings 2
1.5 Document Organization 3
Section 2 | Project Description 4
2.1 Project Location 4
2.2 Project Objectives 4
2.3 Project Description 4
Section 3 | Determination 17
3.1 Environmental Factors Potentially Affected 17
3.2 Determination 18
Section 4 | Evaluation of Environmental Impacts 19
4.1 Aesthetics 19
4.2 Agriculture and Forestry 24
4.3 Air Quality 27
4.4 Biological Resources 33
4.5 Cultural Resources 43
4.6 Energy 53
4.7 Geology and Soils 55
4.8 Greenhouse Gas Emissions 63
4.9 Hazards and Hazardous Materials 66
4.10 Hydrology and Water Quality 76
4.11 Land Use and Planning 84
4.12 Mineral Resources 89
4.13 Noise 91
4.14 Population and Housing 100
4.15 Public Services 101
4.16 Recreation 103
4.17 Transportation 104
4.18 Tribal Cultural Resources 109
4.19 Utilities and Service Systems 113
4.20 Wildfire 117
4.21 Mandatory Findings of Significance 121
Section 5 | References 123
Section 6 | Report Preparers 127
Clearlake Oaks County Water District 127
Acorn Environmental 127
Project Engineers 127

List of Figures

Figure 1: Regional Location 5
Figure 2: Site and Vicinity 6
Figure 3: Aerial Overview 7
Figure 4: Equalization Tank Improvement Plan 9
Figure 5: High Valley Tank Site Improvement Plan- Conceptual 11
Figure 6: Shady Lane Tank Site Improvement Plan- Conceptual 12
Figure 7: National Wetland Inventory 39
Figure 8: Soil Types 59
Figure 9: Zoning 87
Figure 10: Land Use 88
Figure 11: Fire Hazard Severity Zones 119

List of Tables

Table 1.1-1: Project Summary 1
Table 4.3-1: Ambient Air Quality Standards 28
Table 4.7-1: Soil Types 58
Table 4.13-1: Federal Noise Abatement Criteria Hourly A-Weighted Sound Level Decibels 92
Table 4.13-2: Construction Vibration Damage Criteria 92
Table 4.13-3: Groundborne Vibration Impact Criteria for General Assessment 93
Table 4.13-4: Construction Equipment Noise Levels 97
Table 4.13-5: Vibration Source Levels for Construction Equipment 98
Table 4.17-1: Lake County Road Standards 106

List of Appendices

Appendix A Amended Water Master Plan and Engineering Report
Appendix B Biological Resources Assessment

List of Abbreviations and Acronyms

AB	Assembly Bill
ARPA	Archaeological Resources Protection Act
AWWA	American Water Works Association
BMP	Best Management Practice
B.P.	before present
CCR	California Code of Regulations
CalGem	California Geologic Energy Management Division
CalTrans	California Department of Transportation
Cal/OSHA	California Occupational Safety and Health Administration
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CAPS	Criteria Air Pollutants
CARB	California Air Resources Board
CBC	California Building Code
CBSC	California Building Standards Code
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CDFW	California Department of Fish and Wildlife
CDP	Census-Designated Place
CFG	California Fish and Game
CGS	California Geological Survey
CFR	Code of Federal Regulations
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CLOCWD	Clearlake Oaks County Water District
CRHR	California Register of Historical Resources
CRWQCB	California Regional Water Quality Control Board
CWA	Clean Water Act
CWPP	Community Wildfire Protection Plan
dB	Decibel
DBP	Disinfection Byproducts
DMA	District Metered Area
DOC	Department of Conservation
DTSC	Department of Toxic Substances Control
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHSZ	Fire Hazard Severity Zone
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMMP	Farmland Mapping and Monitoring Program
FPPA	Farmland Protection Policy Act
FTA	Federal Transit Authority

GHG	Greenhouse Gas
HAPs	Hazardous Air Pollutants
HMP	Hazard Mitigation Plan
IS/MND	Initial Study/Mitigated Negative Declaration
KUSD	Konocti Unified School District
LCAB	Lake County Air Basin
LCAQMD	Lake County Air Quality Management District
LUST	leaking underground storage tanks
LCFPD	Lake County Fire Protection District
LOS	Level of Service
LRA	Local Responsibility Area
LTA	Lake Transit Authority
MDD	Maximum Day Demand
mph	miles per hour
MRZ	Mineral Resources Zone
MT	metric tons
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OSHA	Occupational Safety and Health Administration
PG&E	Pacific Gas and Electric
PLC	Programmable Logic Controller
PRC	Public Resources Code
PRV	Pressure Reducing Valve
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Plan
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SR	State Route
SRA	State Responsibility Areas
SCADA	Supervisory Control and Data Acquisition
SCH	State Clearing House
SDWA	Safe Drinking Water Act
SHMA	Seismic Hazards Mapping Act
SLF	Sacred Lands File
SOP	Standard Operating Procedures

SWRCB	State Water Resources Control Board
SWQCB	State Water Quality Control Board
TCP	Traditional Cultural Property
TCR	Tribal Cultural Resources
THM	Trihalomethane
UCMP	University of California Museum of Paleontology
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMT	Vehicle Miles Traveled
WMP	Water Master Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Section 1 | Introduction

1.1 PROJECT SUMMARY

Table 1.1-1: Project Summary

Project Title:	Clearlake Oaks County Water District (CLOCWD or District) Water Infrastructure Rehabilitation Project (Proposed Project)
Lead Agency Name and Address:	Clearlake Oaks County Water District 12952 East Highway 20 Clearlake Oaks, CA 95423
Contact Person and Phone Number:	Dianna Mann, General Manger, 707-998-3322
Project Location:	Clearlake Oaks Sections 29-33 of Township 14 North, Range 7 West and Sections 21, 34, and 36 of Township 14 North, Range 8 West; and Lucerne Section 21 of Township 14 North, Range 8 West
General Plan Designation:	The General Plan Land Use Designations for the Proposed Project's improvement areas include: Low Density Residential (LDR), Medium Density Residential (MDR), Rural Residential (RR), Resource Conservation (RC), Resort Commercial (Cr), Community Commercial (CC) and Public Facilities (PF)
Zoning:	The Zoning Designations for the Proposed Project's improvement areas include: Rural Residential (RR), Single-Family Residential (R1), Two-Family Residential (R2), Multi-Family Residential (R3), Open Space (O), Resort Commercial (CR), Community Commercial (C2), and Planned Development Commercial (PDC).
Description of the Proposed Project:	The Proposed Project involves improvements to various components of the water distribution system, including the water treatment plant (WTP), and within the distribution pipelines, storage tanks, and associated pump stations.
Surrounding Land Uses and Setting:	Adjacent properties to the Proposed Project include open space, residential, agriculture, and commercial uses.
Other Public Agencies Whose Approval is Required:	State of California Regional Water Quality Control Board (CRWQCB), California Air Resources Board (CARB), and California Department of Transportation (CalTrans).
Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance impacts to tribal cultural resources, procedures regarding confidentiality, etc.?	Tribal consultation letters were sent to all affected Native American tribes on January 20, 2026.

1.2 BACKGROUND AND PURPOSE OF STUDY

The Clearlake Oaks County Water District (CLOCWD or District) provides water and wastewater treatment to its customers in the approximately 2.1-square mile service area. The District's mission is to provide the best quality water and the safest, most efficient treatment and disposal of wastewater at a reasonable cost to its customers.

As described in detail within the Amended Water Master Plan and Engineering Report (WMP; MC Engineering, 2025) included in **Appendix A** and summarized in **Section 2.0** of this Initial Study, the Proposed Project consists of several infrastructure improvement projects needed to keep the District in compliance with State drinking water regulations.

The purpose of this Initial Study is to evaluate potential environmental impacts associated with the Proposed Project in accordance with California Code of Regulations Title 14 (Chapter 3, Section 15000, et seq.), also known as the California Environmental Quality Act (CEQA) Guidelines. Additionally, because the District intends to apply for the California Clean Water State Revolving Fund Program, partially funded by the U.S. Environmental Protection Agency (USEPA), this addendum has been prepared to address certain federal environmental regulations, including regulations guiding the General Conformity Rule for the Clean Air Act (CAA), the federal Endangered Species Act (FESA), and the National Historic Preservation Act (NHPA). USEPA has allowed a modified CEQA document, called CEQA-Plus, to be the compliance base for projects applying for federal grant monies. These additional regulatory components in compliance with CEQA-Plus requirements are addressed in Sections 4.2.4 Agriculture and Forest Resources; 4.3.5, Air Quality; 4.4.5, Biological Resources; 4.5.6, Cultural Resources; 4.10.4, Hydrology and Water Quality; and 4.13.5, Noise.

1.3 INCORPORATION BY REFERENCE

In compliance with CEQA Guidelines Section 15150, this Initial Study has incorporated by reference the following CEQA compliance documents that were prepared for similar improvements to the CLOCWD water treatment infrastructure:

- Initial Study: Clearlake Oaks County Water District, Water Infrastructure Rehabilitation Project; April 2014: State Clearing House (SCH) Number 2014042074, and
- Revised Initial Study: Clearlake Oaks County Water District, Revised Water Infrastructure Rehabilitation Project; June 2017: SCH Number 2014042074.

1.4 SUMMARY OF FINDINGS

Section 4 of this document contains the analysis and discussion of potential environmental impacts resulting from construction and implementation of the Proposed Project. Based on the resources evaluated, it was determined that the Proposed Project would have no impact on the following resources:

- Aesthetics
- Agriculture and Forestry Resources
- Mineral Resources
- Population/Housing
- Public Services

- Recreation

Impacts of the Proposed Project were determined to be less than significant for the following resources:

- Energy
- Land Use and Planning
- Utilities and Service Systems

Impacts of the Proposed Project to the following resources would be less than significant with the incorporation of mitigation measures:

- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Noise
- Transportation
- Tribal Cultural Resources
- Wildfire

1.5 DOCUMENT ORGANIZATION

This Initial Study/Mitigated Negative Declaration (IS/MND) contains the following six sections plus appendices:

- **Section 1**, Introduction, provides a project summary/environmental checklist form, and an overview of the Proposed Project and the CEQA process.
- **Section 2**, Project Description, provides a detailed description of Proposed Project components.
- **Section 3**, Determination, identifies the environmental factors potentially affected based on the analyses contained in this IS and includes the Lead Agency's determination based upon those analyses.
- **Section 4**, Evaluation of Environmental Impacts, presents the CEQA checklist and environmental analyses for all impact areas and the mandatory findings of significance. A brief discussion of the reasons why the project impact is anticipated to be less than significant or why no impacts are expected is included. Mitigation measures are incorporated and discussed where appropriate to reduce potentially significant impacts to less-than-significant levels.
- **Section 5,** References, contains the bibliography of resources cited within this document.
- **Section 6,** Preparers, includes the list of preparers.

Section 2 | Project Description

This section provides a description of the Proposed Project that serves as the basis for the assessment of potential environmental impacts in **Section 4.0**.

2.1 PROJECT LOCATION

The Clearlake Oaks County Water District (CLOCWD or District) Water Infrastructure and Rehabilitation Project (Proposed Project) involves improvements to various components of the water distribution system, including the water treatment plant (WTP), located at 12952 CA-20, Clearlake Oaks, CA 95423 and within the distribution pipelines, storage tanks, and associated pump stations in and around the community of Clearlake Oaks in Lake County, California adjacent to Clear Lake. The improvement areas are located in Sections 29-33 of Township 14 North, Range 7 West and Sections 21, 34, and 36 of Township 14 North, Range 8 West as depicted on the Mount Diablo Principal Meridian U.S. Geological Survey (USGS) 7.5' Clearlake Oaks quadrangle map and Section 21 of Township 14 North, Range 8 West as depicted on the Mount Diablo Principal Meridian USGS 7.5' Lucerne quadrangle map. **Figure 1** and **Figure 2** show the location of the various improvements included within the Proposed Project .

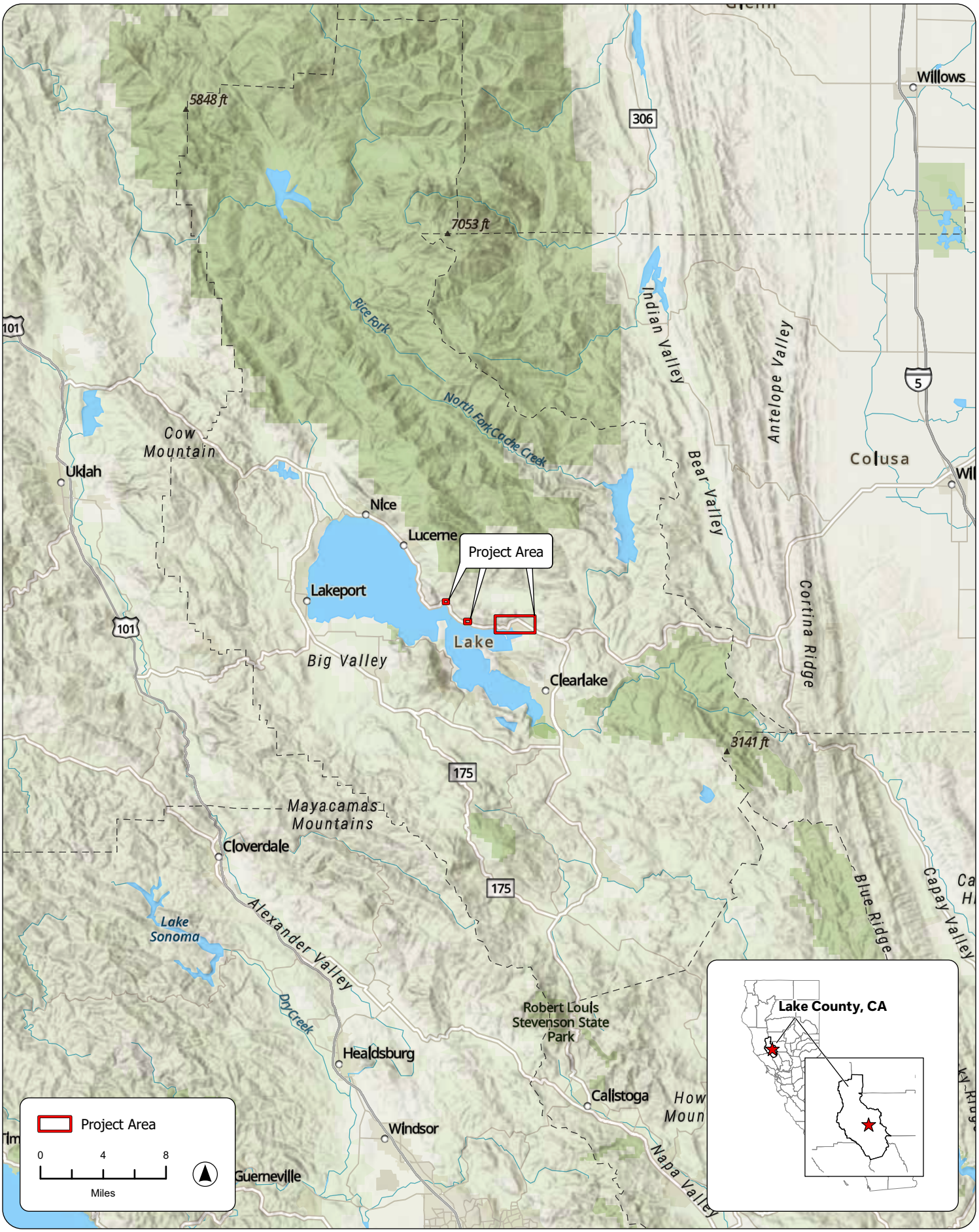
2.2 PROJECT OBJECTIVES

The District has identified the following objectives for the Proposed Project, which seeks to upgrade or replace existing water infrastructure in order to:

- Improve efficiency and capacity of WTP operations to meet historic and anticipated future maximum daily demands;
- Reduce water loss in the distribution system, which is currently in the range of 40% - 50% of the District's annual water production;
- Improve water quality to meet the California Department of Public Health drinking water requirements and minimize the need for "boil water" events;
- Provide system redundancy and supply reliability through improvements to water storage and other critical system functions;
- Make efficient use of existing public facilities in order to reduce infrastructure costs; and
- Implement project elements that avoid or minimize adverse environmental impacts.

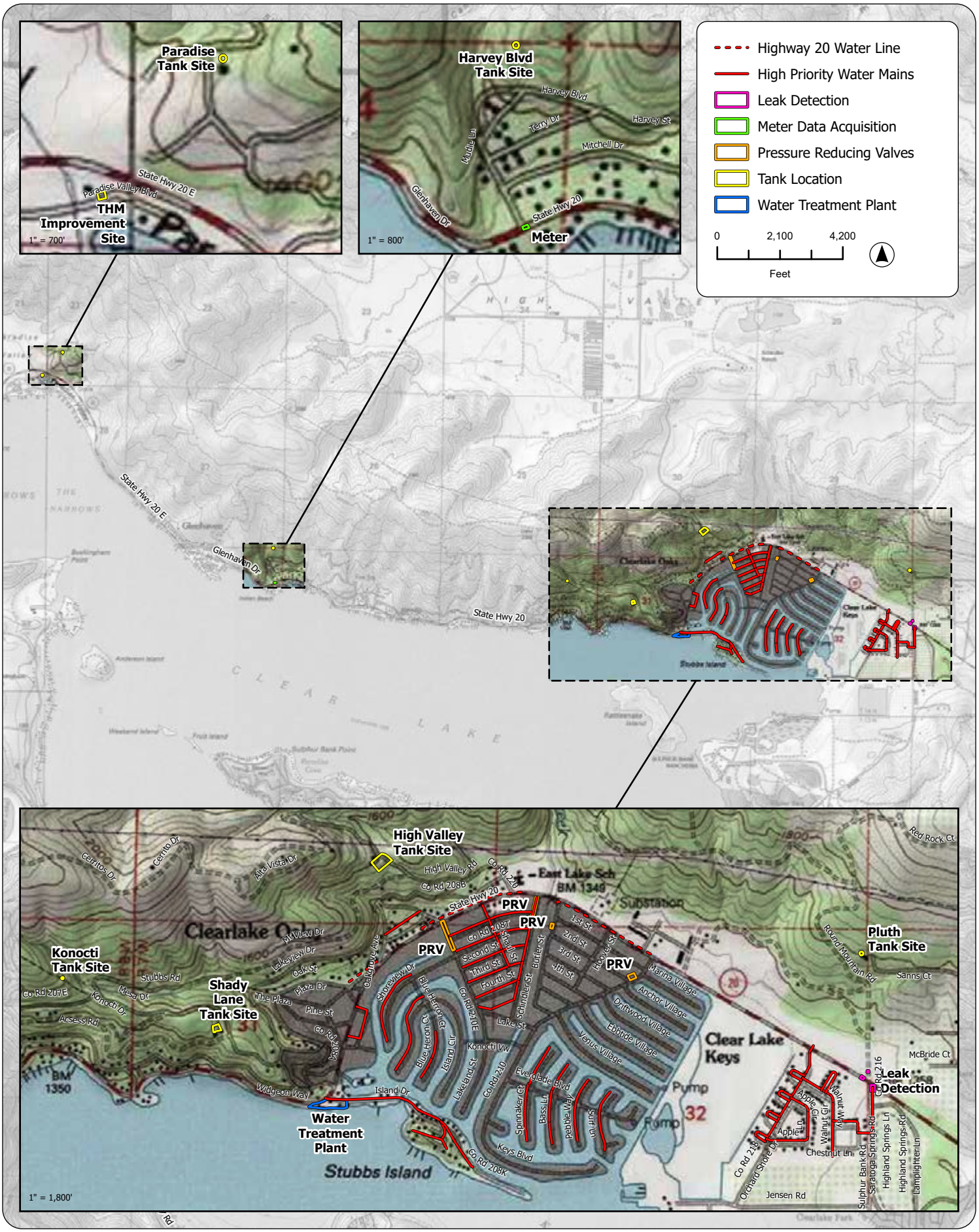
2.3 PROJECT DESCRIPTION

The following components of the Proposed Project are described in detail within the Amended WMP and Engineering Report, included as **Appendix A**, and are shown on **Figure 3**.



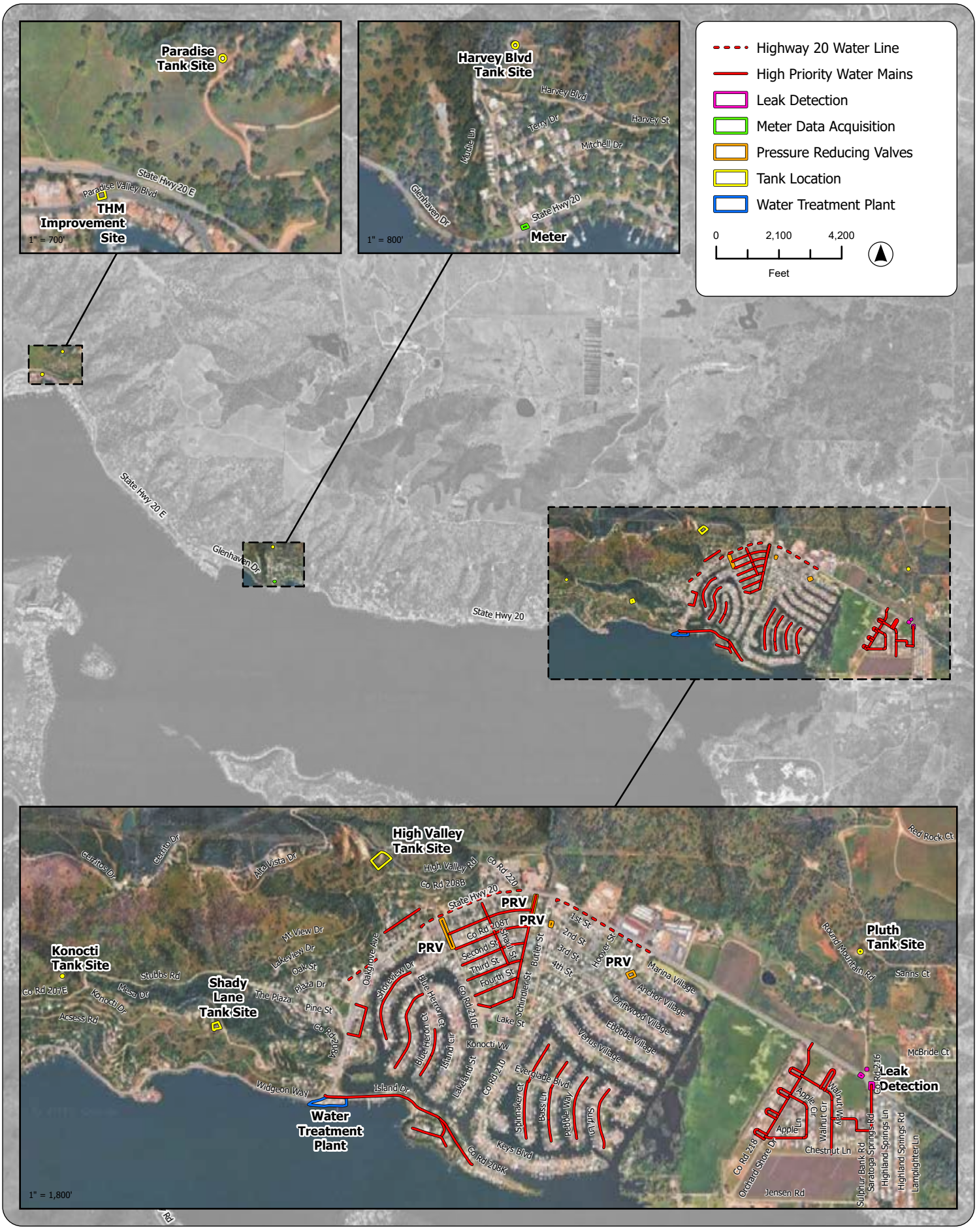
SOURCE: ESRI, 2026; Acorn Environmental, 1/30/2026

Figure 1
Regional Location



SOURCE: "Lucerene, CA" & "Clearlake Oaks, CA" USGS 7.5 Minute Topographic Quadrangles, T14N R7W & T14N R8W, Sections 21, 29, 30, 31, 32, 33, 34, Mt. Diablo Baseline & Meridian; ESRI, 2026; Acorn Environmental, 2/10/2026

Figure 2
Site and Vicinity



SOURCE: ESRI, 2026; Google Earth Aerial Photograph, 5/2024; Acorn Environmental, 2/10/2026

Figure 3
Aerial Overview

2.3.1 Project Components

Water Treatment Plant Improvements

Ozone Generation

The Proposed Project includes modification of the ozone generation equipment to upgrade the ozone feed to a fine bubble injector which utilizes a 7.5 hp recirculation pump between the upstream and downstream locations of the contact tower. The use of fine bubble zone injection is intended to enhance the disinfection capacity of the ozone contact tower and reduce ozone demand. There would not be any ground disturbance for this component as it consists only of mechanical improvements to the existing equipment. For a detailed description of this proposed project see Sections 5.2.1 and 6.2.7 of the Amended WMP included in **Appendix A**.

Equalization Tank Improvements

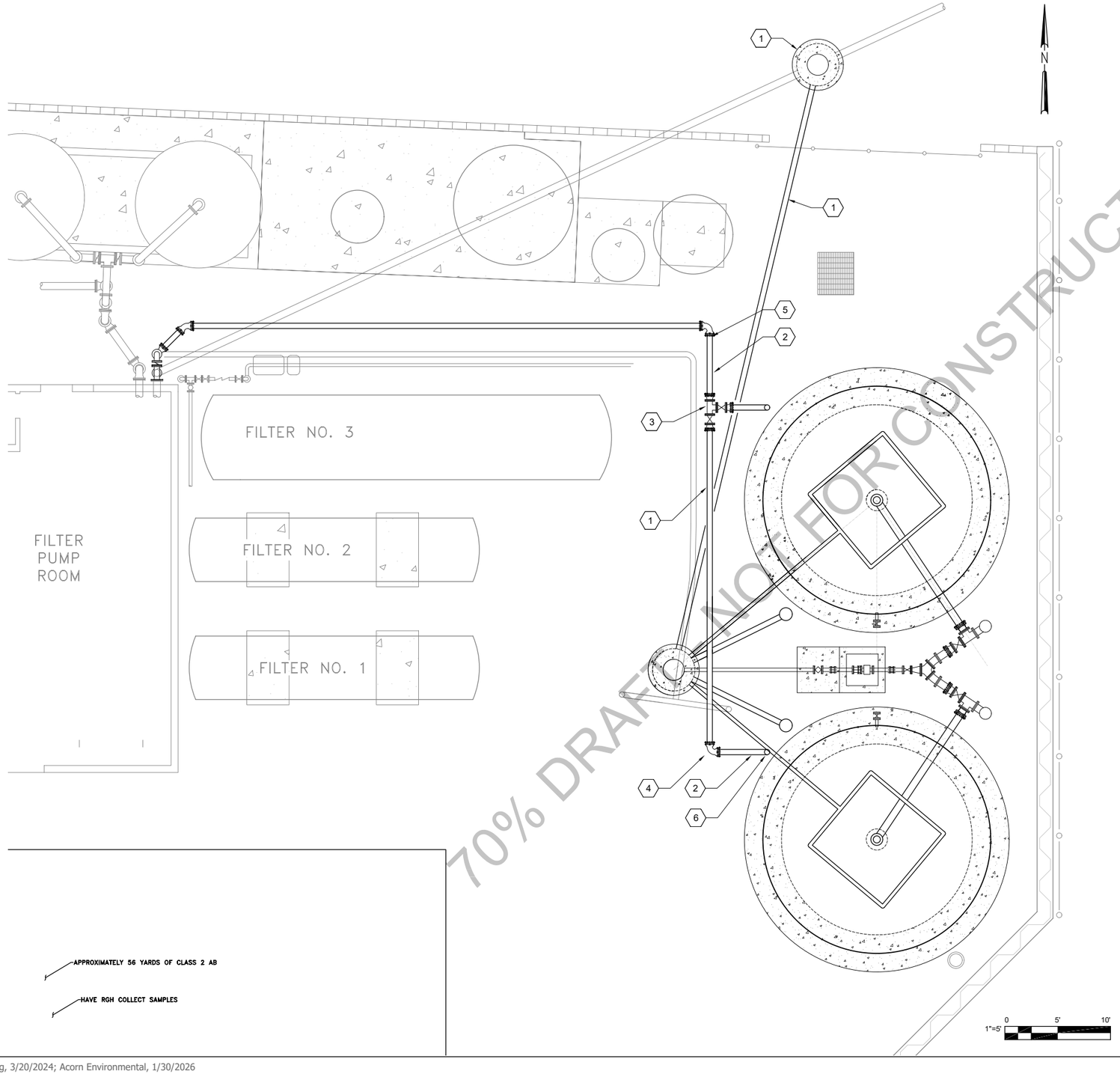
The Proposed Project includes replacement of the existing temporary backwash tanks and associated piping on the east side of the WTP because the tanks have reached the end of their life expectancy. Additionally, the replacement is needed to increase source capacity and water production rates at the WTP by allowing backwash operations to occur at any time when needed by operators. This improvement would allow staff to control the rate of discharge into the sanitary sewer thereby minimizing related disruptions to downstream sewer pump stations, the collection system pipelines, and the wastewater treatment plant (WWTP) especially during rainfall events when the wastewater treatment infrastructure is additionally stressed by stormwater inflow and infiltration. Improvements include:

- Relocation of the existing temporary holding containers;
- Installation of piping for backwash flows and tank drainages; and
- Installation of two new 30,000-gallon, open-top, bolted steel tanks and application of tank coatings on the east side of the WTP as shown in **Figure 4**.

There would be approximately 2,000 square feet of ground disturbance up to 36 inches deep for the two tanks, and 140 feet of yard piping in previously disturbed areas. For a detailed description of this proposed project see Sections 5.2.5 and 6.2.2 of the Amended WMP included in **Appendix A**.

Dissolved Air Floatation Pilot Plant

The Proposed Project includes maximizing the source capacity and increasing treated water production at the WTP through the pretreatment of the raw water and to reduce the organic loading on the existing upflow clarifiers. The Dissolved Air Floatation Pilot Plant would be housed in a trailer that would be temporarily parked at the WTP. There would not be any ground disturbance for the installation of the pilot plant. In the dissolved air floatation pilot plant unit, microbubbles will attach to suspended particles, floating them to the surface for skimming, while clarified water is withdrawn from below. The sludge that is generated will be discharged to the public sewer system. Floatation occurs in an open-top contained treatment unit. For a detailed description of this proposed project see Sections 5.2.9 and 6.3.6 of the Amended WMP included in **Appendix A**.



70% DRAFT NOT FOR CONSTRUCTION

GENERAL SHEET NOTES

1. UNO ALL PRESSURE PIPING SHALL BE AWWA C900 DR 18 INSTALLED PER TRENCH DETAIL 1 SHEET C501.
2. UNO ALL DI PIPE AND FITTINGS SHALL BE RESTRAINED W/ MEGALUG OR EQ. AS APPROVED BY ENGINEER. ALL DI FITTINGS SHALL BE ENCASED IN POLYETHYLENE PER AWWA C105-10.
3. UNO PROVIDE G5 VALVE BOX AND PVC RISER PER DETAIL 5 SHEET C502 AT ALL BURIED VALVES.
4. ELECTRICAL PULL BOXES, CONDUITS, AND OTHER APPURTENANCES NOT SHOWN FOR CLARITY, SEE ELECTRICAL SHEETS.
5. FOR ALL TANK PIPING CONNECTIONS AND TANK APPURTENANCES SEE MECHANICAL SHEETS.

KEYNOTES

1. 8" C900
2. 6" C900
3. SEE DETAIL X ON SHEET CXXX.
4. 6" MJ 90 RESTRAINED W/ MEGALUG
5. 8" MJ 90 RESTRAINED W/ MEGALUG

SOURCE: MC Engineering, 3/20/2024; Acorn Environmental, 1/30/2026

Figure 4
Equalization Tank Improvement Plan

Water Storage Tank and Booster Pump Improvements

Water storage tank and booster pump upgrades proposed under the Proposed Project are summarized below by tank site. In addition to these upgrades, the Proposed Project would also include the construction of some piping, valves, and other appurtenances at each of the Proposed Project improvement areas, with the exception of the Konocti Tank Site.

High Valley Tank and Booster Station

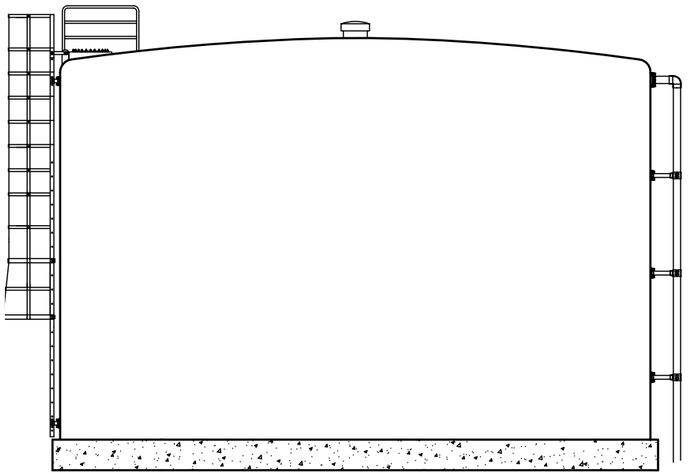
The District currently owns and operates an existing 20 HP booster pump within the High Valley Tank Site. The site previously contained two water storage tanks which have since been removed due to structural deficiencies, leaving behind an empty, graded lot. The Proposed Project includes the construction of a 180,000-gallon steel tank, new booster pump station, and pump station bypass control valve as conceptually shown on **Figure 5**. The installation of a new booster pump station is needed to facilitate water supply for diurnal flows and to improve fire flow capacities and the installation of a welded steel water storage tank is needed to increase water storage. After the relocation of the pump station the 6 inch pipe would be removed, along with 120 linear feet of fence and posts. The pump house would consist of concrete masonry unit construction and feature (3) 50 HP multi stage vertical in-line pumps. The building footprint would measure approximately 34 feet by 12 feet and also house three Variable Frequency Drive panels, a general Programmable Logic Controller (PLC)panel, power panel, transformer and lighting panel, magnetic flow meter, discharge piping, and fittings.

Other site improvements would consist of bypass piping around the tank, pump bypass valving, site paving, site drainage, upgraded Pacific Gas & Electric (PG&E) service to 480V, and a retaining wall to hold back debris from the eroding hillside. The bypass piping would require up to 54 inches of excavation below finished grade. The paved area would be approximately 6,000 square feet with minimal cut of the east side of the property and fill on the west side of the property. The retaining wall would be located along the eastern side of the property and be approximately 10 feet tall. For a detailed description of this proposed project see Sections 5.4.2 and 6.1.4 of the Amended WMP included in **Appendix A**.

Shady Lane Tank and Booster Station

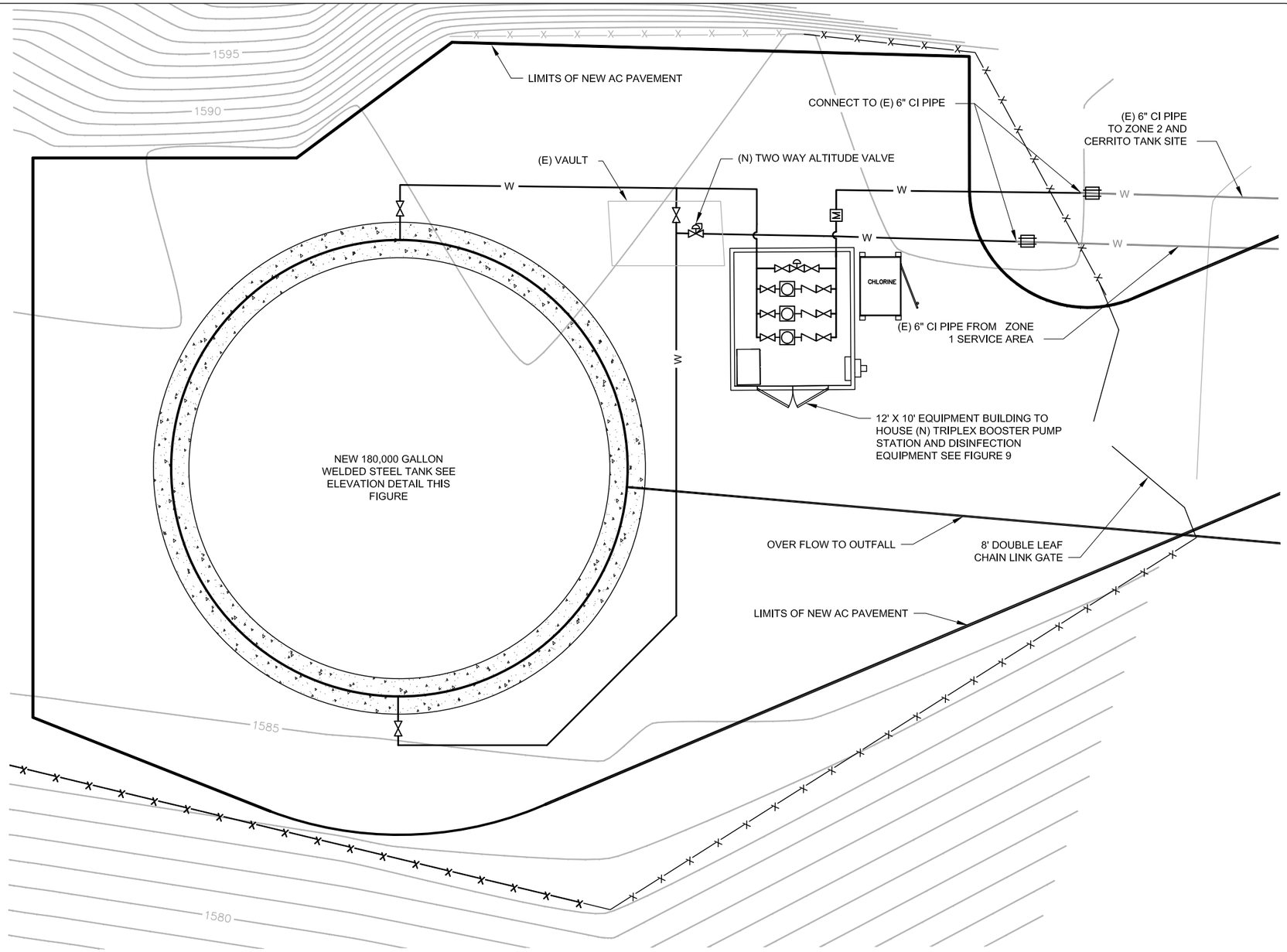
The District currently owns and operates an existing 102,204-gallon steel tank within the Shady Lane Tank Site. The Proposed Project includes construction of outdated and aging booster pumps and associated piping, pump house, electrical work, equipment pad, and a portable generator. The existing pump would be removed and replaced with two more efficient 20 hp pumps and includes the replacement of the magnetic flow meter as conceptually shown on **Figure 6**. Other site improvements would consist of bypass piping around the tank that would require up to 54 inches of excavation below finished grade. In addition, the Proposed Project includes upgrades to the exterior and interior of the tank. These upgrades are needed to extend the service life of critical infrastructure, to provide water for Maximum Day Demand (MDD) and to protect drinking water quality. The project would include installation of sacrificial a cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades that include the following:

- Replace center vent with AWWA compliant mushroom vent;
- Replace the interior ladder;
- Replace the circular hatch with a rectangular hatch;
- Install a self-closing gate; and



WELDED STEEL TANK ELEVATION

SCALE: NTS



GATE VALVE
MAGNETIC FLOW METER
ALTITUDE VALVE
TURBINE PUMP
FCA
CHECK VALVE
SURGE RELIEF VALVE
(N) FENCE
(E) FENCE

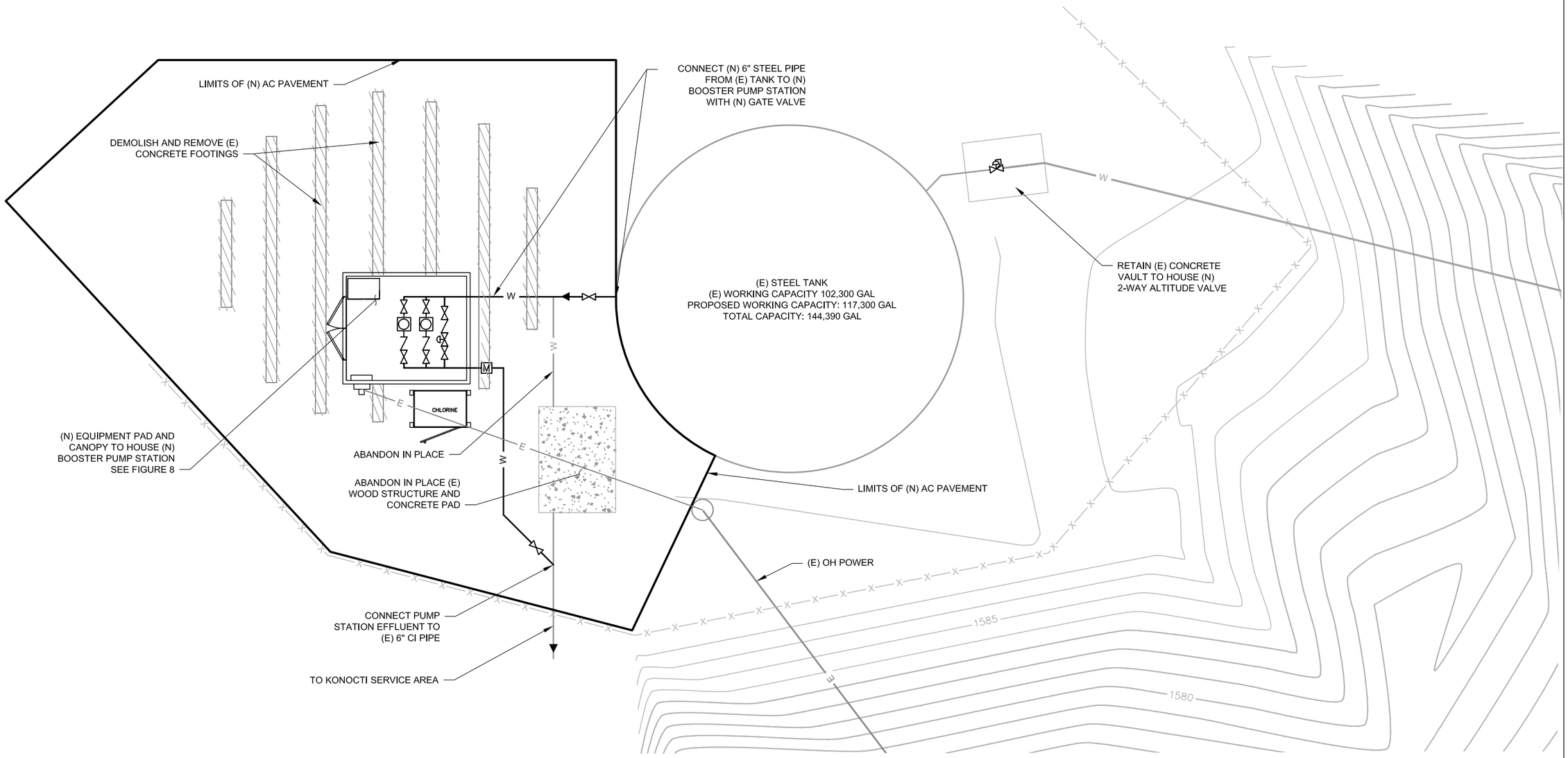
1"=10' 0 10' 20'

1"=40' 0 40' 80'

SOURCE: MC Engineering, 9/2025; Acorn Environmental, 2/10/2026

Figure 5

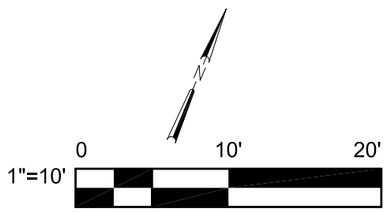
Conceptual High Valley Tank Site Improvement Plan



SITE PLAN

SCALE: 1" = 10'

GATE VALVE
MAGNETIC FLOW METER
ALTITUDE VALVE
TURBINE PUMP
CHECK VALVE
SURGE RELIEF VALVE
(E) FENCE



SOURCE: MC Engineering, 9/2025; Acorn Environmental, 2/10/2026

Figure 6
Conceptual Shady Lane Tank Site Improvement Plan

- Installation of 6 inch bypass piping to allow continued service to the Konocti pressure zone during tank rehabilitation.

For a detailed description of this proposed project see Sections 5.4.1, 5.4.7, 6.1.3, and 6.1.5 of the Amended WMP included in **Appendix A**.

Konocti Tank

The Proposed Project includes upgrades to the exterior and interior of the tank. In addition, the project includes the potential installation of a Trihalomethane (THM) reduction system dependent on available power supply. If the THM reduction system is not installed here, it will be installed at the Harvey Tank Site, described below. These upgrades are needed to extend the service life of critical infrastructure, to provide water for MDD and to protect drinking water quality. No ground disturbance is anticipated. The project would include the installation of an impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades that include the followings:

- Replace the corroded circular hatch with a rectangular hatch;
- Replace the undersized vent with a larger AWWA mushroom vent;
- Install the self-closing gate; and
- Install 40,000 gallons of temporary storage by use of polyethylene tanks and modified site piping.

For a detailed description of this proposed project see Sections 5.4.7 and 6.1.6 of the Amended WMP included in **Appendix A**.

Pluth Tank

The Proposed Project includes upgrades to the exterior and interior of the tank. These upgrades are needed to extend the service life of critical infrastructure, to provide water for MDD and to protect drinking water quality. No ground disturbance is anticipated. The project would include installation of an impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades that include the following:

- Replace center vent with AWWA compliant mushroom vent and
- Replace the interior ladder.

For a detailed description of this proposed project see Sections 5.4.7 and 6.2.8 of the Amended WMP included in **Appendix A**. The existing redwood tank at this location that has been abandoned in place and no longer in active use may be demolished as part of the Proposed Project.

Harvey Tank DBP (Disinfection Byproducts) System

The project includes installation of a mixer and power vent at the tank site. In addition, it includes the potential installation of a THM reduction system dependent on available power supply. If the THM reduction system is not installed here, it will be installed at the Konocti Tank Site, described above. The booster pump station provides the option of conveying flows from the Harvey tank to augment supply during times of high demand. High THM levels within the distribution system threaten the District's ability

to meet regulatory compliance. The ability to drain the tank and pump back to Zone 1 is recommended for fire and emergency purposes and to help mitigate DBP formation.

For a detailed description of this proposed project see Sections 2.6.1.1 and 4.4.3 of the Amended WMP included in **Appendix A**.

Paradise Tank THM Reduction Piping

The Proposed Project consists of hydraulicly separating the west side of the Paradise Cove community from the east side such that all flows entering the west side are downstream of the THM removal equipment within the Paradise tank. These improvements consist of rehabilitating an existing 6-inch pipeline between the Paradise Valley Boulevard and the Paradise Tank and modify piping connections.

Off of Paradise Valley Boulevard (labeled as THM Improvement Site on **Figure 3**) disturbance will include trenching up to 20 feet by 4 feet and would be excavated up to 4 feet to install the necessary components.

The Paradise tank site would have two open trenches approximately 30 feet by 2 feet and 20 feet by 4 feet and would be excavated up to 4 feet deep to install the necessary components.

For a detailed description of this proposed project see Sections 5.3.1.1 and 6.1.2 of the Amended WMP included in **Appendix A**.

Distribution System Improvements

Highway 20 Water Line

The Proposed Project includes removing and replacing the 4 inch pipeline with the addition of a larger capacity pipe to provide adequate peak flows and decrease water loss be reducing the pressure in the Keys. Currently, a 4 inch line restricts flow to the Keys and to the Pluth Tanks. Open trenching would be used for all pipeline replacements with a maximum depth of 4.5 feet and width of 4 feet.

For a detailed description of this proposed project see Sections 4.3.1, 5.3.1, and 6.2.10 of the Amended WMP included in **Appendix A**.

High Priority Water Mains

The Proposed Project includes replacing deficient, leaking, and undersized water mains. The high priority water mains are located at the following:

- 1st Street through 6th Street
- Lake Street and Schindler Street
- Orchard Shore Drive
- Walnut Circle
- Chestnut Circle
- Peach Circle
- Sulphur Bank
- Shoreview Drive
- Blue Heron Court
- Center Way
- Island Circle (West)
- Hickory Lane
- Short Street
- Island Drive
- Oak Knoll
- Spinnaker Court
- Bass Lane
- Surf Lane
- Orchard Shores Drive
- Apple Lane
- Lemon Circle
- Plum Circle
- Grape Circle
- Pebble Way

The pipeline replacements include construction and installation of 6-, 8-, 10-, and 12-inch mains to be constructed with C900 PVC-DR 14 pipe, air relief valves, hydrants, and possible Pressure Reducing Valves (PRV's). The project would also include the construction of either single or double ¾-inch or 1-inch house services, which would have the following services installed during construction: service saddle, polyethylene pipe, valves and meter boxes. All pipeline replacements would be open trenches with a maximum depth of 4.5 feet and maximum width of 4 feet. For a detailed description of this proposed project see Sections 5.3.1 and 6.1.1 of the Amended WMP included in **Appendix A**.

Meter Data Consolidation and Water Loss Management System

The Proposed Project is to implement a system wide metering system which tracks all District Metered Area (DMA) flow data on a single platform to better quantify and identify water loss. The current system is an excel based water loss management system and it uses a combination of Supervisory Control and Data Acquisition (SCADA) flowmeter reads, Badger cellular flowmeter reads, and Badger drive-by reads. These multiple formats result in a complex program that is challenging to run. The three flowmeters, which are currently only read by SCADA, would be upgraded and replaced to the dual output 4/20 and Badger Cellular format. The three existing DMA flowmeters would be replaced with new meters that are more reliable and share a common data output format. The DMA model would be simplified for ease of use to the District staff. The locations of the three new magnetic flow meters would be at the WTP in the pump building, at the Shady Lane Booster Station, and the Harvey PRV vault. For a detailed description of this proposed project see Sections 5.3.5.1 and 6.2.4 of the Amended WMP included in **Appendix A**.

Pressure Reducing Valves

The Proposed Project includes installation of four PRV's with the intent of lowering system pressures as a way of reducing water loss as shown in **Figure 3**. In addition, PRVs will reduce fire flow by reducing pressure in the Keys. All PRV's will be installed at once Bypass valves would be included to avoid limiting fire flow capacity and residual pressures. The installation would include approximately 8 to 10 feet by 7 to 9 feet of excavation, with a depth of 6 feet at each of the four locations.

For a detailed description of this proposed project see Section 4.3.4.1 of the Amended WMP included in **Appendix A**.

Operational Maintenance Management

SCADA System Upgrades

The Proposed Project includes replacement of the obsolete 300 series SCADA Pack controllers with modern controllers. Two SCADA Pack controllers identified to be replaced include one within the filter pump building and one in the high service pump room. Improvements within the filter room would consist of replacing the two SCADA Packs with a single controller and I/O modules within a new enclosure. The existing SCADA Pack within the high service pump room would also be replaced with a controller and remain within the existing enclosure. The existing Ignition SCADA operator interface would need to be modified to communicate with the new PLCs and an electrician would need to be retained to assist in disconnecting the existing conduit, pull instrument control wiring, install new enclosures, and install conductors and conduit. For a detailed description of this proposed project see Sections 5.5.7 of the Amended WMP included in **Appendix A**.

Cross Connection Hazard Assessment

The Proposed Project includes development of a cross-connection hazard assessment, including identification of service connections where backflow prevention devices are required, updated construction drawing details, and the development of a workplan for customer compliance enforcement. It would include standards for installation of backflow protection devices at select connections that pose a threat to the District's distribution system. It is intended to supplement the 2025 Cross Connection Control Plan. The assessment will comply with the California Cross Connection Control Policy Handbook. For a detailed description of this proposed project see Sections 5.3.4.1 and 6.2.5 of the Amended WMP included in **Appendix A**.

Leak Detection Program

Development of a leak detection program is the cornerstone of reducing water loss in the distribution system and would allow the CLOCWD to proactively repair failing lines. The Program would consist of performing system wide acoustic surveys and making associated repairs to prevent future water shortages. Additionally, this component includes potholing in the vicinity of a valve cluster near the intersection of Highway 20 and Sulphur Bank Drive (see **Figure 3**) to verify what the purpose of each valve is in order to look for water leaks in the vicinity and to connect the proposed new water mains to the system. For a detailed description of this proposed project see Sections 5.5.3 and 6.2.6 of the Amended WMP included in **Appendix A**.

2.3.2 Construction and Timing

Energy efficient construction equipment would be used to the extent feasible. Construction of the Proposed Project would last approximately 18 months, with a tentative start date of May 1, 2027. Some of the work would be completed simultaneously, but the majority of the construction would be staggered. The following equipment may be used during construction:

- Backhoes and excavators
- Trenchers and loaders
- Dump trucks
- Pavers and rollers
- Trash/waste storage
- Small crane
- Welding equipment
- Material stockpiles/supply yards
- Generators and compressors
- Hand tools
- Boring and trenching equipment
- Service trucks with crane attachments
- Jack/bore and scaffolding
- Water and pump trucks
- Compactors

Due to the uncertainty of the exact locations of underground utilities, a locating service would be utilized to locate all existing utilities prior to any ground disturbance.

Section 3 | Determination

3.1 ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

As indicated by the discussions of existing and baseline conditions, and impact analyses that follow in this Section, environmental factors not checked below would have no impacts or less than significant impacts resulting from the project. Environmental factors that are checked below would have potentially significant impacts resulting from the project. Mitigation measures are recommended for each of the potentially significant impacts that would reduce the impact to less than significant.

☐ Aesthetics	☐ Agricultural/Forestry Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☐ Energy
☒ Geology/Soils	☒ Greenhouse Gas Emissions	☒ Hazards and Hazardous Materials
☒ Hydrology/Water Quality	☐ Land Use/Planning	☐ Mineral Resources
☒ Noise	☐ Population/Housing	☐ Public Services
☐ Recreation	☒ Transportation	☒ Tribal Cultural Resources
☐ Utilities/Service Systems	☒ Wildfire	☒ Mandatory Findings of Significance

The analyses of environmental impacts in **Section 4**, **Impact Analysis**, result in an impact statement, which shall have the following meanings.

Potentially Significant Impact: This category is applicable if there is substantial evidence that an effect may be significant, and no feasible mitigation measures can be identified to reduce impacts to a less than significant level. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

Less than Significant with Mitigation Incorporated: This category applies where the incorporation of mitigation measures would reduce an effect from a "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measure(s) and briefly explain how they would reduce the effect to a less than significant level (mitigation measures from earlier analyses may be cross-referenced).

Less Than Significant Impact: This category is identified when the proposed project would result in impacts below the threshold of significance, and no mitigation measures are required.

No Impact: This category applies when a project would not create an impact in the specific environmental issue area. "No Impact" answers do not require a detailed explanation if they are adequately supported by the information sources cited by the lead agency, which show that the impact does not apply to the

specific project (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

3.2 DETERMINATION

On the basis of this initial evaluation (to be completed by the Lead Agency):

- ☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
- ☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
- ☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
- ☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
- ☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Dianna Mann — **Signature**

Feb 12, 2026 — **Date**

Section 4 | Evaluation of Environmental Impacts

4.1 AESTHETICS

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) In nonurbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

4.1.1 Regulatory Setting

State

California Department of Transportation (CalTrans)

CalTrans administers the Scenic Highway Program which selects certain highway corridors in the State for their scenic qualities. For designated highways, CalTrans works to preserve and protect their scenic values through planning and design of highway projects. The Scenic Highway system includes a list of highways that have been designated and those that are eligible for designation as scenic highways.

Local

Lake County General Plan

The Lake County General Plan aims to protect and enhance aesthetics and scenic values as a part of the broader vision for land use and community development.

Policy LU-7.9 – Integrate Natural Features: The County shall emphasize each community's natural features as the visual framework for new development and redevelopment.

Policy LU-7.10 – Visual Access: The County shall maintain visual access to views of Clear Lake, hillsides, creeks, and other distinctive natural areas by regulating building orientation, height, and bulk.

Policy OSC-2.8 – Scenic Viewpoints Along Roadways, Bikeways, and Pedestrian Trails: Scenic viewpoints along roadways and multi-use trails should be provided where there are major views of specific features, such as Clear Lake, Mt. Konocti, or panoramic views of the countryside. Interpretative information should be provided at these points to help inform visitors and residents of the natural and cultural history of the County.

Policy OSC-7a.5 – Preservation of Lake Views: Development regulations and review procedures should prevent further blockage of lake views from shoreline roadways and where feasible, restore visual contact with the lake from these roadways.

County of Lake General Performance Standards

Article 41 of the County of Lake General Performance Standards outlines standards for lighting and glare as follows:

41.8 Glare and heat: All exterior lighting accessory to any use shall be hooded, shielded or opaque. No unobstructed beam of light shall be directed beyond any exterior lot line. Buildings and structures under construction are exempt from this provision.

4.1.2 Environmental Setting

The Proposed Project improvement areas are partially visible from State Route (SR) 20, as well as from Glenhaven Drive, Paradise Valley Boulevard, High Valley Road, Orchard Shore Drive, and several residential houses that surround the components of the Project.

Designated scenic highways, roadways, and resources do not occur within viewing range of the Proposed Project improvement areas (Caltrans, 2026). SR-20 is listed as an "Eligible State Scenic Highway" (Caltrans, 2025a). The nearest Officially Designated Scenic Highway is SR-116 approximately 40 miles southwest of the Proposed Project improvement areas (Caltrans, 2026).

4.1.3 Impact Assessment

a) Would the project have a substantial adverse effect on a scenic vista?

Water Treatment Plant Improvements

The water treatment plant improvements include modification of the ozone generation equipment, replacement of the existing temporary backwash tanks and associated piping at the WTP, and installation of the dissolved air floatation pilot plant. All of these improvements would occur at the WTP on Island Drive adjacent to Clear Lake. Views of the Proposed Project at the WTP from the surrounding vicinity are of the WTP building and associated infrastructure. The Proposed Project components at the WTP would mostly be internal improvements that would not alter the view of the site, except for the two new 30,000-

gallon tanks and a trailer that will house the dissolved air floatation pilot plant which would be parked on the WTP lot. **Site Photograph 1** provides an example view of the WTP.

Water Storage Tank and Booster Pump Improvements

Water storage tank improvement sites include the High Valley tank and booster station, Shady Lane tank and booster station, Konocti tank, Pluth tank, Harvey tank DBP, and Paradise tank THM. All tank sites, except for the Paradise tank THM, are located on hills elevated from SR-20. Views of the tank sites from the surrounding vicinity are typically obscured by the terrain and trees and not easily visible from nearby residences or heavily traveled roadways. **Site Photographs 2** and **3** provide example views of water tanks.

Distribution System Improvements

The Highway 20 water line, high priority water mains, meter data consolidation and water loss management system, and pressure reducing valves are all part of the distribution system improvements. These components of the Proposed Project are all either underground or would not be visible to viewers in the surrounding vicinity. Views would mostly remain as they are, a majority being of typical residential water infrastructure. The land surrounding the Highway 20 water line and high priority water mains is largely developed, residential land with typical residential limited light emitting sources. **Site Photograph 4** provides an example view of the high priority water main residential areas.

Operational Maintenance Management

The operational maintenance management components of the Proposed Project include SCADA system upgrades, cross connection hazard assessment, and a leak detection program. These components would not be visible following implementation and are more operational to improve the functioning and efficiency of the water infrastructure. Views of the Proposed Project improvement components are typical of residential water infrastructure.



Site Photograph 1: View from SR-20 and Island Drive looking southeast at WTP



Site Photograph 2: View from Mesa Drive looking west at the Shady Lane tank site



Site Photograph 3: View from Sanns Court looking west at the Pluth tank site



Site Photograph 4: View from Schindler Street looking south along a high priority water main

Conclusion

No Impact. The Proposed Project would not erect any structure that could impact scenic vistas. The Proposed Project is located near Clear Lake, although the Proposed Project would not provide a vantage point to a scenic vista and is not visible from any known scenic vista. The Proposed Project will not result in the obstruction of federal, state, or locally classified scenic areas, historic properties, community landmarks, or formally classified scenic resources, such as a scenic highway, national or state scenic area, or scenic vista. Therefore, there would be no impact.

b) Would the project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No Impact. The Proposed Project is not located along a State-designated Scenic Highway (Caltrans, 2026). While there are "Eligible State Scenic Highways" in the vicinity, the Proposed Project does not occur directly adjacent to officially designated scenic highways. All Project-related disturbance would occur in developed areas and would occur mostly below ground with the exception of some of the water tank improvements and the new water tanks and dissolved air floatation pilot plant at the WTP, minimizing any potential damage to resources such as trees, rock outcroppings, and historic buildings. Therefore, there would be no impact.

c) In nonurbanized areas, would the project substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

No Impact. The Proposed Project is located in an area zoned by the County for single family residential, two-family residential, multi-family residential, open space, rural residential, planned development – commercial, community commercial, resort commercial, suburban reserve, service commercial, planned development-residential, and rural lands (Lake County, 2025a). The improvements of the Proposed Project would not conflict with any applicable zoning and would not alter the scenic quality of the Proposed Project improvement areas. All views from publicly accessible vantage points, such as sidewalks and parking lots, will not be degraded. Therefore, the Proposed Project would have no impact on visual character.

d) Would the project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

No Impact. The Proposed Project would not introduce new sources of light to the Proposed Project improvement areas. Lighting would be similar to the sources of light from the existing WTP. The Proposed Project will be consistent with Article 41 of the County of Lake General Performance Standards which require all exterior lighting accessory to any use be hooded, shielded or opaque and no unobstructed beam of light be directed beyond any exterior lot line. Day and nighttime views in the area would not be significantly adversely impacted. Therefore, the Proposed Project would have no impact.

4.2 AGRICULTURE AND FORESTRY

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	☐	☐	☐	☒

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

4.2.1 Regulatory Setting

Federal

Farmland Protection Policy Act (FPPA)

The FPPA is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It assures that federal programs are administered in a matter that is compatible with state and local units of government, and private programs and policies to protect farmland (7 U.S. Code [USC] Section 4201). The Natural Resources Conservation Service (NRCS), responsible for the implementation of the FPPA, categorizes farmland in a number of ways. These categories include: prime farmland, farmland of statewide importance, and unique farmland. Prime farmland is considered to have the best possible features to sustain long-term productivity. Farmland of statewide importance includes farmland similar to prime farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Unique farmland is characterized by inferior soils and generally needs irrigation depending on climate. The Land Evaluation and Site Assessment is a numeric rating system used by the NRCS to evaluate the relative agricultural importance of farmlands.

State

California Farmland Mapping and Monitoring Program (FMMP)

The California FMMP, which monitors the conversion of the State's farmland to and from agricultural use, was established by the California Department of Conservation (DOC), under the Division of Land Resource Protection. The program maintains an inventory of state agricultural land and updates its "Important Farmland Series Maps" every two years. The FMMP is an informational service only and does not constitute state regulation of local land use decisions. The four categories of farmland, which include Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance, are considered valuable and any conversion of land within these categories is typically considered to be an adverse impact.

Williamson Act

The Williamson Act is a State program that was implemented to preserve agricultural land. Under the provisions of the Williamson Act (California Land Conservation Act 1965, Section 51200), landowners contract (Williamson Act Contract) with the county to maintain agricultural or open space use of their lands in return for reduced property tax assessments. The contract is self-renewing; however, the

landowner may notify the county at any time of intent to withdraw the land from its preserve status. Withdrawal from a Williamson Act contract involves a ten-year period of tax adjustment to full market value before protected agricultural/open space land can be converted to urban uses.

Public Resources Code (PRC)

The California PRC compiles statewide laws related to the conservation, utilization, and supervision of natural resources, along with mines and mining, oil and gas, and forestry. Under the PRC, Section 12220 (g) defines Forest Land as land that can support 10-percent native tree cover for any species and that allows for management of one or more forest resources. The PRC Section 4526 defines Timberland as land available for and capable of growing a crop of tress of a commercial species used to produce lumber and other forest products. The PCR Section 51104 (g) defines Timberland Production Zone as an area which has been zoned for and is devoted to growing and harvesting timber, or for growing and harvesting timber and compatible uses.

4.2.2 Environmental Setting

The Proposed Project improvement areas are primarily located within an area that was residentially developed in the 1960's (Lake County News, 2022). This area of proposed improvements was previously marsh wetland, now known as the Clearlake Keys. The improvement areas mostly follow paved roadways and areas previously graded for existing water tanks. Historical imagery does not show evidence of agriculture or forestry use in the path of the Proposed Project. The FMMP identified the Proposed Project as being located in mostly Urban and Built-up Land, with some portions going through Grazing Land (DOC, 2025a). Urban and Built-up Land is commonly residential, commercial, and industrial, and is occupied by structures with a building density of 1 unit to 1.5 acres or 6 structures to 10 acres, approximately. The NRCS prepared a custom soil resource report for the Proposed Project improvement areas (NRCS, 2026).

4.2.3 Impact Assessment

a) Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

No Impact. The Proposed Project improvement areas are not currently used for agriculture, nor identified as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance per the FMMP (DOC, 2025a). Additionally, the rehabilitation of the water infrastructure would not cause the conversion of any land. Therefore, the Proposed Project would have no impact on farmland.

b) Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?

No Impact. The Proposed Project improvement areas are not zoned as agricultural land. None of the land within the improvement areas is subject to a Williamson Act contract. Although construction would involve trenching and some ground disturbance to make replacements or improvements, the land would be returned to its previous state following the infrastructure rehabilitation. Therefore, the Proposed Project would have no impact.

c) Would the project conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?

No Impact. The Proposed Project improvement areas and surrounding land uses are not zoned as forest land (as defined in PRC Section 12220 (g)), timberland (as defined by PRC section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g)). Therefore, there would be no impact to the existing zoning or cause rezoning for these land types.

d) Would the project result in the loss of forest land or conversion of forest land to non-forest use?

No Impact. The Proposed Project improvement areas do not contain any forest land and would not result in the loss or conversion of any forest land. Therefore, the Proposed Project would have no impact on timberland or forest land.

e) Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

No Impact. The Proposed Project will not involve changes to the existing environment which could result in the conversion of Farmland to non-agricultural use or conversion of forest land to non-forest use. Therefore, no impact would occur.

4.2.4 Compliance with Federal Environmental Laws and Regulations

As discussed above, the Proposed Project is not in areas designated as protected farmland by the NRCS under the FPPA. The Proposed Project will not involve changes to the existing environment which could result in the conversion of farmland to non-agricultural use. Therefore, the Proposed Project would not result in direct or indirect impacts to federally protected farmland. The Proposed Project would comply with all federal regulations relating to agricultural resources, including the FPPA.

4.3 AIR QUALITY

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	☐	☐	☒	☐

c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☒	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☐	☒	☐

4.3.1 Regulatory Setting

Federal

Clean Air Act of 1970

The CAA; 42 USC Chapter 85 is the federal legislation for the protection of air quality. The CAA gives the USEPA authority to regulate air quality by promulgating standards and levels for air quality and enforcing those standards and levels on federal, state, and tribal land. The CAA requires the USEPA to regulate Hazardous Air Pollutants (HAPs), which are those pollutants that are known or suspected of causing cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

The Federal CAA of 1970, as amended, establishes air quality standards for several Criteria Air Pollutants (CAPs): ozone (O_3), carbon monoxide (CO), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). These pollutants are termed "criteria" pollutants because the USEPA has established specific concentration threshold criteria based upon specific medical evidence of health effects or visibility reduction, soiling, nuisance, and other forms of damage. These National Ambient Air Quality Standards (NAAQS) are divided into primary and secondary standards. Primary standards are designed to protect public health, and secondary standards are intended to protect public welfare from effects such as visibility reduction, soiling, nuisance, and other forms of damage. NAAQS and California Ambient air quality standards (CAAQS) are presented in **Table 4.3-1.**

Areas are designated attainment, nonattainment, or maintenance by the USEPA depending on whether the area is below or exceeds the established NAAQS. Nonattainment areas must take steps towards attainment within a specific period of time. Once an area reaches attainment for a particular criteria pollutant, then the area is re-designated to attainment. The CAA places most of the responsibility on states to achieve compliance with the NAAQS. States, municipal statistical areas, and counties that contain areas of nonattainment are required to develop a State Implementation Plan, which outlines policies and procedures designed to bring the state into compliance with the NAAQS.

Table 4.3-1: Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards Concentration	National Standards Primary	National Standards Secondary
Ozone (O_3)	1 hour	0.09 ppm (180 µg/m^3)	–	Same as primary
Ozone (O_3)	8 hours	0.070 ppm (137 µg/m^3)	0.070 ppm (147 µg/m^3)	standard
Respirable particulate matter (PM_{10})	24 hours	50 µg/m^3	150 µg/m^3	Same as primary

Pollutant	Averaging Time	California Standards Concentration	National Standards Primary	National Standards Secondary
Respirable particulate matter (PM_{10})	Annual arithmetic mean	20 µg/m^3	–	standard
Fine particulate matter ($PM_{2.5}$)	24 hours	–	35 µg/m^3	Same as primary standard
Fine particulate matter ($PM_{2.5}$)	Annual arithmetic mean	12 µg/m^3	9.0 µg/m^3	15 µg/m
Carbon monoxide (CO)	8 hours	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	–
Carbon monoxide (CO)	1 hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	–
Carbon monoxide (CO)	8 hours (Lake Tahoe)	6 ppm (7 mg/m^3)	–	–
Nitrogen Dioxide (NO_2)	Annual arithmetic mean	0.030 ppm (57 µg/m^3)	0.053 ppm (100 µg/m^3)	Same as primary standard
Nitrogen Dioxide (NO_2)	1 hour	0.18 ppm (339 µg/m^3)	100 ppb (188 µg/m^3)	–
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	–	0.030 ppm (for certain areas) [h]	–
Sulfur Dioxide (SO_2) [9]	24 hours	0.04 ppm (105 µg/m^3)	0.14 ppm (for certain areas)	–
Sulfur dioxide (SO_2)	3 hours	–	–	0.5 ppm (1,300 µg/m^3)
Sulfur dioxide (SO_2)	1 hour	0.25 ppm (655 µg/m^3)	75 ppb (196 µg/m^3)	–
Lead (Pb)	30-day average	1.5 µg/m^3	–	–
Lead (Pb)	Calendar quarter	–	1.5 µg/m^3 (for certain areas)	Same as primary standard
Lead (Pb)	Rolling 3- month average	–	0.15 µg/m3	
Visibility-reducing particles	8 hours	See footnote [1]	No national standards	No national standards
Sulfates	24 hours	25 µg/m3	No national standards	No national standards
Hydrogen sulfide	1 hour	0.03 ppm (42 µg/m^3)	No National Standards	No National Standards
Vinyl Chloride	24 hours	0.01 ppm (26 µg/m^3)	No National Standards	No national standards

Notes: µg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; ppb = parts per billion; ppm = parts per million

[1] In 1989, the Air Resources Board converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively

Source: CARB, 2024

State

California Clean Air Act of 1988

The California Air Resources Board (CARB) oversees air quality planning and control throughout California. CARB is primarily responsible for ensuring implementation of the California CAA, responding to the CAA requirements, and regulating emissions from motor vehicles and consumer products in the State. CARB has established emissions standards for vehicles sold in California and for various types of equipment available commercially. It also sets fuel specifications to further reduce vehicular emissions.

The CCAA establishes ambient air quality standards for the state and a legal mandate to achieve these standards by the earliest practical date. These standards apply to the same six criteria pollutants as the CAA and also include sulfate, visibility, hydrogen sulfide, and vinyl chloride. They are generally more stringent than the NAAQS and, in the case of PM_{10} and NO_2, are far more stringent. CAAQS are health-based to protect the health and welfare of the populace with a reasonable margin of safety. These pollutants include ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, sulfates, Pb, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. **Table 4.3-1** provides the federal and state ambient air quality standards.

Local

Lake County Air Quality Management District

Lake County Air Quality Management District (LCAQMD) is a regional agency that regulates stationary sources of air pollution within the Lake County Air Basin (LCAB). Its primary purpose is to enforce local, state, and federal air quality law, rules, and regulations in order to satisfy ambient air quality standards and protect the public from harm due to poor air health.

All projects in Lake County and in the community of Clearlake Oaks are subject to applicable LCAQMD rules and regulations in effect at the time of construction. Descriptions of specific rules applicable to the Proposed Project may include, but are not limited to:

- Visible emissions shall meet the standards in accordance with Chapter II, Article I Visible Emissions.
- Particulate matter emissions from combustible sources shall meet the standards in accordance with Chapter II, Article II Particulate Matter Emissions (LCAQMD, 2001).

The LCAQMD has not adopted air quality thresholds for the determination of impact significance for projects subject to CEQA review.

Lake County General Plan

The Lake County General Plan contains the following policies and implementation measures related to air quality that are relevant to the Proposed Project:

Goal HS-3: To reduce the generation of air pollutants and promote non-polluting activities to minimize impacts to human health and the economy of the County.

> **Policy HS-3.2.** Best Available Air Pollution Control Technologies. The County shall require the use of the best available air pollution control technologies to maintain healthful air quality and high visibility standards, along with continuing compliance with State and Federal Ambient Air Quality Standards.

Policy HS-3.9. Air Quality Analysis. The County may require an analysis of potential air quality impacts associated with significant new developments through the environmental review process, and identification of appropriate mitigation measures prior to approval of any major development project.

Policy HS-3.10. Dust Suppression During Construction. The County shall require dust-suppression measures for grading activities, and asbestos dust hazard mitigation plans for projects located in Naturally Occurring Asbestos Areas.

4.3.2 Environmental Setting

Climate and Topography

The Proposed Project is located in Lake County, California, within the LCAB. The LCAB is situated between northwest–southeast-trending mountain ridges at the southern end of the northern Coast Range. Synoptic weather patterns typical of the northern California intermountain coastal climate dominate the LCAB. During summer, the interaction between the Pacific high-pressure system and thermal low-pressure conditions over the Great Basin creates predominantly westerly winds. Winter conditions are generally influenced by northwesterly winds associated with passing storm systems. The LCAB frequently experiences temperature inversions that trap pollutants near the ground surface, especially during early morning hours. Upper-air subsidence during the summer further restricts vertical dispersion. As a result, the highest pollutant concentrations typically occur under stagnant weather conditions and are most often attributed to locally generated pollutants, poorly managed control burns, or wildfire events. The summer-season burn ban, combined with the region's low population density and limited industrial activity, has contributed to the LCAB being in attainment for all state ambient air quality standards (LCAB, 2002).

Attainment Status

Lake County is currently designated as being in attainment for all state and federal ambient air quality standards (CARB, 2023; USEPA, 2025).

Sensitive Receptors

The nearest sensitive receptors to the Proposed Project include single-family homes located adjacent to the proposed project components, including the high priority water mains and pressure reducing valves. East Lake Elementary School is located approximately 0.10 miles north of the northernmost Highway 20 water line.

4.3.3 Impact Assessment

a) Would the project conflict with or obstruct implementation of the applicable air quality plan?

No Impact. In areas within the state where air quality standards are not met, CARB collaborates with local air districts to develop and implement plans to achieve compliance with federal and state standards. As discussed above, Lake County is designated attainment for all criteria air pollutants under both state and federal standards; therefore, no applicable air quality plan has been adopted for the region. As such, the Proposed Project would have no potential to conflict with or obstruct implementation of one.

b) Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?

Less than Significant Impact. Construction of the Proposed Project would involve minor demolition, grading, and trenching associated with infrastructure replacements and improvements as detailed **Section 2.3**. These activities would result in the temporary generation of emissions from the use of heavy-duty diesel construction equipment and vehicle trips, and the generation of fugitive dust. However, the LCAB is designated attainment for all CAPs under both state and federal standards; therefore, construction would not have the potential to violate air quality standards or result in a cumulatively considerable net increase in criteria pollutants for non-attainment areas. Furthermore, **Mitigation Measure AQ-1** discussed below under Question C would further reduce the fugitive dust during construction. Operation of the Proposed Project would require ongoing maintenance of the new infrastructure; however, these activities would be comparable to existing operations and would not generate significant emissions.

c) Would the project expose sensitive receptors to substantial pollutant concentrations?

Less than Significant Impact with Mitigation. During construction, sensitive receptors may be affected by the temporary generation of emissions and fugitive dust from construction activities, the nearest of which include single-family homes located adjacent to portions of the high priority water mains. Heavy-duty diesel-powered equipment would be the primary source of localized pollutants; however, not all construction activities require such equipment (e.g., Meter Data Consolidation and Water Loss Management System), and usage would be intermittent. All construction work would occur within previously disturbed areas and would not require extensive ground disturbance beyond necessary trenching, thereby limiting fugitive dust generation. While some activities may overlap, the majority of construction work would be staggered and progress sequentially along each alignment, preventing concentrated or prolonged emissions. **Mitigation Measure AQ-1**, which includes measures to reduce equipment idling, would further reduce potential exposure to emissions and fugitive dust. Operation of the Proposed Project would require ongoing maintenance of the new infrastructure; however, these activities would be comparable to existing conditions and would not generate significant pollutant emissions. Therefore, construction and operation of the Proposed Project would not expose sensitive receptors to substantial pollutant concentrations and impacts would be less than significant with mitigation.

d) Would the project result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Less than Significant Impact. Exhaust from construction equipment and the use of asphalt and other materials may generate temporary odors during construction. Because equipment would operate intermittently and work would progress along each alignment, odor-generating activities would be short-lived at any given location and would not affect a substantial number of people. Operation of the Proposed Project would not introduce new odor sources beyond those already associated with the existing water infrastructure. Therefore, construction and operation of the Proposed Project would result in a less-than-significant impact related to odors.

4.3.4 Mitigation Measures

AQ-1: The following best management practices (BMPs) shall be implemented by the project applicant to minimize short-term air quality impacts during construction.

- Water exposed surfaces twice a day.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Cover all exposed stockpiles.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent streets.
- Limit traffic speeds on unpaved roads to 15 miles per hour (mph).
- Suspend grading activity when winds (instantaneous gusts) exceed 25 mph.
- Minimize idling times either by shutting equipment off when not in use or reducing the maximum idling time to five minutes for Diesel-fueled commercial motor vehicles over 10,000 pounds (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]) and provide clear signage for construction workers at all access points.
- Maintain and properly tune all construction equipment in accordance with manufacturers' specifications.

4.3.5 Compliance with Federal Environmental Laws and Regulations

As discussed above, the Proposed Project is located in an attainment area for all CAPs, therefore, no conformity determination is required for this project. Due to the limited duration of construction activities, the infrequent use of heavy equipment, and no increase in long-term operational activities, the Proposed Project would not emit a significant amount of CAPs or HAPs. Therefore, the Proposed Project would not constitute a major source of CAP emissions. The Proposed Project would not be a major source of CAP emissions and would not impact a Federal Class I area. The Proposed Project would not exceed the USEPA's general conformity *de minimus* threshold or hinder the attainment of air quality objectives in the local air basin. The Proposed Project would comply with all federal regulations relating to air quality, including the CAA.

4.4 BIOLOGICAL RESOURCES

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies,	☐	☐	☒	☐

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?				
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☐	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

4.4.1 Regulatory Setting

Federal

Federal Endangered Species Act

The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) implement the FESA of 1973 (16 USC Section 531 et seq.). Threatened and endangered species on the federal list (50 Code of Federal Regulations [CFR] Section 17.11, 17.12) are protected from "take" (direct or indirect harm), unless a FESA Section 10 Permit is granted or a FESA Section 7 Biological Opinion with incidental take provisions is rendered. Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the project area and determine whether the proposed project will have a potentially significant impact upon such species. Under FESA, habitat loss is considered to be an impact to the species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC Section 1536[3], [4]). Therefore, project-related impacts to these species or their habitats would be considered significant and would require mitigation. Species that are candidates for listing are not protected under FESA; however, USFWS advises that a candidate species could be elevated to listed status at any time, and therefore, applicants should regard these species with special consideration.

Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act

Many bird species, especially those that are breeding, migratory, or of limited distribution, are protected under federal and state regulations. Under the Migratory Bird Treaty Act of 1918 (16 USC Section 703-711), migratory bird species and their nests and eggs that are on the federal list (50 CFR Section 10.13) are protected from injury or death, and project-related disturbances must be reduced or eliminated during the nesting cycle. The Bald and Golden Eagle Protection Act (16 USC Section 668) specifically protects bald and golden eagles from harm or trade in parts of these species.

Clean Water Act

The U.S. Army Corps of Engineers (USACE) has primary federal responsibility for administering regulations that concern waters of the U.S. (including wetlands), under Section 404 of the Clean Water Act (CWA). Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the U.S. The USACE requires that a permit be obtained if a project proposes the placement of structures within, over, or under navigable waters and/or discharges dredged or fill material into waters below the ordinary high water mark. A Section 401 Water Quality Certification is required in order to comply with CWA Sections 301, 302, 303, 306, and 307 and has been delegated by USEPA to the Regional Water Quality Control Board (RWQCB).

State

California Endangered Species Act

The California Endangered Species Act of 1970 (CESA) (California Fish and Game [CFG] Code Section 2050 et seq., and CCR Title 14, Section 670.2, 670.51) prohibits "take" (defined as hunt, pursue, catch, capture, or kill) of species listed under CESA. A CESA permit must be obtained if a project will result in take of listed species, either during construction or over the life of the project. Section 2081 establishes an incidental take permit program for state-listed species. Under CESA, California Department of Fish and Wildlife (CDFW) has the responsibility for maintaining a list of threatened and endangered species designated under state law (CFG Code 2070). CDFW also maintains lists of species of special concern, which serve as "watch lists." Pursuant to requirements of CESA, an agency reviewing proposed projects within its jurisdiction must determine whether any state-listed species may be present in the Project area and determine whether the proposed project will have a potentially significant impact upon such species. Project-related impacts to species on the CESA list would be considered significant and would require mitigation.

California Fish and Game Code

CFG Code (Section 3503, 3503.5, and 3800) prohibits the possession, incidental take, or needless destruction of any bird nests or eggs. Fish and Game Code Section 3511 designates certain bird species "fully protected", making it unlawful to take, possess, or destroy these species except under issuance of a specific permit. CFG Code Sections 4700, 5050, and 5515 designates certain mammal, amphibian, and reptile species "fully protected", making it unlawful to take, possess, or destroy these species except under issuance of a specific permit. The California Native Plant Protection Act of 1977 (CFG Code Section 1900 et seq.) requires CDFW to establish criteria for determining if a species or variety of native plant is endangered or rare. Section 19131 of the code requires that landowners notify CDFW at least 10 days prior to initiating activities that will destroy a listed plant to allow the salvage of plant material.

CFG Code (§1601 - 1607) protects fishery resources by regulating "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." The limit of CDFW jurisdiction is subject to the judgment of the Department; currently, this jurisdiction is interpreted to be the "stream zone," defined as "that portion of the stream channel that restricts lateral movement of water" and delineated at "the top of the bank or the outer edge of any riparian vegetation, whichever is more landward." CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the CDFW and the applicant is the Lake or Streambed Alteration Agreement.

CEQA

CEQA (PRC Section 15380) defines "rare" in a broader sense than the definitions of threatened, endangered, or fully protected. Under the CEQA definition, CDFW can request additional consideration of species not otherwise protected. CEQA requires that the impacts of a project upon environmental resources must be analyzed and assessed using criteria determined by the lead agency. Sensitive species that would qualify for listing but are not currently listed may be afforded protection under CEQA. The CEQA Guidelines (Section 15065) require that a substantial reduction in numbers of a rare or endangered species be considered a significant effect. CEQA Guidelines (Section 15380) provide for assessment of unlisted species as rare or endangered under CEQA if the species can be shown to meet the criteria for listing. Plant species on the California Native Plant Society (CNPS) Lists 1A, 1B, or 2 are typically considered rare under CEQA. California "Species of Special Concern" is a category conferred by CDFW on those species that are indicators of regional habitat changes or are considered potential future protected species. While they do not have statutory protection, Species of Special Concern are typically considered rare under CEQA and thereby warrant specific protection measures.

California Water Code

Waste Discharge Requirements are required pursuant to California Water Code Section 13260 for any persons discharging or proposing to discharge waste, including dredge/fill, which could affect the quality of the waters of the state.

Local

Lake County General Plan

The Lake County General Plan aims to protect and enhance the natural resources that make Lake County unique. The following goals and policies are designed to address biological resources:

Goal OSC-1: To preserve and protect environmentally sensitive significant habitats, enhance biodiversity, and promote healthy ecosystems throughout the County.

Policy OSC-1.1 – Protection of Rate and Endangered Species: The County should ensure the protection of environmentally sensitive wildlife and plant life, including those species designated as rare, threatened, and/or endangered by State and/or Federal government.

Policy OSC-1.13 – Management of Oak Woodland Communities: The County shall support the conservation and management of oak woodland communities and their habitats.

Policy OSC-1.14 – Visual Access: Prior to approving a specific plan or project, the County shall require a biological study to be prepared by a qualified biologist for proposed development within areas containing a moderate to high potential for sensitive habitat, sensitive wildlife species, and/or sensitive plant species. As appropriate, the study shall include the following activities: (1) inventory species listed in the CNPS Manual of California Vegetation; (2) inventory species identified by USFWS, Department of Fish and Game, and NMFS; (3) inventory special-status species listed in the California Natural Diversity Database (CNDDB); and (4) conduct field surveys of the Project site by a qualified biologist.

Policy OSC-1.15 – Protect Natural Resources: The County shall strive to protect natural resource areas, fish and wildlife habitat areas, scenic areas, open space areas, and parks from encroachment or destruction by incompatible development and invasive species.

Resolution #95-211 – Oak Woodland Management Policy

Lake County adopted Resolution #95-211, the Oak Woodland Management Policy, which requires monitoring of oak woodland resources and supporting educational materials to address the conservation of oak woodlands.

4.4.2 Environmental Setting

Methodology

A Biological Resources Assessment (BRA) was prepared by Acorn Environmental for the Proposed Project in January 2026 and is included as **Appendix B**. Biologist Geo Graening, PhD, conducted a biological field assessment on December 29, 2025, and collected data on wildlife and plant species present, as well as habitat types and jurisdictional waters. The following sources and materials were reviewed:

- Previous biological resource studies pertaining to the Proposed Project improvement areas or vicinity.
- USGS 7.5 degree-minute topographic quadrangles of the Proposed Project improvement areas and vicinity.
- Aerial photography of the Proposed Project improvement areas.
- CNDDB, electronically updated monthly by subscription.
- A query of the CNPS's database Inventory of Rare and Endangered Plants of California (online edition).
- USFWS National Wetlands Inventory (NWI) mapper.
- USFWS species list (IPaC Trust Resources Report).

Habitat types occurring in the Proposed Project improvement areas were mapped on aerial photographs and information on habitat conditions and the suitability of habitats to support listed species was also recorded. The Proposed Project improvement areas were also assessed for the presence of potentially-jurisdictional water features, including riparian zones, isolated wetlands and vernal pools, and other biologically-sensitive aquatic habitats.

Most of the WTP compound is devoid of vegetation and the vegetation that is present is ornamental or ruderal. The exceptions are the tank sites (High Valley Tank site, Shady Lane Tank site, and the Paradise Tank site). These tank sites are surrounded by trees and natural habitats and are in less urbanized settings.

Clearlake Oaks and the Clearlake Keys, where much of the systems upgrades would occur, consists of all ornamental or ruderal vegetation.

Habitat Types

The NWI reported no water features specifically within the Proposed Project improvement areas, but there are nearby water resources as shown in **Figure 7**. The Proposed Project improvement areas are entirely ruderal or developed in nature and described individually below. No natural habitats are located within the Proposed Project improvement areas. The CNDDB reported no special-status habitats, and no critical habitat for federally-listed species were determined to occur within the Proposed Project improvement areas (**Appendix B**). No designated wildlife corridors or fishery resources exist within the Proposed Project improvement areas; however, wildlife corridors exist nearby in the marshlands of Clear Lake and Clear Lake contains important fishery resources (**Appendix B**).

Equalization Tank Improvements
Areas within the fenced WTP compound are devoid of vegetation.

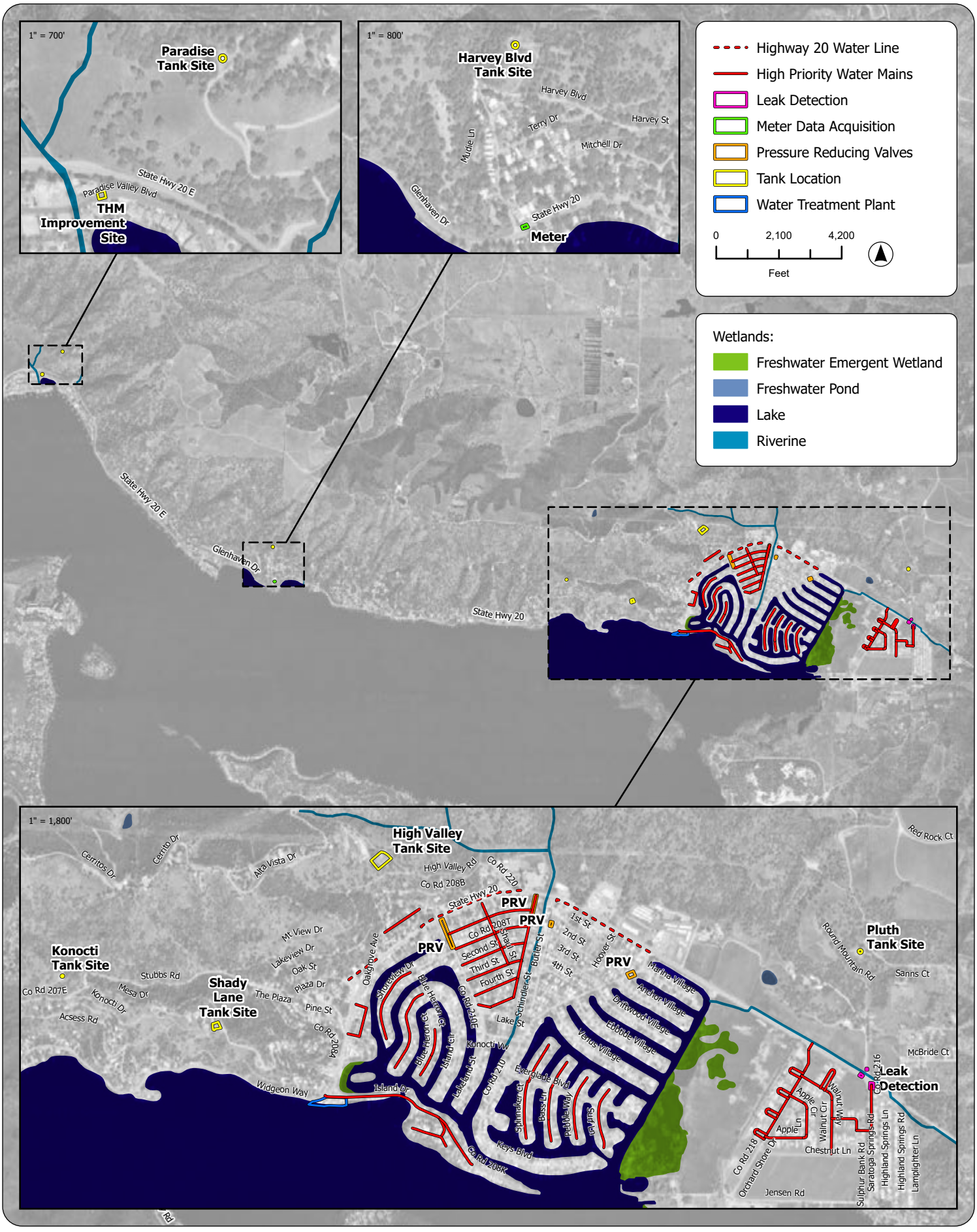
High Valley Tank and Booster Station
The fenced tank compound has been graded flat and armored with gravel. There is some vegetated cover of non-native annual grasses and weedy forbs, and there is a clump of invasive giant reed in the front driveway.

Shady Lane Tank and Booster Station
The area west of the existing tank has been graded flat and armored with gravel. Concrete footings are located in the gravel area.

Paradise Tank THM Reduction Piping
These areas include roadway, which is paved with asphalt, or inside the fenced tank compound, which has been graded flat and armored with gravel. There is some vegetated cover of non-native annual grasses and weedy forbs.

Highway 20 Water Line
These areas include roadway, which is paved with asphalt, or in the road shoulder, which consists of imported gravel road base or bare ground. There is some vegetated cover of non-native annual grasses and weedy forbs.

High Priority Water Mains and Pressure Reducing Valves.
These areas include roadway, which is paved with asphalt or concrete. These areas are devoid of vegetation except for weeds which grow through pavement cracks. Adjacent to these project areas are sidewalks and residential lawns and other landscaping.



SOURCE: USFS, 5/7/2025; ESRI, 2026; Google Earth Aerial Photograph, 5/2024; Acorn Environmental, 2/10/2026

Figure 7

National Wetland Inventory

Listed Species and Other Special-Status Species

The CNDDB reported no special status species as occurring within the Proposed Project improvement areas, although it did report occurrences of the following species in the vicinity:

- Eel grass pondweed (*Potamogeton zosteriformis*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Pallid bat (*Antrozous pallidus*)
- Osprey (*Pandion haliaetus*)
- Konocti manzanita (*Arctostaphylos manzanita ssp. elegans*)
- Watershield (*Brasenia schreberi*)
- Clear Lake hitch (*Lavinia exilicauda chi*)
- Brownish dubiraphian riffle beetle (*Dubiraphia brunnescens*)
- Clear Lake tule perch (*Hysterocarpus traskii lagunae*)
- Western ridged mussel (*Gonidea angulata*)

Using the USFWS' IPaC Trust Resource Report System, a species list was generated for the Proposed Project improvement areas. However, the list is generated using a regional and/or watershed approach and does not indicate whether the site provides suitable habitat. The following species were identified by the IPaC:

- California Condor (*Gymnogyps californianus*) Experimental Population, Non-Essential
- Northern Spotted Owl (*Strix occidentalis caurina*) Threatened
- Northwestern Pond Turtle (*Actinemys marmorata*) Proposed Threatened
- Clear Lake Hitch (*Lavinia exilicauda chi*) Proposed Threatened
- Monarch Butterfly (*Danaus plexippus*) Candidate
- Burke's Goldfields (*Lasthenia burkei*) Endangered

The ruderal and developed land within the Proposed Project improvement areas has a very low potential for harboring special-status species due to the dominance of aggressive non-native grasses and forbs and periodic weed maintenance (**Appendix B**). Trees adjacent to the site could serve as bat roosting habitat. The Proposed Project improvement areas do not contain grasslands, so there is no nectar foraging habitat for Monarch butterfly. Although special-status species occur in Clear Lake adjacent to the site, the Proposed Project improvement areas do not contain water resources and will not directly interact with Clear Lake or its tributary waters. **Appendix B** provides details on special-status species reported by the CNDDB and CNPS in the vicinity of the site. During the field survey, no special-status species were observed within the Proposed Project improvement areas.

Critical Habitat and Habitat Conservation Plans

No critical habitat for any federally-listed species occurs within the Proposed Project improvement areas. The improvement areas are not located within any adopted Habitat Conservation Plan or Natural Community Conservation Plan.

4.4.3 Impact Assessment

a) Would the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Less-than-Significant Impact with Mitigation. The Proposed Project would not modify any natural habitat. No candidate, sensitive, or special-status species occur on the Proposed Project improvement areas, nor is there suitable habitat for listed or special-status species. Construction activities would result in limited ground disturbance and would not require the modification of any habitat, although some activities could result in indirect impacts due to noise disturbance in the vicinity of the Proposed Project improvement areas. The CNDDB database reported special-status bird and bat species in the vicinity of the site.

The tank sites (High Valley Tank site, Shady Lane Tank site, and the Paradise Tank site) are surrounded off-site by trees and natural habitats and are in less urbanized settings. There is a greater potential for bird nesting and bat roosting in adjacent trees. Noise, vibration, and other construction-related disturbance, could indirectly impact nesting birds or roosting bats in trees near the Proposed Project improvement areas, which is considered a potentially significant impact. **Mitigation Measure BIO-1** (see **Section 4.4.4**) has been identified to reduce impacts to sensitive wildlife species, such as special-status bats and nesting birds. With the implementation of **Mitigation Measure BIO-1**, the Proposed Project would have a less-than-significant impact.

b) Would the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Less-than-Significant Impact. The Proposed Project improvement areas do not contain any riparian habitat or other sensitive natural communities. While riparian and marshland habitat occurs adjacent to the site, there would be no direct disturbance to these habitats as the Proposed Project improvement areas consist of ruderal/developed land, and agricultural land. Additionally, the site does not contain any water resources and would not directly interact with Clear Lake or its tributary waters. Therefore, impacts to riparian habitat or other sensitive natural communities would be less than significant.

c) Would the project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Less-than-Significant Impact with Mitigation. There are no aquatic resources within the Proposed Project improvement areas; however, the shoreline of Clear Lake is adjacent to the WTP, the meter data acquisition site, and the THM Improvement Site, and the canals (keys) are adjacent to some high priority water main segments. Although no work is proposed in open water or the adjacent lacustrine wetlands, construction activities have the potential to introduce pollutants (sediment, petroleum products, concrete waste, etc.) into adjacent aquatic resources, which is considered a potentially significant impact. **Mitigation Measure GEO-1** includes erosion control measures to prevent pollutants from entering adjacent aquatic resources, which would reduce these indirect impacts to a less-than-significant level.

d) Would the project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

No Impact. No fishery resources occur within or near the Proposed Project improvement areas. No designated wildlife corridors exist within or near the Proposed Project improvement areas. The Proposed Project involves relatively limited ground disturbance and would not disrupt the movement of any species. The site is not located within any adopted Habitat Conservation Plan or Natural Community Conservation Plan. Therefore, the Proposed Project would not interfere with the movement of native, resident, or migratory fish or wildlife corridors of the use of native wildlife nursery sites and result in no impact.

e) Would the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

No Impact. The Lake County General Plan has policies in place for the protection of natural resources and habitats. The Proposed Project would not involve the removal of any trees within or in the vicinity of the Proposed Project improvement areas. There would be no conflict with any local policies or ordinances and therefore, the Proposed Project would have no impact.

f) Would the project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

No Impact. The Proposed Project improvement areas are not within any adopted Habitat Conservation Plan or Natural Community Conservation Plan. Thus, the Proposed Project does not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or another approved governmental habitat conservation plan and would result in no impact.

4.4.4 Mitigation Measures

BIO-1: Roosting Bats and Nesting Birds

At the High Valley Tank site, Shady Lane Tank site, and the Paradise Tank site, a pre-construction survey for roosting bat shall be conducted by a qualified biologist within 500 feet of improvements. If construction activities occur during the nesting bird season (typically February through August), a pre-construction survey for the presence of special-status bird species or any nesting bird species should be conducted by a qualified biologist within 500 feet of improvements. If active nests or roosting bats are identified in these areas, CDFW and/or USFWS shall be consulted to develop measures to avoid "take" prior to the initiation of any construction activities. Avoidance measures may include establishment of a buffer zone using construction fencing or postponement of construction activities until a qualified biologist has determined that the nest/roost are no longer active.

4.4.5 Compliance with Federal Environmental Laws and Regulations

As discussed above, no federally-listed wildlife or plant species are likely to occur within the Proposed Project improvement areas due to the lack of suitable habitat. There are no waters of the U.S. or wetland features within the Proposed Project improvement areas. **Mitigation Measure BIO-1** has been identified to reduce impacts to sensitive wildlife species, such as special-status bats and nesting birds, although no

trees would be removed as part of the Proposed Project. With the implementation of **Mitigation Measure BIO-1**, the Proposed Project would have a less-than-significant impact on federally listed species. The Proposed Project would comply with all federal regulations relating to biological resources, including the FESA, Migratory Bird Treaty Act, Wild and Scenic Rivers Act of 1968, and Executive Order 11990, Protection of Wetlands.

4.5 CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource pursuant to § 15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	☐	☒	☐	☐
c) Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☒	☐	☐

4.5.1 Regulatory Setting

Federal

National Historic Preservation Act (NHPA)

Section 106 of the NHPA, as amended, and its implementing regulations found at 36 CFR Part 800, require federal agencies to identify cultural resources that may be affected by actions involving federal lands, funds, or permitting actions. The significance of the resources must be evaluated using established criteria outlined at 36 CFR 60.4, as described below. If a resource is determined to be a historic property, Section 106 of the NHPA requires that effects of the undertaking on the resource be determined. A historic property is:

> …any prehistoric or historic district, site, building, structure or object included in, or eligible for inclusion in the National Register of Historic Place, including artifacts, records, and material remains related to such a property… (NHPA Section 301[5]).

If it is determined that a historic property will be adversely affected by implementation of a proposed action, prudent and feasible measures to avoid or reduce impacts must be taken. The State Historic Preservation Officer must provide an opportunity to review and comment of these measures prior to implementation of the proposed action.

National Register of Historic Places (NRHP)

The eligibility of a resource for listing in the NRHP is determined by evaluating the resource using criteria defined in 36 CFR 60.4 as follows.

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, association, and:

> A. That are associated with events that have made a significant contribution to the broad patterns of our history;
> B. That are associated with the lives of persons significant in our past;
> C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
> D. That has yielded, or may be likely to yield, information important to prehistory or history.

Archaeological Resources Protection Act (ARPA)

The ARPA of 1979 (Public Law 96-95; 16 USC 470aa-mm), provides for the protection of archaeological resources and sites which are on public and Indian lands, and fosters increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data which were obtained before October 31, 1979. ARPA also provides for penalties for noncompliance and illegal trafficking.

Native American Graves Protection and Repatriation Act (NAGPRA)

NAGPRA is a federal law passed in 1990. NAGPRA provides a process for museums and federal agencies to return certain Native American cultural items—human remains, funerary objects, sacred objects, or objects of cultural patrimony—to lineal descendants, and culturally affiliated Indian tribes and Native Hawaiian organizations. NAGPRA includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional and inadvertent discovery of Native American burials and cultural items on federal and tribal lands, and penalties for noncompliance and illegal trafficking.

State

California Environmental Quality Act

CEQA requires that, for projects financed by or requiring the discretionary approval of public agencies in California, the effects that a project has on historical and unique archaeological resources be considered (PRC Section 21083.2). Historical resources are defined as buildings, sites, structures, or objects, each of which may have historical, architectural, archaeological, cultural, or scientific importance (PRC Section 50201). The CEQA Guidelines (Section 15064.5) define three cases in which a property may qualify as a historical resource for the purpose of CEQA review:

- The resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR).
- The resource is included in a local register of historic resources, as defined in section 5020.1(k) of the PRC, or is identified as significant in a historical resources survey that meets the requirements of section 5024.1(g) of the PRC (unless the preponderance of evidence demonstrates that the resource is not historically or culturally significant).
- The lead agency determines that the resource may be a historical resource as defined in PRC §§ 5020.1(j), 5024.1, or significant as supported by substantial evidence in light of the whole record.

> Section 5024.1 defines eligibility requirements and states that a resource may be eligible for inclusion in the CRHR if it:
>
> 1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
> 2. Is associated with the lives of persons important in our past;
> 3. Embodies the distinctive characteristics of a type, period, region, or method of construction, represents the work of an important creative individual, or possesses high artistic values; or
> 4. Has yielded, or may be likely to yield, information important in prehistory or history.

Resources must retain integrity to be eligible for listing on the CRHR. Resources that are listed in or eligible for listing in the NRHP are considered eligible for listing in the CRHR and thus are significant historical resources for the purposes of CEQA (PRC Section 5024.1(d)(1)).

PRC Section 21083.2 governs the treatment of a unique archaeological resource, which is defined as "an archaeological artifact, object, or site about which it can be clearly demonstrated" that it meets any of the following criteria:

- It contains information needed to answer important scientific research questions, and there is a demonstrable public interest in that information.
- It has a special and particular quality such as being the oldest of its type or the best example of its type
- It is directly associated with a scientifically recognized important prehistoric or historic event or person.

Assembly Bill 52

Signed into law in September of 2014, Assembly Bill 52 (AB 52) established Tribal Cultural Resources (TCRs) as a new category under CEQA and mandated a more rigorous process for consultation among California Native American Tribes and CEQA lead agencies. The law also requires noticing and consultation with affected Native American tribes for projects filing a Notice of Preparation, Notice of Mitigated Negative Declaration or Notice of Negative Declaration on or after July 1, 2015 (Stats. 2114, ch. 532, § 11 (c)).

TCRs are defined in PRC 21074 as sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:

> Included or determined to be eligible for inclusion in the California Register of Historical Resources or is listed in a local register of historical resources as defined in subdivision (k) of Section 5020.1.
>
> A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1 [of the PRC]. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purposes of this paragraph, the lead agency shall consider the significance of the resource to a California Native American tribe.

A project that has potential to impact a TCR such that it would cause a substantial adverse change constitutes a significant effect on the environment unless mitigation reduces such effects to a less than significant level.

Local

Lake County General Plan

The Lake County General Plan aims to protect and enhance the natural and cultural resources that make Lake County unique. The goals and policies designed to address cultural resources are as follows:

Goal OSC-8: To manage and project sites of cultural and archaeological importance for the benefit of present and future generations.

Policy OSC-8.1 – Evaluation of Cultural and Archaeological Resources: The County should participate in and support efforts to identify its significant cultural and archaeological resources using appropriate State and Federal standards.

Policy OSC-8.2 – Protection of Resources with Potential State or Federal Designations: The County should encourage the protection of cultural and archaeological sites with potential for placement on the National Register of Historic Places and/or inclusion in the California State Office of Historic Preservation's California Points of Interest and California Inventory of Historic Resources. Such sites may be of statewide or local significance and have anthropological, cultural, military, political, architectural, economic, scientific, religious, or other values.

4.5.2 Environmental Setting

Cultural resource databases were searched for the Proposed Project in November of 2025.

Prehistoric Setting

Paleoindian Period (11,500 – 10,000 before present [B.P.])

The Paleoindian period (11,500– 10,000 years B.P.) was characterized by small, highly mobile groups occupying broad geographic areas. Evidence of occupation of northern California during this period is limited. The Post Pattern in the North Coast Ranges represents the earliest known occupation during this time period and is distinguished by large fluted projectile points and flaked stone crescents. In the Clear Lake Basin, the Post Pattern reflects an early focus on lacustrine resources and game hunting. Most proximate to the project area, fluted projectile points have been recovered from the Borax Lake site located roughly two miles south of the WWTP (Acorn Environmental, 2026).

Archaic Period (10,000 – 1,500 B.P.)

During the Archaic period, consisting of the Lower Archaic (10,000 - 7,000 B.P.), the Middle Archaic (7,000 - 2,500 B.P.) and the Upper Archaic periods (2,500 - 1,500 B.P.), settlement mobility may have continued, although groups began to establish longer-term base camps in localities from which a more diverse range of resources could be exploited. The Borax Lake Pattern (10,000 – 7,000 B.P) appears after a time of rapid environmental change during the early Holocene. By approximately 8,850 B.P. distinctive artifact assemblages appear that include wide-stemmed projectile points, handstones, millingslabs, and flake tools. The addition of milling tools. Obsidian, and chert concave-base projectile points, and the occurrence

of sites in a wider range of environments suggest that the economic base was more diverse (Acorn Environmental, 2026).

The Mendocino Pattern appears during the Early Archaic and continues through to the Upper Archaic. The Mendocino Pattern is signaled by the presence of notched, concave-base, and foliate projectile points, and an abundance of milling slabs and handstones. Perhaps coeval, the Berkeley Pattern (7,000 – 1,200 B.P.) was widespread in central California. Thought to have developed in the Sacramento and upper San Joaquin valleys, Berkeley Pattern sites sometimes include tightly flexed burials in association with Olivella saucer and saddle beads, as well as *Haliotis* ornaments. A well-developed bone and antler tool technology is apparent in Berkeley Pattern sites, alongside baked clay artifacts. The local variant of the Berkeley Pattern is the Houx Aspect, marked by Excelsior and wide-stemmed projectile points, *Olivella* and *Macoma* shell beads, bowl mortars and pestles, and serrated flake tools, and often occur in association with dark midden soils. By the Upper Archaic, residential mobility was reduced in favor of a more sedentary adaptation, the development of numerous small villages, and the beginnings of a more complex society and economy began to emerge (Acorn Environmental, 2026).

Emergent Period (1,500 – 200 B.P.)

During the Emergent period (1,500 - 200 B.P.), social complexity developed toward the ethnographic pattern of large, central villages where political leaders resided, with associated hamlets and specialized activity sites. During this time period, the Augustine Pattern (1,650 – 200 B.P.) appears with the introduction of the bow and arrow. In the Clear Lake Basin subarea of the North Coast Ranges, the Clear Lake Aspect is the local variant of the Augustine Pattern. Clear Lake Aspect sites are characterized by distinctive small corner-notched and triangular Rattlesnake projectile points, shell and magnesite beads, elongated charmstones, slab mortars used with hopper baskets and pestles, and a diverse array of bone tools. Acorns were harvested and processed intensively, supported by a broad spectrum of animal and vegetable resources such as small mammals and fowl. Bedrock mortars become abundant during this period.

Ethnographic Setting

The Proposed Project lies within the traditional territory of the Southeastern Pomo. Pomo speakers have been sub-divided into seven distinct language groups: Kashaya, Southern, Central, Northern, Northeastern, Eastern, and Southeastern, and can be linked to the larger family of Hokan speakers (Acorn Environmental, 2026). Southeastern Pomo speakers occupied the area around East Lake and Lower Lake, on the eastern margin of Clear Lake.

The Pomo peoples organized themselves into small tribelets or village communities, and the social and political organization of these individual groups showed considerable variation. The Pomo economy was based on a seasonal round of fishing, hunting, and the collection of a variety of plants for food, tools, structures and trade. Beads (also called *po* or *pol*), made from magnesite, were also an important part of the Pomo economy. These beads were of such high value that they were traded individually rather than in a necklace like the Pomo did with the clam shell coins they made. The Pomo were also known for their expertise in basket making. The types of houses used by the Pomo varied depending on the climate and vegetation of each district. In the Kashaya Pomo region, single-family dwellings were typically made of redwood bark slabs erected in conical fashion to create a structure 8 to 15 feet in diameter and 6 to 8 feet high (Acorn Environmental, 2026).

Typical weapons used in hunting were the bow and arrow for larger game, club for bear, and spears for sea lions and seals. Smaller animals were captured by bola, low brush fences, nets, snares, and basketry traps. Lake, stream, and ocean fish were caught in traps, with lines or weirs. The traditional mortar and pestle were used for processing of acorns, Buckeye nuts and other seeds, grasses, and roots. Knives were made from obsidian or chert and could be attached to handles and used as axes (Acorn Environmental, 2026).

Historic Setting

The first non-native people to enter Lake County may have been Spanish soldiers led by Luis Argüello on their expedition through the North Coast Ranges in 1821, but the route of the expedition is not known. A more sustained presence in the region was initiated with the entry of trappers and hunters from Oregon traveling to Russian settlements like Fort Ross and Bodega. In 1832 or 1833, American trappers led by Ewing Young of the Hudson's Bay Company passed through the Clear Lake region.

In 1844, Salvador Vallejo obtained a land grant for Rancho Lupyomi, which included all of Clear Lake and its surrounding areas. Vallejo raised cattle there until 1847, when he sold his land rights and 800 cattle to Charles Stone, Andy Kelsey, and others. Stone and Kelsey's harsh treatment of native laborers led to their murder in 1849. In retaliation, U.S. troops killed over 100 native people, with many dying on what is now called Bloody Island (Acorn Environmental, 2026).

In 1848, Walter Anderson and his wife, the first recorded female settler, moved to Clear Lake. Like many early settlers, they made their living by herding cattle. The population of Clear Lake expanded rapidly in the mid-19th century, reaching 1,000 by 1861. This period saw the establishment of businesses and mills. A dam built on Cache Creek in 1866 caused flooding by raising lake levels, prompting locals to destroy it in 1868. A second dam was constructed in 1914 and remains today (Acorn Environmental, 2026).

Lake County is composed of lands that were once parts of Mendocino and Napa counties. The County was formed in 1861 with Lakeport as the seat of government. The wooden courthouse where the County's business was conducted burned in 1867 and the county seat temporarily relocated to Lower Lake until a new stone building was completed in 1871 in Lakeport.

The California Borax Company mined Sulphur Bank between 1865 – 1869, resulting in the complete removal of a large mound of sulphur said to measure 40 feet high and 300 feet long. Mercury was then mined there beginning in 1873 until after World War II. At its peak, the Sulphur Bank Mine employed more than 1,000 people, a majority of whom were Chinese immigrants. The mine was designated California Historical Landmark No. 428 in 1949 (Acorn Environmental, 2026).

The land that would eventually become Clearlake Oaks was settled by Charles "Uncle Jack" Stubbs, who's family went on to become prominent figures in the county. Stubbs, a sailor hailing from England, settled in Lake County in 1859 and began raising livestock. He sold butchered meat of the Sulphur Bank Mine, located adjacent to his ranch, which eventually grew to roughly 3,000 acres. A small town took shape in the 1920s on the north side of East Lake and in 1926 a post office was established there and designated Stubbs. In 1935 the name was changed to Clear Lake Oaks (Acorn Environmental, 2026).

By the late 19th century, the key industries around Clear Lake were livestock, dairy farming, milling, and mining minerals like borax, sulfur, and mercury. The area also became known for its resorts built around the mineral springs, although interest in these waned in the early 1900s with the rise of automobile travel.

Clear Lake saw a temporary revival as a vacation destination in the 1920s with the completion of Highway 20 and the construction of vacation homes. However, the local economy shifted to agriculture, focusing on fruit and walnut cultivation. Lake County became renowned for its pears, grapes, and wineries, particularly after the Bartlett pear, developed locally, was showcased at the 1855 World's Fair. Since the 1940s, Lake County has produced a significant share of California's pear crop, and vineyards have also become increasingly important to the region (Acorn Environmental, 2026).

Post-World War II growth reshaped the shoreline east of the original settlement of Stubbs with the creation of the Clearlake Oaks Keys. In the 1960s developers dredged extensive wetlands and marshes to cut a grid of canals into the delta at the mouth of Cache Creek, generating about 6.5 miles of navigable channels (Acorn Environmental, 2026).

4.5.3 Methodology

Native American Outreach

The California Native American Heritage Commission (NAHC) was contacted on October 27, 2025, to request a search of the Sacred Lands File (SLF) and a list of local Native American contacts that may have information regarding the Project area. Ms. Melina Carlos of the NAHC responded via email on October 28, 2025, and stated that the SLF search for the Project area was positive and that the Elem Indian Colony Pomo Tribe should be contacted for more information. The NAHC also provided a list of an additional 34 representatives from 20 another Native American tribes that are traditionally and culturally affiliated with the Project area. Tribes contacted on January 20, 2026, include the following:

> Elem Indian Colony Pomo Tribe, Big Valley Band of Pomo Indians of the Big Valley Rancheria, Cahto Tribe, Cloverdale Rancheria of Pomo Indians, Coyote Valley Band of Pomo Indians, Dry Creek Rancheria of Pomo Indians, Estom Yumeka Maidu Tribe of the Enterprise Rancheria, Guidiville Rancheria of California, Habematolel Pomo of Upper Lake, Hopland Band of Pomo Indians, Koi Nation of Northern California, Manchester Band of Pomo Indians of the Manchester Rancheria, Middletown Rancheria of Pomo Indians of California, Noyo River Indian Community, Pinoleville Pomo Nation, Potter Valley Tribe, Redwood Valley or Little River Band of Pomo Indians, Robinson Rancheria of Pomo Indians, Round Valley Reservation/ Covelo Indian Community, Scotts Valley Band of Pomo, and Yokayo Tribe.

The communication included an introduction to the Proposed Project, maps of the area, and disclosed the methodology of the records search and pedestrian survey. Letters to all three Elem contacts identified by the NAHC, including the Chairperson, Administrator, and Cultural Resources Director were returned by the Postal Service as undeliverable. However, contact information was located for the Tribe's Tribal Historic Preservation Officer, Mr. Clifford Mota. After two weeks with no response to the initial communication, follow up emails were sent or phone calls were made. One response was received from Mr. Mota of the Elem Indian Colony, who acknowledged receipt of the letter on January 22, 2026, and stated he would review the project information.

Literature Review

A review of historical sources, including archaeological, ethnographic, and historical sources in the public domain and the author's library, as well as historical maps and aerial photographs, identified past land uses within and adjacent to the Project area. No significant cultural features of interest were identified in

the sources consulted beyond ubiquitous orchards, residential development, and rangeland. Precontact archaeological sites have a moderate to high potential to occur at or near the surface within the Project area. Given the identified landforms around the Project area, archaeological deposits are expected to occur at the surface and shallow contexts where prior land uses may have affected integrity.

Records Search

A record search was completed on November 5, 2025, by the Northwest Information Center of the California Historical Resources Information System at Sonoma State University. The cultural resource site map and records, survey reports, and other relevant material, which included the California Office of Historic Preservation's Build Environment Resources Directory, the Archaeological Determinations of Eligibility and the California Inventory of Historic Resources (1976), were reviewed. Additional sources of information and maps were consulted as a part of the literature review (Acorn Environmental, 2026).

Field Survey

A pedestrian survey for the Proposed Project improvement areas was conducted on October 31 and December 29, 2025, by qualified archaeologist, Mike Taggart, RPA. The fieldwork included an intensive survey of tank sites, valves, and leak detection locations. Reconnaissance-level survey was conducted for water pipeline replacement in streets, landscaped areas, along SR-20, and the WTP. Water mains and the WTP are all completely obscured, with virtually no ground visibility in the immediate vicinity. The survey identified a single potential cultural resource: Pluth tank.

Pluth Tank

The Pluth tank is a cylindrical water treatment feature located adjacent to a modern steel water storage tank within an active water storage facility. The tank consists of vertical redwood staves bound by multiple horizontal steel tension hoops, giving it a barrel-like appearance characteristic of mid-twentieth-century redwood water infrastructure. Prior to decommissioning in 2022, the tank provided approximately 91,700 gallons of active storage. The use of redwood stave construction with steel banding is consistent with water treatment and storage technologies commonly employed in California during the mid-twentieth century, prior to the widespread adoption of welded steel tanks.

Based on institutional knowledge and the tank's construction characteristics, installation most likely occurred between the mid-1960s and mid-1970s. Although the precise date could not be confirmed, this estimated period aligns with the materials and construction methods observed.

The Pluth tank appears to have been purpose-built as a functional component of the local water storage system and does not display distinctive design features, unique construction techniques, or associations with significant historical events or persons beyond its utilitarian role. The tank represents a common example of mid-twentieth-century municipal water treatment technology rather than a rare, innovative, or otherwise distinctive resource. After evaluation, the Pluth Tank is recommended not eligible for listing in the CRHR.

Results

The literature review, historic maps, aerial photographs, and field survey identified 10 known cultural resources and one newly documented resource that are intersected by, or adjacent to, the Project area.

Only two of these sites are eligible for listing on the NRHP, both under Criterion D and both intersecting with Proposed Project components. The records search and GIS processing identified 10 prior studies intersecting the Project area. These studies cover much of the Proposed Project improvement areas with the exception of the water mains in the eastern portion of the area connected to Orchard Shore Drive, water mains on select streets in the Keys, the High Valley Tank site, and the Shady Lane Tank site.

Resources in the immediate vicinity are dominated by obsidian lithic scatters, with the large occupation site of Elem just to the south. All but two of the resources were found not eligible for the CRHR or were not evaluated due to poor integrity.

4.5.4 Impact Assessment

a) Would the project cause a substantial adverse change in the significance of a historical resource pursuant to § 15064.5?

Less-than-Significant with Mitigation. Two previously documented cultural resources are intersected by project components. These two resources are considered eligible for the NRHP under Criterion D. The rest of the documented cultural resources are deemed not eligible or were not evaluated due to poor integrity. The ground under a majority of the Proposed Project components is highly disturbed from excavation of the channels in the Keys and construction of the uplands in the 1960s. Much of the Proposed Project improvement areas have been paved. Additionally, most improvements involve equipment replacement or rehabilitation within existing facilities and would not result in ground disturbance. The High Valley tank site represents the most substantial ground-disturbing component of the project, although no resources were identified in proximity to this area.

The assessment identified resources located adjacent to the WTP and areas located in proximity to ground disturbance associated with the improvements. However, implementation of **Mitigation Measures CUL-1** and **CUL-3** would avoid a substantial adverse change. Therefore, the Proposed Project would result in a less than significant impact with mitigation.

b) Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?

Less-than-Significant Impact with Mitigation. Precontact archaeological sites were found to have a moderate to high potential to occur at or near the surface within the Project area considering landscape positioning, depositional environment, proximity to ethnographic villages, and previously documented archaeological sites nearby. In contrast, the landforms around the site have been mapped as Older Pleistocene in age, and too old to harbor buried archaeological deposits. Thus, archaeological deposits were expected to occur at the surface and shallow contexts where prior land uses could allow preservation. As discussed in **Section 4.5.3** and **Question a)** two previously documented cultural resources are intersected by project components, both of which are eligible for the NRHP under Criterion D.

The proposed water main replacement in front of the WTP on Island Drive is intersected by an identified resource site. The site is characterized as a precontact beach-side lithic scatter and midden containing shell, faunal remains, and obsidian, with intact subsurface deposits buried beneath fill. Although the site is completely obscured at the surface, trenching outside beyond the existing buried utility corridor could disturb intact subsurface deposits that contribute to its information potential. New ground disturbance beyond the limits of prior installations near/through the resource area is expected to be minimal. While

the nature of the lithic scatter, prior ground disturbance, and minimal ground disturbance would likely not result in a substantial adverse change to the resource, archaeological and tribal monitoring near the WTP under **Mitigation Measure CUL-3** would be utilized to avoid or minimize adverse impacts in the event of an inadvertent discovery.

The proposed meter data acquisition project component at the corner of Harvey Boulevard and SR-20 intersects a large, multi-component precontact habitation site containing midden, lithic scatter, and reported burials, with portions retaining intact subsurface deposits. This site is eligible for listing on the NRHP. No cultural constituents were observed where the valves intersect the site, and no new ground disturbance outside the existing vault would occur; therefore, this component would not affect intact deposits.

Should buried artifacts or features be inadvertently discovered during construction, work should stop in the vicinity until an archaeologist can make an assessment. Therefore, if such resources were discovered, implementation of **Mitigation Measure CUL-1** would ensure that work is halted until resources eligible for NHRP and CRHR can be identified and important information is recovered. As discussed above, for areas of high archaeological sensitivity, tribal monitoring of excavation and related ground disturbance would be implemented. This would reduce the impact of the Proposed Project to less-than-significant impact with mitigation incorporated.

c) Would the project disturb any human remains, including those interred outside of dedicated cemeteries?

Less-than-Significant Impact with Mitigation. The Proposed Project would not disturb any known human remains, including those interred outside of formal cemeteries, because there are no known human remains located on or in the vicinity of the Proposed Project improvement areas. If human remains are inadvertently uncovered, **Mitigation Measure CUL-2** would ensure that work is halted, the Lake County coroner is contacted, and compliance with Section 15064.5 I (1) of the CEQA Guidelines and Health and Safety Code Section 7050.5 is required. Project-related ground disturbance in the vicinity of the find should not resume until the process detailed in CEQA Guidelines Section 15064.5 (c) has been completed. Therefore, the Proposed Project will have a less-than-significant impact with mitigation incorporated.

4.5.5 Mitigation Measures

CUL-1: In the event archaeological resources are discovered during site excavation, grading, or construction, work on the site will be suspended until the significance of the features can be determined by a qualified archaeologist. If significant resources are determined to exist, the archaeologist shall make recommendations for protection or recovery of the resource. If archaeological resources are inadvertently discovered, all finds would be subject to CEQA guidelines 15064.5 and PRC 21083.2. Procedures for inadvertent discovery include the following:

- All work within 50-feet of the find shall be halted until the significance of the find can be evaluated in accordance with NRHP and CRHR criteria by an archaeologist or a paleontologist if the find is of paleontological nature.
- If any find is determined to be significant, then representatives of the County of Lake shall meet with the archaeologist, or paleontologist, to determine the appropriate course of action. If necessary, a Treatment Plan shall be prepared by an archaeologist, or paleontologist, which outlines the recovery of the resource, analysis and reporting of the find. The Treatment Plan shall be submitted to the County for review and approval prior to resuming construction.

- All significant cultural or paleontological materials recovered shall be subject to scientific analysis, professional curation, and a report prepared by the professional archaeologist, or paleontologist, according to the current professional standards.

CUL-2: If human remains are encountered during construction activities, Lake County shall comply with Section 15064.5 (e) (1) of the CEQA Guidelines and PRC Section 7050.5. All project-related ground disturbance within 100-feet of the find shall be halted until the county coroner has been notified. If the coroner determines that the remains are Native American, the coroner will notify the NAHC to identify the most likely descendants of the deceased Native Americans. Project-related ground disturbance in the vicinity of the find shall not resume until the process detailed in Section 15064.5 (e) has been completed.

CUL-3: Tribal monitoring of excavation and related ground disturbance shall occur in areas of high resource sensitivity, including adjacent to the WTP.

CUL-4: Worker Awareness and Sensitivity Training: Prior to the beginning of construction (including ground-clearing), a qualified professional archaeologist shall administer a cultural resources awareness and sensitivity training program to all construction workers who will be performing trenching or construction work. The program shall include a review of the types of finds that could occur, regulatory requirements, and a list of contacts (with telephone numbers) in case of accidental discoveries. The training program shall be repeated periodically as new construction workers are added to the project.

4.5.6 Compliance with Federal Environmental Laws and Regulations

The Proposed Project area encompasses the WTP, tank sites, and parts of the distribution system. As discussed previously, the Proposed Project improvement areas are composed of existing developed and disturbed areas which have been thoroughly surveyed via pedestrian surveys conducted by Mike Taggart, RPA, on October 31 and December 29, 2025. One resource was identified during the survey that was determined not to be eligible for protection under the NHPA. Mitigation for monitoring has been recommended to ensure that no impact would occur to previously identified resources. The Proposed Project would comply with federal regulations relating to cultural resources, including the NHPA.

4.6 ENERGY

Would the project	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐

4.6.1 Regulatory Setting

Local

Lake County General Plan

The Lake County General Plan contains the following policies and implementation measures related to energy that are relevant to the Proposed Project:

Goal PFS-6: To ensure that adequate and efficient public utilities are provided to meet the needs of residents and businesses in the County.

> **Policy PFS-6.1.** Electric Service. The County shall coordinate with electricity providers in planning for the timely expansion of electrical facilities to meet future demand, and for projects affecting public health, schools, or for significant air emissions reductions.

Policy PFS-6.4. Energy Conservation. The County shall support the use of energy conservation devices and renewable energy sources in residential, commercial, and industrial developments, and shall continue to develop renewable energy sources for County facilities when practical.

4.6.2 Environmental Setting

Pacific Gas & Electric (PG&E) provides electricity service to Lake County and to the areas where the Proposed Project improvements would occur. No natural gas service is available in Lake County; instead, propane is supplied by private companies (Lake County, 2019). PG&E provides natural gas and electric service to approximately 16 million customers across a 70,000-square-mile area in northern and central California.

4.6.3 Impact Assessment

a) Would the project result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

b) Would the project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

Less-than-Significant Impact.

Construction:

Construction of the Proposed Project is anticipated to last 18 months and would require on-site energy use and fuel consumption (e.g., gasoline and diesel) for worker, hauling, and vendor vehicle trips, as well as for the operation of construction equipment and machinery. The use of this energy is necessary for Proposed Project development and would be utilized only when needed for construction progress. Construction equipment would be energy efficient to the extent feasible required to comply with CARB's In-Use Off-Road Diesel-Fueled Fleets Regulation, which limits idling and mandates the phase-out of older, high-emitting diesel vehicles, thereby improving overall fuel efficiency and reducing unnecessary energy consumption.

Operation:

During operation, energy usage associated with the upgraded water facilities and meter data acquisition would generally remain comparable to existing conditions; however, certain components would enhance energy efficiency and system durability. The replacement of the existing pump at the Shady Lane Tank with two more efficient pumps, installation of a tank at the High Valley site along with associated upgrades, installation of a mixer and power vent at the Harvey Tank site, replacement of Highway 20 pipelines for increased capacity, replacement of high priority water main pipelines, flowmeter replacement, installation of PRVs, along with general operational system upgrades, would improve operational reliability and efficiency. Some of these improvements eliminate outdated, energy-intensive systems, reducing long-term energy consumption and operational costs. Overall, operation of the Proposed Project would not result in a significant impact on energy resources.

4.7 GEOLOGY AND SOILS

Would the project:	**Potentially Significant Impact**	**Less than Significant Impact with Mitigation Incorporated**	**Less than Significant Impact**	**No Impact**
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒	☐
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii. Strong seismic ground shaking?	☐	☐	☒	☐
iii. Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv. Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water	☐	☐	☐	☒

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
disposal systems where sewers are not available for the disposal of waste water?				
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐

4.7.1 Regulatory Setting

Federal

Clean Water Act

The CWA prohibits the discharge of sediment and erosion into navigable waters of the United States to protect water quality. It establishes regulatory measures to control soil erosion and sediment runoff, ensuring that construction and land development activities implement BMPs to prevent sediment pollution. The goal is to maintain the integrity of the nation's waters by minimizing the impact of soil disturbance and erosion on water quality.

National Earthquake Hazards Reduction Act

The National Earthquake Hazards Reduction Act was passed in 1977 to reduce the risks to life and property from future earthquakes in the United States. The Act established the National Earthquake Hazards Reduction Program, which was most recently amended in 2004. The Federal Emergency Management Agency (FEMA) is designated as the lead agency of the program.

State

California Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (PRC Section 2621 et seq.) was passed in 1972 to reduce the risk to life and property from surface faulting in California. The Act prohibits the siting of most structures intended for human occupancy on the surface trace of active faults. For projects proposed in an active Fault Zone, a geologic investigation must be prepared to demonstrate that proposed buildings would not be constructed across active faults. According to the California Geological Survey, an "active" fault is defined as one that has shown evidence of movement within the last 11,000 years.

California Seismic Hazards Mapping Act (SHMA)

The California SHMA of 1990 (PRC Section 2690–2699.6) addresses nonsurface fault rupture earthquake hazards, including strong ground shaking, liquefaction, and seismically induced landslides. The SHMA also addresses expansive soils, settlement, and slope stability. Under the SHMA, cities and counties may withhold development permits for sites within seismic hazard areas until geologic/geotechnical investigations have been completed and measures to reduce potential damage have been incorporated into development plans.

California Building Standards Code

The California Building Standards Code (CBSC) consists of 13 parts, including the California Building Code (CBC), Energy Code, Fire Code, and Green Building Standards Code. Part 2 of the CBSC is the CBC that includes standards for structural design, excavation, grading, seismic design, drainage, and erosion control. CBC Chapter 18 (Soils and Foundations) and Appendix J (Grading) include requirements for geotechnical investigations and soil reports.

Local

Lake County General Plan

The Lake County General Plan, Health and Safety Element and Land Use Element, includes goals and policies related to geology and soils. The goals and policies generally focus on minimizing risks associated with geological and soil conditions and protecting valuable resources. The Plan address geological hazards to ensure public safety and property protection, which includes addressing hazards such as earthquakes and seismic hazards and landslides and unstable slopes. In addition, the plan addresses erosion control standards for construction and grading, and to protect soil health and water quality. It also aims to protect valuable agricultural resources and has separate policies addressing geothermal resources and aggregate resources management (Lake County, 2008).

Lake County Code of Ordinances

The Lake County Code of Ordinances contains multiple ordinances that directly pertain to geology and soils, mainly through regulations designed to mitigate hazards and control development. The grading ordinance is the primary regulatory tool for managing earth disturbance and addresses soils and geological stability. The goals of the ordinance are to minimize hazards to life and property, protect against soil erosion, protect waterways , fish, wildlife, and sensitive vegetation, protect air quality from dust and asbestos, and maintain consistency with the General Plans goals. Key requirements related to geology and soils include permit requirements, engineered plans and reports, erosion control and sediment detention with implementation of erosion control and sediment detention plans and BMPs to prevent loss of soil and protect water quality during and after grading, seismic/geologic hazard zones, and winter grading restrictions.

Lake County Multi-Jurisdictional Hazard Mitigation Plan

The Lake County Multi-Jurisdictional Hazard Mitigation Plan (HMP) 2025 is prepared by multiple organizations including the auditor-controller's office, Lake County sheriff, and the cities of Lakeport and Clearlake amongst others. The plans mission is to enhance the County's resilience in disasters by focusing on mitigation, preparation, response and recovery. It identifies and prioritizes a list of fourteen major natural hazards of concern including wildfire, drought and water shortage, earthquake, severe weather from storms, severe weather from heat, aquatic biologic hazards, flood, tree mortality, climate change, levee failure, agriculture hazards, dam failure, volcano and geothermal gases, and subsidence. The plan analyzes the risk associated with known active and potentially active fault zones and addresses hazards like ground shaking, liquefaction, and surface rupture. The plan also identifies areas of high landslide susceptibility based on slope steepness and soil types and proposes mitigation strategies for development in these areas. Lake County has regions where serpentine and ultramafic rocks are common, where the weathering of these rocks creates soil containing naturally occurring asbestos, which when disturbed by grading or construction can cause a significant health hazard. The plan contains specific protocols, like those outlined in the grading ordinance, to minimize soil disturbance and protect air quality. Chapter 9

Flood specifically evaluates the County's flood hazard profile, location and extent, previous occurrences, probability of future events, and exposure and vulnerability. The HMP outlines strategies to minimize flood hazards, including regulating development within flood-prone areas, preserving natural floodplain functions, and implementing infrastructure improvements to manage stormwater and reduce flood risk (Lake County, 2025b).

4.7.2 Environmental Setting

Lake County is located in the north central part of the Coast Range Geomorphic Province, which is characterized by northwest-southeast trending valleys and ridges. These are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent shearing along the San Andreas Fault. The bedrock in the site vicinity is mapped as Mesozoic-era rocks of the Franciscan Formation, overlaid by alluvium and recent volcanic rocks, including pyroclastic rocks (USGS, 1960).

Seismic Conditions

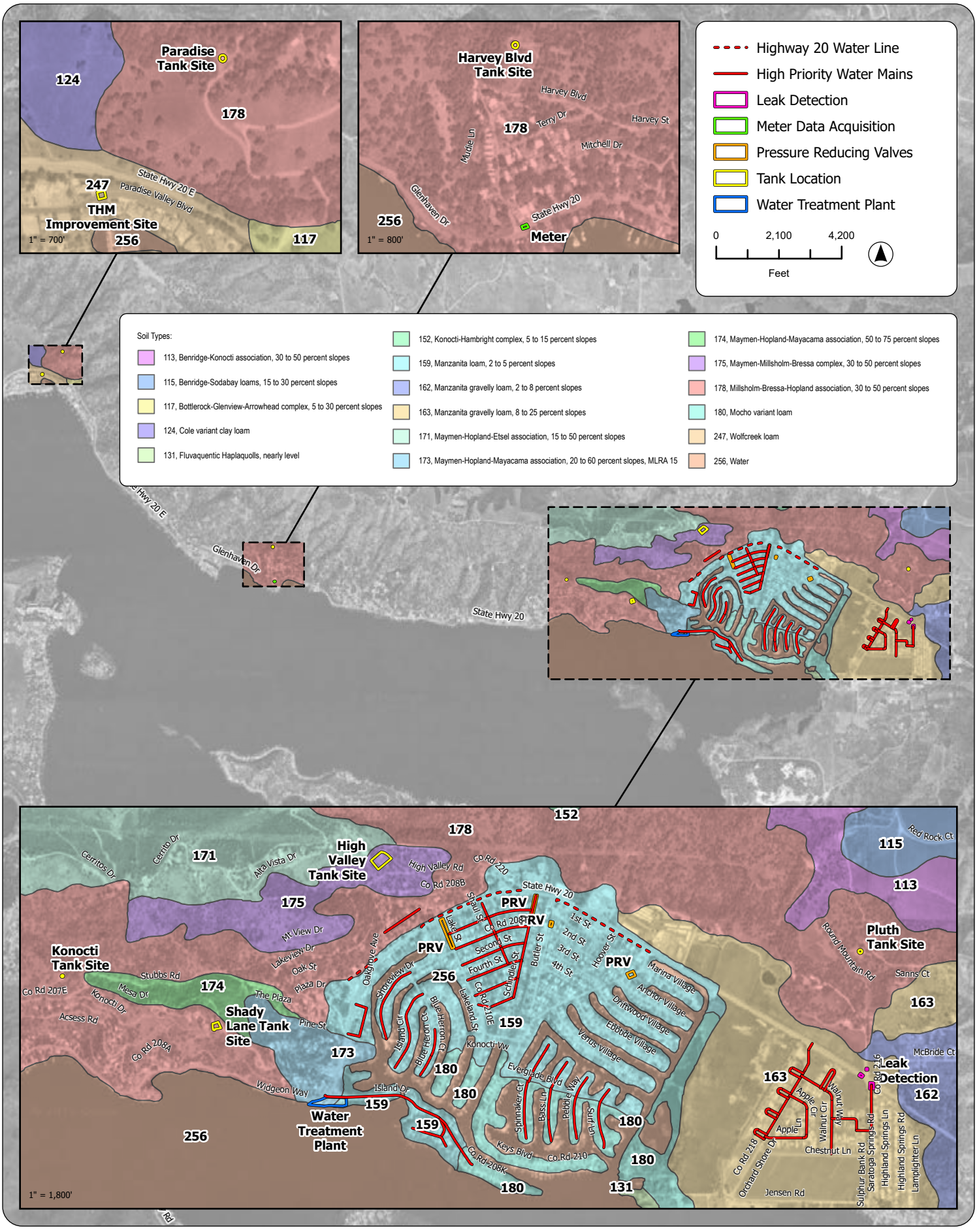
The Proposed Project is not located in a designated Fault-Rupture Hazard Zone, as identified under the Alquist-Priolo Earthquake Fault Zoning Act (USGS, 2025). There are a number of inactive faults in the vicinity of the Proposed Project. An active fault is one that shows displacement within the last 11,000 years (Holocene epoch) and is considered more likely to generate a future earthquake than a fault that has not shown signs of recent activity. The nearest faults to the Proposed Project are the Clover Valley Fault Zone and the Cross Spring Fault Zone, both of which are mapped as a quaternary fault of undifferentiated age (USGS, 2025). The nearest active faults are the Big Valley Fault and the Bartlett Springs Fault System and are located approximately 8 miles southwest, and 6 miles southeast of the Proposed Project, respectively (CDOC, 2026).

Soil Types and Characteristics

The Proposed Project improvement areas contain seven soil types (NRCS, 2026) as described in **Table 4.7-1** and shown in **Figure 8**.

Table 4.7-1: Soil Types

Soils	Hydrologic Soil Group	Drainage Class	Ksat (µm/s)	Runoff Class	Linear Extensibility
Konocti-Hambright complex, 5 to 15 percent slopes	C	Well drained	Moderately low	Medium	Moderate
Manzanita loam, 2 to 5 percent slopes	C	Well drained	Moderately low	Low	Moderate
Manzanita gravelly loam, 8 to 25 percent slopes	C	Well drained	Moderately low	High	Moderate
Maymen-Hopland-Mayacama association, 20 to 60 percent slopes	D	Somewhat excessively drained	Moderately high	High	Low
Maymen-Millsholm-Bressa complex, 30 to 50 percent slopes	D	Well drained	Moderately high	High	Moderate
Millsholm-Bressa-Hopland association, 30 to 50 percent slopes	D	Well drained	Moderately high	High	Moderate
Wolfcreek loam	C	Well drained	Moderately high	Low	Moderate



SOURCE: NRCS Soils, 2025; ESRI, 2026; Google Earth Aerial Photograph, 5/2024; Acorn Environmental, 2/10/2026

Figure 8
Soil Types

Soil Hazards

The hydrologic soil group is a classification based on the runoff potential of the soils when thoroughly saturated by a long duration storm. Soils are grouped into four classes that grade from A to D, with A being coarse-grained soils with high infiltration and low runoff potential and D being mostly fine-grained clays with extremely slow infiltration and high runoff potential. The majority of the soils within the Proposed Project improvement areas have a hydrologic rating of C, with some with a rating of D. A Hydrologic soil rating of C indicates a slow infiltration rate when thoroughly wetted , and a rating of D indicates a very slow infiltration rate when thoroughly wetted (NRCS, 2026).

Drainage class is a measure of the frequency and duration of wet periods under conditions similar to those in which the soil developed. The majority of the soil types within the Proposed Project improvement areas are well-drained to somewhat excessively drained (NCRS, 2026).

Expansive soils may increase in volume when water is absorbed and shrink when dried. This property is measured using linear extensibility. Expansive soils are of concern because they can cause foundations to rise during the rainy season and fall during the dry season, causing structural distortion. The soils within the Proposed Project have low to moderate linear extensibility ratings, indicating they have low to moderate shrink-swell potential (NRCS, 2026).

Paleontological Resources

A search of the University of California Museum of Paleontology (UCMP) specimen records cited no listings for unique paleontological resources or geological features in the immediate project area and did cite a few invertebrates within Clear Lake, but not within the immediate project area. However, the database search listed 249 specimens within Lake County. All specimen records were located at least 3 miles northwest of the Harvey Blvd Tank Site which is the closest Proposed Project location (UCMP, 2025).

4.7.3 Impact Assessment

a) Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

Less-than-Significant Impact. The Proposed Project is not within a designated Alquist-Priolo Earthquake Fault Zone. No known faults with evidence of historic activity cut through the valley soils in the vicinity of the Proposed Project, and the nearest active fault is approximately 6 miles from the Proposed Project. Due to the geology of the County and its distance from active faults, the potential for loss of life, property damage, ground settlement, or liquefaction to occur in the vicinity of the Proposed Project are considered minimal. In addition, all replacement pipelines and other water infrastructure will be installed in accordance with the CBC. Therefore, the Proposed Project would not cause potential substantial adverse effects, including the risk of loss, injury, or death involving a rupture of a known earthquake fault.

ii. Strong seismic ground shaking?

Less-than-Significant Impact. The nearest active fault is approximately 6 miles from the Proposed Project. Ground shaking generally decreases with distance and increases with the depth of unconsolidated alluvial deposits. Considering the distance to the causative faults, the potential for ground motion in the vicinity of the Proposed Project is minimal. In addition, all replacement pipelines will be installed in accordance with the CBC. Therefore, the Proposed Project would not cause potential substantial adverse effects, including the risk of loss, injury, or death involving strong ground shaking.

iii. Seismic-related ground failure, including liquefaction?

Less-than-Significant Impact. There are no geologic hazards or unstable soil conditions known to exist on within the Proposed Project Improvement Areas. Additionally, neither liquefaction nor lateral spreading has been observed in the project vicinity from any historic earthquake (California DOC, 2025b). The Proposed Project improvement areas are mapped as having low liquefaction potential (USGS, 2025). Due to the nature of the underlying soils and the history of low ground shaking potential, liquefaction and lateral spreading potential in the project area are considered very low. In addition, all water lines will be installed in accordance with the CBC. Therefore, the Proposed Project would not cause potential substantial adverse effects, including the risk of loss, injury, or death involving liquefaction.

iv. Landslides?

Less-than-Significant Impact. There have been three recorded landslide events in the vicinity of the meter data acquisition location as mapped by the USGS. These landslides covered portions of SR-20, and only the paved road was impacted. The remainder of the Proposed Project improvement areas do not have any recorded landslide events but are found in the area (USGS, 2025b). Improvements would not increase the landslide potential of this area, as the installation and rehabilitation would occur within the existing disturbed area of the roadway and water infrastructure. The remainder of the improvement areas are not in areas with previously recorded landslides or in areas at risk. In addition, all water lines and water main pipelines will be installed in accordance with the CBC. The Proposed Project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving landslides.

b) Would the project result in substantial soil erosion or the loss of topsoil?

Less-than-Significant Impact with Mitigation. The Proposed Project would cause some ground disturbance for the WTP improvements, water storage tank and booster pump improvements, and distribution system improvements, although any disturbance would be returned to the original condition of the site and all disturbance would occur in previously disturbed areas. There is some potential for erosion to occur during grading and stabilization activities at the Proposed Project improvement areas. With implementation of **Mitigation Measure GEO-1**, which requires various erosion control measures and BMPs, impacts would be reduced to a less-than-significant level.

c) Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

Less-than-Significant Impact. The Proposed Project improvement areas have a relatively stable soils and no apparent unique or significant landforms. Furthermore, the project area has a relatively low potential

for frequent and strong seismic shaking (California DOC, 2025b). Such factors minimize the potential for other geologic hazards such as landslides, lateral spreading, subsidence, liquefaction, or collapse. Additionally, portions of the Proposed Project improvement areas will be conducted in previously disturbed areas that contains engineered fill and will be installed in accordance with the CBC. Therefore, the Proposed Project is unlikely to become unstable and result in geologic hazards. As a result, the Proposed Project would have a less-than-significant impact.

d) Would the project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?

Less-than-Significant Impact. The soils within the Proposed Project have low to moderate linear extensibility ratings and are not considered expansive soils (NRCS, 2026). The Proposed Project would not be located on expansive soil or create substantial direct or indirect risks to life or property. There would be a less-than-significant impact.

e) Would the project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of waste water?

No Impact. The Proposed Projects do not require wastewater disposal or the use of septic systems. There would be no impact.

f) Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Less-than-Significant Impact with Mitigation. The UCMP database cited no listings for unique paleontological resources or geological features in the immediate project area. However, the database search listed 249 specimens within Lake County (UCMP, 2025). Accordingly, there is a reasonable basis for concluding that paleontological impacts may be encountered at the Proposed Project as a result of construction-related excavation activities, which is a potentially significant impact. **Mitigation Measure GEO-2** has been identified to reduce impacts to paleontological resources. Implementation of **Mitigation Measure GEO-2** would ensure that impacts would be less-than-significant.

4.7.4 Mitigation Measures

GEO-1: The following erosion control measures and BMPs shall be required during construction:

- Temporary erosion control measures (such as silt fences, staked straw bales, and temporary revegetation) shall be employed for disturbed areas.
- Construction activities shall be scheduled to minimize land disturbances during peak runoff periods and to the immediate area required for construction. Soil conservation practices shall be completed during the fall or late winter to reduce erosion during spring runoff. Existing vegetation would be retained where possible. To the extent feasible, grading activities shall be limited to the immediate area required for construction.
- Topsoil removed during construction shall be carefully stored and treated as an important resource. Berms shall be placed around topsoil stockpiles to prevent runoff during storm events.

- Establish fuel and vehicle maintenance areas away from all drainage courses and design these areas to control runoff. To the degree needed, these areas would be established before construction begins and would be clearly marked.
- Disturbed areas would be re-vegetated or re-paved after completion of construction activities.

GEO-2: If paleontological resources (fossils) are discovered during project activities, all work shall cease within a 100-feet of the find until a qualified professional paleontologist as defined by the Society of Vertebrate Paleontology's Conformable Impact Mitigation Guidelines Committee can assess the nature and importance of the find and recommended appropriate treatment. The Clearlake Oaks Water District will also be notified of the discovery and the qualified professional paleontologist's opinion within 48 hours of the initial finding. Treatment may include preparation and recovery of fossil materials, so that they can be housed in an appropriate museum or university collection and also may include preparation of a report for publication describing the finds. Project activities shall not resume until after the qualified professional paleontologist has given clearance and evidence of such clearance has been submitted to the Clearlake Oaks Water District.

4.8 GREENHOUSE GAS EMISSIONS

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☒	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☒	☐	☐

4.8.1 Regulatory Setting

Federal

Massachusetts v. EPA, 549 U.S. 497 (2007)

In Massachusetts v. EPA, 549 U.S. 497 (2007), the Supreme Court found that greenhouse gas emissions (GHGs) are air pollutants covered by the CAA. The Court also acknowledged that climate change is caused, in part, by human activities. The Supreme Court's ruling paved the way for the regulation of GHG emissions by the USEPA under the CAA. The USEPA has enacted regulations that address GHG emissions, including, but not limited to, mandatory GHG reporting requirements, carbon pollution standards for power plants, and air pollution standards for oil and natural gas.

State

Assembly Bill 32

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global Warming Solutions Act of 2006," signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main State strategies for reducing GHGs to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions. Based on this guidance, CARB approved a 1990 statewide GHG level and 2020 limit of 427 MT CO_2e. The Scoping Plan was approved by CARB on December 11, 2008, and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and Cap-and-Trade) have been adopted since approval of the Scoping Plan.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2013 Scoping Plan update defined CARB's climate change priorities for the next five years and set the groundwork to reach post-2020 statewide goals. Senate Bill (SB) 32 was signed by the governor on September 8, 2016, to extend AB 32 by requiring the State to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). To ensure consistency with SB 32 CARB adopted another update the Scoping Plan in December 2017. The 2017 Scoping Plan update highlights California's progress toward meeting the "near-term" 2030 GHG emission reduction goals defined in the original Scoping Plan. The strategy includes extending the Cap-and-Trade program post-2020, implementation of the Short-Lived Climate Pollutant Plan and Mobile Source Strategy and increasing renewable energy generation and improving energy efficiency. In 2016, the Legislature passed SB 32. This established a benchmark for California to reduce GHG emissions to 40 percent below 1990 levels by 2030. Under the 2022 Scoping Plan, seven key areas were identified: transportation sustainability, clean electricity grid, sustainable manufacturing and buildings, carbon dioxide removal and capture, short-lived climate pollutants (non-combustion gases), and natural and working lands.

Local

Lake County Air Quality Management District

The LCAQMD has not adopted GHG thresholds for the determination of impact significance for projects subject to CEQA review. Lake County is currently in the process of developing a Climate Action Plan; however, it has not yet been finalized and therefore cannot be used for evaluating GHG emissions.

4.8.2 Environmental Setting

Gases that absorb and re-emit infrared radiation in the atmosphere are called GHGs. The GHGs that are widely seen as the principal contributors to human-induced climate change include carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), fluorinated gases such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Water vapor is excluded from the list of GHGs because it is short-lived in the atmosphere and its atmospheric concentrations are primarily determined by natural processes, such as oceanic evaporation.

GHGs are emitted by both natural processes and human activities. Of these gases, CO_2, CH_4, and N_2O are emitted in the greatest quantities from human activities. Emissions of CO_2 are largely by-products of fossil

fuel combustion, whereas CH_4 results from off-gassing are associated with agricultural practices and landfills. N_2O is produced by microbial processes in soil and water, including those reactions that occur in fertilizers that contain nitrogen, fossil fuel combustion, and other chemical processes. In addition to natural sources, human activities are exerting a substantial and growing influence on climate by changing the composition of the atmosphere and the ocean, and by modifying the land surface through deforestation and urbanization that reduces carbon capture and decreases albedo. GHGs are typically quantified in terms of "carbon dioxide equivalent" (CO_2e), a common measure used to compare the emissions of various GHGs based on their global warming potential. This measure is usually presented in metric tons (MT) and is expressed as MT CO_2e.

4.8.3 Impact Assessment

a) Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

b) Would the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Less-than-Significant Impact with Mitigation.

Construction:

The Proposed Project would generate GHG emissions during construction from the use of heavy-duty diesel-powered construction equipment and vehicle trips. The LCAQMD has not adopted formal thresholds of significance for GHG emissions, and although it is in the process of developing a CAP, the plan is not finalized and therefore cannot be used to evaluate the Proposed Project's GHG emissions. LCAQMD has determined that the Bay Area Air District thresholds of significance may be used to evaluate GHG emissions for projects in Lake County; however, the Bay Area Air District has not established quantitative thresholds for construction-related GHG emissions, noting that such emissions are temporary and variable and therefore would not significantly contribute to long-term GHG emissions impacts in the LCAB. Since there are no thresholds to compare construction emissions against, this analysis relies on the implementation of BMPs to reduce GHG emissions, as recommended by the California Air Pollution Control Officers Association (CAPCOA, 2010). **Mitigation Measure GHG-1** requires measures such as using alternative-fueled equipment, sourcing local building materials, recycling construction and demolition waste, and minimizing vehicle idling. With the implementation of these measures, construction-related GHG emissions would be minimized, and the Proposed Project would have a less-than-significant impact on GHG emissions.

Operation:

The Proposed Project involves rehabilitation and upgrades to existing water infrastructure, including improvements at the WTP, water tanks, pipelines, and associated monitoring and operational equipment. These improvements would increase the energy efficiency and system durability of the water facilities and reduce corresponding operational GHG emissions from energy use and transportation for maintenance activities (see **Section 4.6**). Therefore, the Proposed Project would not increase GHG emissions over baseline conditions and there would be a less-than-significant impact.

4.8.4 Mitigation Measures

GHG-1: CLOCWD shall ensure through contractual obligations that the following measures are implemented during construction to minimize GHG emissions:

- The contractor shall operate at least 15 percent of construction vehicles/equipment using alternative fuels (e.g., biodiesel, electric).
- The contractor shall source at least 10 percent of construction materials locally.
- The contractor shall recycle at least 50 percent of construction and demolition waste.
- Idling times shall be minimized either by shutting off equipment when not in use or reducing the maximum idling time to five minutes (as required by the California Airborne Toxics Control Measure (Title 13, Section 2485 of the CCR).

4.9 HAZARDS AND HAZARDOUS MATERIALS

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☒	☐	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code § 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☐	☒
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	☐	☒	☐	☐

4.9.1 Regulatory Setting

Federal

USEPA

The USEPA administers numerous statutes pertaining to human health and the environment. The USEPA regulates toxic air contaminants through its implementation of the CAA. Although the CAA covers a range of air pollutants, Section 112(r) specifically covers "extremely hazardous materials" which include acutely toxic, extremely flammable, and highly explosive substances. Section 112(r) (referred to as the USEPA's Risk Management Plan (RMP)) requires facilities involved in the use or storage of extremely hazardous materials to implement a RMP. A RMP requires a detailed analysis of potential accident factors present at a facility and requires the implementation of mitigation measures designed to reduce the identified accident potential.

The USEPA also regulates the land disposal of hazardous materials through the Resource Conservation and Recovery Act (RCRA). Under RCRA, the USEPA regulates the activities of waste generators, transporters, and handlers (any individual who treats, stores, and/or disposes of a designated hazardous waste). RCRA further requires the tracking of hazardous waste from its generation to its final disposal through a process often referred to as the "cradle-to-grave" regulation. The "cradle-to-grave" regulation requires detailed documentation and record keeping for hazardous materials generators, transporters, and/or handlers in order to ensure proper accountability for violations.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The CERCLA provides a Federal fund to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through various enforcement mechanisms, the USEPA obtains private party cleanup orders and recovers costs from financially viable individuals and companies once a response action has been completed. Uncontrolled or abandoned hazardous-waste site identification, monitoring, and response activities in states are coordinated though the state environmental protection or waste management agencies.

Federal Occupational Safety and Health Administration (OSHA)

OSHA regulates the preparation and enforcement of occupational health and safety regulations with the goal of providing employees a safe working environment. OSHA regulations apply to the workplace and cover activities ranging from confined space entry to toxic chemical exposure. OSHA regulates workplace exposure to hazardous chemicals and activities through regulations governing workplace procedures and equipment.

State

Department of Toxic Substances Control (DTSC)

The California DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous waste under the RCRA and the State Hazardous Waste Control Law. Both laws impose "cradle-to-grave" regulatory systems for handling hazardous waste in a manner that protects human health and the environment.

California Occupational Safety and Health Administration (Cal/OSHA)

Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations in the State. Cal/OSHA regulations concerning the use of hazardous materials in the workplace, as detailed in Title 8 of the CCR, include requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation.

Cal/OSHA enforces hazard communication program regulations that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating hazard information related to hazardous substances and their handling, and preparation of health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that Safety Data Sheets be available to employees and that employee information and training programs be documented.

State Water Quality Control Board (SWQCB) Underground Storage Tank (UST) Program

The SWQCB UST Program is a state-level regulation managed by the State Water Resources Control Board (SWRCB) in California. The program is designed to prevent releases of hazardous substances from USTs, protect groundwater quality, and ensure compliance with federal and state UST regulations.

Regional Water Quality Control Board

The SWRCB and RWQCBs regulate hazardous substances, materials, and wastes through a variety of State statutes including, for example, the Porter-Cologne Water Quality Control Act, Cal. Water Code Section 13000 et seq., and the UST cleanup laws (Cal. Health and Safety Code Section 25280- 25299.8). RWQCBs regulate all pollutant or nuisance discharges that may affect either surface water or groundwater. Any person proposing to discharge waste within any region must file a report of waste discharge with the appropriate regional board.

Cortese List – Government Code Section 65962.5

The provisions in California Government Code § 65962.5 require CalEPA to compile a database listing of hazardous waste facilities and other permitted activities within their jurisdiction. This database is collectively referred to as the "Cortese list." The sites for the list are designated by the SWRCB, the Integrated Waste Board, and the DTSC. The Cortese list is updated quarterly.

California Building Code and California Fire Code

Prior to issuance of building permits and during occupancy of the Proposed Project, the Lake County Building Division and Fire Department would be responsible for reviewing plans for facilities proposing to use hazardous materials to ensure that applicable CBC and California Fire Code standards are included in project design. These standards address, among other elements, proper storage and secondary

containment for hazardous materials and fire-safe construction and materials. Use of appropriate design features would help reduce the potential for accidental releases of hazardous materials that could affect occupants or require emergency response services.

2023 State Hazard Mitigation Plan

The 2023 California State Hazard Mitigation Plan (SHMP) is the State's primary guidance document for reducing long-term risks from natural and human-caused hazards and provides a framework that local governments must consider when preparing their own hazard mitigation plans. The SHMP outlines historical and current hazards affecting California, identifies statewide mitigation strategies and actions, and offers guidance to local jurisdictions on hazard planning. The 2023 update expands analysis of climate change and equity-priority communities and reorganizes hazards according to impact ratings rather than by hazard type. The SHMP is divided into two volumes—the Core Plan and Technical Appendices—and is supported by additional resources, including the Adaptation Planning Guide, MyPlan 2.0, and a statewide webinar series. The update was developed with input from Statewide Hazard and Working Groups composed of subject-matter experts from multiple levels of government; a new Climatic Hazards Group now focuses on drought, extreme heat, freeze events, and severe storms. These groups continue to advise on emerging hazard data and statewide mitigation efforts during the plan's implementation phase. The 2023 SHMP is effective through August 29, 2028.

California Department of Toxic Substances Control

The DTSC is a sub-agency of the CalEPA that regulates the generation, transportation, treatment, storage, and disposal of hazardous waste under the federal RCRA and the State Hazardous Waste Control Law. Both laws impose "cradle-to-grave" regulatory systems for handling hazardous waste in a manner that protects human health and the environment.

California Occupational Safety and Health Administration

Cal/OSHA assumes primary responsibility for developing and enforcing State workplace safety regulations. Cal/OSHA regulations concerning the use of hazardous materials in the workplace, as detailed in Title 8 of the CCR, include requirements for safety training, availability of safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal/OSHA enforces hazard communication program regulations that contain training and information requirements, including procedures for identifying and labeling hazardous substances, communicating hazard information related to hazardous substances and their handling, and preparation of health and safety plans to protect workers and employees at hazardous waste sites. The hazard communication program requires that Material Safety Data Sheets be available to employees and that employee information and training programs be documented.

Local

2025 Lake County Multi-Jurisdictional Hazard Mitigation Plan

The Lake County Multi-Jurisdictional HMP (2025) was prepared by Lake County in coordination with the Lake County Sheriff's Office of Emergency Services, County departments, and the Cities of Clearlake and Lakeport. The Plan establishes a countywide framework to reduce risks to life, property, infrastructure, and the environment through hazard identification, risk assessment, and long-term mitigation strategies. The HMP evaluates a broad range of hazards affecting Lake County, including wildfire, flood, earthquake, drought and water shortage, severe weather, aquatic hazards, levee and dam failure, tree mortality,

subsidence, and volcanic or geothermal gas release, among others. For each hazard, the Plan assesses historical occurrences, location and extent, probability of future events, and exposure and vulnerability of the built environment, natural resources, and critical facilities. The Plan also addresses secondary and cascading hazards, such as erosion, debris flows, infrastructure damage, and potential releases of hazardous materials that may occur during major hazard events. Climate change is integrated throughout the HMP as a factor that can intensify hazard frequency and severity, particularly for wildfire, flooding, drought, and extreme heat. A countywide Mitigation Strategy identifies goals, objectives, and actions to improve community resilience, guide infrastructure planning, protect water resources, and support coordinated emergency response across jurisdictions.

Lake County General Plan

The General Plan, Health and Safety Element addresses the hazardous materials and emergency response planning for the County. Applicable general plan policies related to the Proposed Project are listed below. Appendix GPCT analyzes the Proposed Project's consistency with the General Plan pursuant to the CEQA Guidelines Section 15125(d); however, the determination of the Proposed Projects consistency with the General Plan ultimately rests with the Lake County Board of Supervisors.

Goal HS-1. To ensure the County is protected from injury and damage resulting from natural catastrophes, man-made events, and hazardous conditions.

Policy HS-1.1: The County shall permit development only in areas where the potential danger to the health and safety of people can be mitigated to an acceptable level.

Policy HS-1.3: The County shall ensure all buildings for human habitation are designed in compliance with the Uniform Building Code and other requirements based on risk (e.g., seismic hazards, flooding), type of occupancy, and location (e.g., floodplain, fault).

Goal HS-5. To protect residents, visitors, and property from hazardous materials through their safe use, transport, and disposal.

Policy HS-5.1: The County shall strive to ensure that hazardous materials are used, transported, and disposed within the County in a safe manner and in compliance with local, state, and federal safety standards. Investigations and enforcement action shall be taken as necessary for any illegal hazardous waste disposal or other violations of federal, state, or local hazardous materials laws and regulations.

Policy HS-5.2: The County shall work with Caltrans and the Highway Patrol to ensure that hazardous materials transported within the County are restricted to routes that have been designated for such transport.

Policy HS-5.5: The County shall prevent incompatible land uses within close proximity to hazardous waste properties.

Policy HS-5.11: The County shall require that developers have Phase I or Phase II environmental site assessments performed during the design phase on sites known to contain hazardous materials or which had previously been utilized for the handling or storage of hazardous materials.

Goal PFS-5. To ensure the safe and efficient disposal or recycling of solid and hazardous waste generated in the County.

Policy PFS-5.4: The County shall require the proper disposal and recycling of hazardous materials and should investigate hazardous waste disposal needs for anticipated geothermal and agricultural toxic wastes.

Goal T-3. To enhance airports in the County to meet the County's changing needs and demands while minimizing adverse airport-related environmental impacts and safety hazards.

Policy T-3.2: The County shall promote compatible land use planning in areas surrounding airports. Land uses involving the concentration of people and/or hazardous materials should not be developed in the approach pattern. Federal and state regulations governing operations and land use restrictions related to airports shall be supported by the County.

4.9.2 Environmental Setting

For the purposes of this section, the term "hazardous materials" as defined by the CCR are substances with certain physical properties that could pose a substantial present or future hazard to human health or the environment when improperly handled, disposed, or otherwise managed. Hazardous materials are grouped into the following four categories based on their properties:

- Toxic: causes human health effect
- Ignitable: has the ability to burn
- Corrosive: causes severe burns or damage to materials
- Reactive: causes explosions or generates toxic gases

Hazardous waste is any hazardous material that is discarded, abandoned, or slated to be recycled. The criteria that define a material as hazardous also define a waste as hazardous. If improperly handled, hazardous materials and hazardous waste can result in public health hazards if released into the soil or groundwater or through airborne releases in vapors, fumes, or dust. Soil and groundwater having concentrations of hazardous constituents higher than specific regulatory levels must be handled and disposed of as hazardous waste when excavated or pumped from an aquifer. The CCR, Title 22, Sections 66261.20-24 contains technical descriptions of toxic characteristics that could cause soil or groundwater to be classified as hazardous waste.

Hazardous materials are routinely used, stored, and transported within the community of Clearlake Oaks and the broader Lake County region. Hazardous waste generators include commercial businesses, automotive and marine service stations, public agencies, and residential uses. Federal, State, and local agencies maintain comprehensive databases that identify facilities that use hazardous materials, generate hazardous waste, contain leaking underground storage tanks (LUSTs), or require cleanup oversight. These include DTSC's EnviroStor database, the SWRCB GeoTracker system, and California DOC - California Geologic Energy Management Division's (CalGEM) WellSTAR.

A review of the SWRCB GeoTracker database identified seven historical LUST cleanup cases within the project area, all of which are listed as Completed – Case Closed:

- Clearlake Oaks Chevron (12585 Highway 20; Case Closed 6/17/2004): Gasoline release with groundwater impacts; cleanup completed under Central Valley RWQCB oversight.
- Oaks Boathouse (12700 Island Drive; Case Closed 11/7/1994): Gasoline release with potential surface water impacts; cleanup completed.

- Former Snow's Automotive (12617–12621 Highway 20; Case Closed 2/21/2017): Gasoline constituents (benzene, toluene, ethylbenzene, xylene, naphthalene) affecting drinking water supply wells; cleanup completed and land use controls recorded.
- Exxon (12609 Highway 20; Case Closed 3/12/1993): Gasoline-contaminated soil; cleanup completed.
- M&M Auto / Oak's Union 76 (12622 Highway 20; Case Closed 12/4/1991): Gasoline-contaminated soil; cleanup completed.
- Sea Breeze Resort (9595 Harbor Drive, Glenhaven; Case Closed 6/22/1992): Gasoline-contaminated soil; cleanup completed.
- Indian Beach Resort (9945 Hwy 20 East, Glenhaven; Case Closed 8/20/1996): Gasoline-contaminated aquifer; cleanup completed.

All seven sites have been closed by regulatory agencies, indicating that any remaining contamination is not expected to pose a significant risk under current land use conditions. No open cleanup cases or active hazardous materials release sites are located within or immediately adjacent to the project work areas (California State Water Resources Control Board, 2026).

DTSC's EnviroStor database (California Department of Toxic Substances Control, 2026a) and the Cortese List (pursuant to Government Code § 65962.5) (California Department of Toxic Substances, 2026b) identify one active cleanup site in the project vicinity: the Sulphur Bank Mercury Mine, a 150-acre State Response/NPL (Superfund) site located along Sulphur Bank Road on the eastern shore of the Oaks Arm of Clear Lake. The former sulfur and mercury mine contains approximately 3 million cubic yards of waste rock with elevated mercury and arsenic in soil, sediment, and surface water. The site is jointly managed by DTSC and the USEPA and consists of multiple Operable Units addressing mine waste, impacted residential areas, lake sediments, and adjacent wetlands. USEPA has completed several removal actions and continues to advance long-term remediation planning, including release of a Proposed Cleanup Plan in 2023. Mercury levels in Clear Lake fish have resulted in a State fish consumption advisory. Although the Sulphur Bank Mercury Mine appears on the Cortese List, no portion of the Proposed Project is located within the Superfund site boundary (California Department of Toxic Substances Control, 2026a).

A search of the CalGEM's WellSTAR geothermal well system identified 18 historical geothermal wells in the vicinity of the Sulphur Bank Mercury Mine and Herman Impoundment. These wells were drilled for exploratory steam or temperature-gradient investigations by operators such as Freeport-McMoRan Resource Partners, Earth Energy, Inc., and Bradley Mining. Representative wells include SBM-1 (API 03390580), SBM-3 (API 03390582), SBM-14 (API 03390593), and Bradley Mining Well 1 (API 03390006). All identified wells are documented as Plugged and Abandoned, and no active or idle geothermal wells occur on or adjacent to the project construction locations. No wells requiring additional regulatory coordination are present within the project work areas (California DOC, 2026b).

4.9.3 Impact Assessment

a) Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

b) Would the project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Less than Significant Impact with Mitigation. Construction of the Proposed Project would involve the routine transport, use, and short-term storage of limited quantities of hazardous materials such as fuels, lubricants, hydraulic fluids, solvents, concrete additives, paints, welding gases, and cleaning agents. These materials are typical for construction involving excavation, trenching, pipeline replacement, mechanical and electrical upgrades, structural improvements, and concrete work. Hazardous materials would be used in small quantities and would not require bulk storage. Potential accidental releases during construction could occur from equipment leaks, refueling operations, or improper handling. However, all contractors would be required to comply with applicable federal and State regulations, Cal/OSHA requirements, and construction BMPs, including Standard Operating Procedures for fueling. These construction BMPs have been incorporated as **Mitigation Measures HM-1** and **HM-2** to reduce potential adverse effects.

During operation, the rehabilitated water facilities would continue to use chemicals already employed at the water treatment plant for treatment and disinfection. The Proposed Project does not introduce new types or substantially greater quantities of hazardous materials than are currently used. Instead, the project improves operational safety by upgrading multiple components of the water system that strengthens the entire system by improving structural integrity, containment, reliability, and monitoring, such as:

- Upgrading existing water storage tanks to improve efficiency and conserve water.
- Modify the ozone generation equipment to enhance disinfection capacity to reduce ozone demand.
- Equalization tank improvements—including new tanks, relocation of existing temporary holding tanks, and installation of piping for backwash flows and tank drainages.
- Dissolved Air Flotation Pilot Plant- includes maximizing the source capacity and increasing treated water production at the water treatment plant through pretreatment of raw water.
- Water storage tank and booster pump improvements.
- Distribution system improvements- includes removing and replacing the Highway 20 water line, replacements of high priority water mains, pressure reducing valves, and meter data consolidation and water loss management system.
- Operational maintenance management- includes SCADA system upgrades, a Cross Connection Hazard Assessment and Leak Detection Program.

The project would remain subject to hazardous materials regulations administered by CalEPA, DTSC, SWRCB/RWQCB, and Lake County Environmental Health, as well as any applicable Hazardous Materials Business Plan requirements.

Accordingly, the Proposed Project would not create a significant hazard to the public or environment through routine hazardous materials use or through reasonably foreseeable upset and accident conditions. This impact would be less than significant with mitigation.

c) Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Less than Significant Impact with Mitigation. East Lake Elementary School, part of the Konocti Unified School District, is located approximately 0.10 miles from the northern-most component of the Proposed Project. As described in **Questions (a) and (b)**, construction activities would involve only limited quantities of typical construction-related hazardous materials that would be used in small amounts, stored temporarily, and handled in accordance with existing federal and State regulations and spill-prevention procedures. These materials would not generate hazardous emissions, nor would construction activities involve acutely hazardous substances. Similarly, project operation would not introduce new chemical types or hazardous emission sources. Instead, operational upgrades would further reduce the potential for accidental releases relative to existing conditions. Because the Proposed Project would not emit hazardous substances or handle acutely hazardous materials capable of affecting nearby receptors, and because all construction and operational activities are governed by stringent hazardous materials regulations, the presence of East Lake Elementary School within 0.10 miles would not result in a significant hazard. This impact would be less than significant with mitigation.

d) Would the project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code § 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Less than Significant Impact. A review of the Cortese List identified one active Cortese-listed site in the broader vicinity of the Proposed Project: the Sulphur Bank Mercury Mine, a State Response/NPL (Superfund) site located along Sulphur Bank Road. As described in **Section 4.9.2**, the site contains historic sulfur and mercury waste materials and remains under long-term cleanup oversight. However, no portion of the Proposed Project is located on, within, or immediately adjacent to the Sulphur Bank Mercury Mine Superfund site boundary. Because the improvement areas are not situated on a Cortese-listed property, and because the nearest listed site is geographically separate and unrelated to project activities, the Proposed Project would not pose a significant hazard to the public or the environment related to listed contamination. This impact would be less than significant.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?

No Impact. The Proposed Project is not located within an airport land use plan and there are no public airports located within two miles of the Improvement areas. The nearest airport is Hoberg Airport, located approximately 9.5 miles south of the Improvement areas. The Proposed Project will have no impact.

f) Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Less-than-Significant Impact. The Proposed Project involves rehabilitation and upgrades to existing water infrastructure, including improvements at the water treatment plant, Highway 20 water line, priority water mains, tanks, pressure reducing valves, and associated electrical and operational equipment. These

activities would occur within previously developed sites, public rights-of-way, and utility corridors that already support water facilities and municipal infrastructure. Construction may require intermittent lane closures or temporary traffic controls near the Highway 20 water line, or by priority water mains within roadways; however, all work within public streets would be subject to Lake County encroachment permits, traffic control requirements, and coordination with emergency service providers to maintain access at all times. These measures ensure that construction activities would not impede emergency vehicle circulation. For these reasons, the Proposed Project would not impair or physically interfere with an adopted emergency response plan or emergency evacuation plan. This impact would be less than significant.

g) Would the project expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?

Less-than-Significant Impact with Mitigation. As described in **Section 4.20.2**, the improvement areas are primarily located within a Local Responsibility Area with varying Fire Hazard Severity Zone classifications. Construction activities would involve temporary equipment with limited ignition potential. Contractors would be required to comply with federal, state, and local regulations, such as California Building/Fire Code and Lake County fire-safe regulations, and implement standard construction BMPs to minimize fire risk, included as **Mitigation Measure WILD-1** as discussed in **Section 4.20.4**. These requirements ensure that the likelihood of accidental ignition during construction remains low. During operation, the improved water facilities would not involve the handling or storage of new flammable materials and would instead the decrease the chances of igniting a fire wildfire, such as reducing the chance of fire ignition due to faulty electrical equipment. This impact is less than significant with mitigation.

4.9.4 Mitigation Measures

HM-1

Personnel shall follow written Standard Operating Procedures (SOPs) for filling and servicing construction equipment and vehicles. The SOPs, which are designed to reduce the potential for incidents involving hazardous materials, shall include the following:

- Refueling shall be conducted only with appropriate pumps, hoses, and nozzles per manufacture guidelines;
- Catch pans shall be placed under equipment to catch potential spills during servicing;
- All disconnected hoses shall be placed in containers to collect residual fuel from the hose;
- Vehicle engines shall be shut down during refueling;
- No smoking, open flames, or welding shall be allowed in refueling or service areas;
- Refueling shall be performed away from bodies of water to prevent contamination of water in the event of a leak or spill;
- Service trucks shall be provided with fire extinguishers and spill containment equipment, such as absorbents;
- Should a spill contaminate soil, the soil shall be put into containers and disposed of in accordance with local, State, and federal regulations;
- All containers used to store hazardous materials shall be inspected at least once per week for signs of leaking or failure. All maintenance and refueling areas shall be inspected monthly. Results of inspections shall be recorded in a logbook that would be maintained on site; and

- The amount of hazardous materials used in project construction and operation shall be consistently kept at the lowest volumes needed.

HM-2

If suspected soil contamination is encountered during grading activities, all work shall be halted and a qualified individual, in consultation with the RWQCB, shall determine the appropriate course of action.

4.10 HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☐	☒	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i. result in a substantial erosion or siltation on- or off-site;	☐	☒	☐	☐
ii. substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐
iii. create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☐	☐	☒	☐
iv. impede or redirect flood flows?	☐	☐	☒	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☒	☐
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☒	☐

4.10.1 Regulatory Setting

Federal

Clean Water Act

The CWA, as amended by the Water Quality Act of 1987, is the major federal legislation governing water quality and establishes the national water quality goals. The pertinent sections of the CWA include:

- Section 303 and Section 304: Provide water quality standards, criteria, and guidelines.
- Section 401: Water Quality Certification. Requires an application for any federal permit that proposed an activity which may result in the discharge to Waters of the U.S. to obtain certification from the state that the discharge will comply with other prevision of the CWA.
- Section 402: Established the National Pollution Discharge Elimination System (NPDES) for the discharge of any pollutant (except for dredge of fill material) into Waters of the U.S. This permit system is administered by the SWRCB and is discussed in further detail below.
- Section 404: Establishes a permit program for the discharge of dredge or fill material into Waters of the U.S. This permit program is administered jointly by the USACE and the USEPA.

Safe Drinking Water Act (SDWA)

Under the SDWA, the USEPA regulates contaminants of concern to domestic water supply. Contaminants of concern are those defined to pose a threat to public health or alter the aesthetic acceptability of the water. These types of contaminants are classified as either primary or secondary Maximum Contaminant Levels.

Federal Emergency Management Agency

FEMA is responsible for mapping flood prone areas under the National Flood Insurance Program (NFIP). Communities that participate in the NFIP are required to adopt and enforce a floodplain management ordinance to reduce future flood risks related to new construction in a flood hazard area.

National Pollution Discharge Elimination System

Under Section 402(p) of the CWA, the USEPA established the NPDES to enforce the discharge standards for both point-source and non-point source pollution, such as construction activities. Construction activities include clearing, grading, excavation, stockpiling, and reconstructing existing facilities involving removal and replacement of existing foundations or other hardscapes. Construction projects disturbing one or more acres of soil must be covered under the NPDES Construction General Permit process. The responsibility for issuing NPDES programs is delegated to the SWRCB and the nine RWQCBs. Additional discussion for NPDES as it relates to State specific regulations are discussed below.

State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (California Water Code Section 13000 et seq.) provides the basis for water quality regulation within California. The Act requires a “Report of Waste Discharge” for any discharge of waste (liquid, solid, or otherwise) to land or surface waters that may impair a beneficial use of surface or groundwater of the state. The RWQCB implements waste discharge requirements identified in the Report.

CCR - Title 22, Division 4, Chapter 3 – Water Recycling Criteria

This section of the CCR, commonly referred to as Title 22, establishes the recycled water quality criteria, acceptable uses of recycled water, wastewater treatment requirements for each use, use area requirements, engineering report requirements, reporting and record keeping requirements, and design requirements for operational reliability of treatment.

The regulations establish acceptable levels of constituents in recycled water for a range of uses and prescribe means for assurance of reliability in the production of recycled water. Criteria for the production of recycled water include water quality standards, treatment process requirements, operational requirements, and treatment reliability requirements. The intent of the regulations is to ensure the protection of public health associated with the use of recycled water. Title 22 recycled water regulations for a specific reuse category are based on the expected degree of contact with the recycled water.

State Non-degradation Policy

In 1968, as required under the Federal Anti-degradation Policy described previously, the SWRCB adopted a Non-degradation Policy aimed at maintaining high quality for waters in California. The Non-degradation Policy states that the disposal of wastes into state waters shall be regulated to achieve the highest water quality consistent with maximum benefit to the people of the state and to promote the peace, health, safety, and welfare of the people of the state.

Regional Water Quality Control Boards

The SWRCB and RWQCBs also regulate hazardous substances, materials, and wastes through a variety of State statutes, including the Porter Cologne Water Quality Control Act, California Water Code Section 13000 et seq., and the underground storage tank cleanup laws, California Health and Safety Code Subsection 25280–25299.8. RWQCBs regulate all pollutant or nuisance discharges that may affect either surface water or groundwater. Any person proposing to discharge waste within any region must file a report of waste discharge with the appropriate regional board. The Proposed Project is located within the jurisdiction of the Central Valley RWQCB.

Sustainable Groundwater Management Act (SGMA)

The SGMA, enacted in September 2014, established a framework for groundwater resources to be managed by local agencies in areas designated by the Department of Water Resources as “medium” or “high” priority basins. Basins were prioritized based, in part, on groundwater elevation monitoring conducted under the California Statewide Groundwater Elevation Monitoring program. The SGMA requires local agencies in overdrafted, medium and high-priority basins to form Groundwater Sustainability Agencies and be managed in accordance with locally-developed Groundwater Sustainability Plans.

Local

Lake County Code of Ordinances

Water resources and safety in Lake County are regulated by the Lake County Code of Ordinances (Code). Chapter 9 of the Code - Health and Sanitation, Article VIII, contains regulations for wells and the preservation of groundwater. Per the Code, a well permit must first be obtained from the Health Officer and filed with the Lake County Health Department prior to construction. Chapter 25 of the Code - Floodplain Management, outlines floodplain management regulations to minimize flood losses, including

regulation of erosion, alteration of floodplains, control of grading and dredging, and regulation of the construction of flood barriers. Chapter 28 of the Code – Groundwater, regulates the extraction and exportation of groundwater from Lake County. Chapter 29 of the Code – Stormwater Management Ordinance, regulates stormwater for the purpose of reducing pollutants in stormwater discharges and by prohibiting non-stormwater discharges

Lake County General Plan

The General Plan contains goals and policies related to water resources. Applicable General Plan Water Resources Element and Health and Safety Element policies related to the Proposed Project are listed below:

Goal HS-6. To minimize the possibility of the loss of life, injury, or damage to property as a result of flood hazards.

Policy HS-6.1: All development within the designated floodway or floodplain zones shall conform to Federal Emergency Management Administration regulations and the Lake County Flood Plain Management Plan.

Policy HS-6.2: The 100-year floodplain zones should be protected and maintained through strict limitation on land use. To carry out this policy, the following guidelines on development should be observed:

- Critical facilities (those facilities which should be open and accessible during emergencies) should not be permitted.
- Passive recreational activities (those requiring non-intensive development, such as hiking, horseback riding, picnicking) are permissible.
- New development and divisions of land, especially residential subdivisions, shall be developed to minimize flood risk to structures, risk to infrastructure, and ensure safe access during flood conditions.
- The County shall impose stringent controls on approvals of septic systems where there is a substantial likelihood of infiltration of floodwater into the systems, and/or the discharge from the systems into floodwaters.

Policy HS-6.6: Prior to the approval of urban development project sites and projects within floodplain areas, the project applicant shall demonstrate that such development will not adversely impact downstream properties or contribute to flooding hazards.

Goal WR-2: To protect the quality of surface and groundwater resources to meet the needs of all beneficial users.

Policy WR-2.1: Protect Surface & Ground Water Quality. All proposed land use and development plans should be evaluated as to their potential to create surface and groundwater contamination hazards from point and non-point sources. Effects include but are not limited to: soil erosion; direct discharge of potentially harmful substances; ground leaching from storage of raw materials, petroleum products, or wastes; floating debris by runoff from the site.

Policy WR-2.4: BMPs. The County shall continue to require the use of feasible and practical BMPs to protect surface water and groundwater from the adverse effects of construction activities and urban runoff.

Goal WR-5: Encourage efficient use of water for new and existing land uses.

Policy WR-5.1: Water Use Efficiency for New Development. The County shall require the use of water conservation techniques appropriate for new development. Such techniques include but are not limited to; requiring low flow plumbing fixtures on new construction, the use of high efficiency irrigation systems, use of gray-water for landscaping, the integration of storm water runoff into passive groundwater recharge, the use (when feasible) of reclaimed water resources for reasonable and beneficial use and the use of drought-tolerant vegetation.

Policy WR-5.2: Water Use Efficiency for Existing Development. The County shall encourage the retrofitting of existing development with water-conserving devices.

Policy WR-5.5: Water-Conserving Appliances. The County shall require the use of water-conserving appliances and fixtures in all new development, as mandated by State law (California Health and Safety Code, Section 17921.3; Title 20, CCR, Section 1601(b); and other applicable sections of Title 24 of the CCR).

Goal PFS-4: To ensure the management of stormwater in a safe and environmentally sensitive manner through the provision of adequate storm drainage facilities to protect people and property and maintain the quality of receiving waters.

Policy PFS-4.2: Development Requirements. The County shall encourage project designs that minimize drainage concentrations and impervious coverage, compliment groundwater recharge, avoid floodplain areas, and where feasible, be designed to provide a natural watercourse appearance and that maintain natural watershed functions.

Policy PFS-4.3: Stormwater Detention Basins. The County shall require stormwater detention basins that are designed to ensure public safety, be visually unobtrusive, provide temporary or permanent wildlife habitat values, and where feasible provide recreational uses.

Lake County Rules and Regulations for On-Site Sewage Disposal

The Lake County Rules and Regulations for On-Site Sewage Disposal (County of Lake, 2010) are rules adopted in per the County Code to prescribe requirements for on-site sewage disposal systems. This document provides design criteria for standard on-site sewage disposal subsurface systems (LCR 1-130) as well as alternative systems that maybe used in the Project area including subsurface drip disposal systems (LCR 1-155), pressurized distribution systems (LCR 1-160), aerobic systems (LCR 1-195), sand filter systems (LCR 1-190 & LCR 1-200), other media filter (LCR 1-210-215) systems, steep slope systems (LCR 1-220), holding tanks (LCR 1-270), and experimental systems (LCR 1-290).

4.10.2 Environmental Setting

Regional Hydrology

The improvement areas are located in the Sacramento River Hydrologic Region, Cache Creek hydrologic unit, Upper Cache Creek hydrologic area (Caltrans, 2025b) and the Schindler Creek-Frontal Clear Lake watershed (EPA, 2026). Schindler Creek is the nearest stream to the project components, which drains from the hillsides north of the Improvement areas and discharges into Clear Lake. Schindler Creek is not listed on the 303(d) list of impaired water bodies, although Clear Lake is listed for lead, microcystins, oxygen (dissolved), pH, mercury, boron, and nutrients. TMDLs were approved for mercury and nutrients on October 20, 2003, and September 21, 2007, respectively, but are in development for microcystins, oxygen (dissolved), pH, boron, and lead (State Water Resources Control Board, 2024).

FEMA establishes flood hazard designations through the NFIP and publishes Flood Insurance Rate Maps (FIRMs) identifying areas subject to flooding during the 1-percent annual chance (100-year) and 0.2-percent annual chance (500-year) flood events. The improvement areas are covered by FIRM Panels 06033C0544D, 06033C0543D, 06033C0539D, 06033C0538D, 06033C0536D, and 06033C0525D. According to the effective FIRMs, the THM Improvement Site is primarily located within Zone X, a 0.2% annual chance flood hazard, and area with 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile. The Paradise Tank, meter data acquisition data location, Harvey Blvd Tank, Konocti Tank, Shady Lane Tank, High Valley Tank, and Pluth Tank locations are all located in Zone X, an area of minimal flood hazard. The majority of the water line, high priority water mains, and pressure reducing valve locations are located in Zone AE, In addition, the water treatment plant is located in Zone AE. Zone AE means a Special Flood Hazard Area subject to inundation by the 1-percent annual chance flood with established Base Flood Elevations (FEMA, 2026).

Groundwater

Lake County lies over the southwest portion of the Sacramento Valley Groundwater Basin. The primary groundwater basin in the Improvement areas vicinity is the Clear Lake Cache Formation Basin, High Valley Basin, Long Velley Basin, and Burns Valley Basin (California Department of Water Resources, 2026). Groundwater is utilized for irrigation and domestic supply and is generally of good quality. Groundwater in these basins is used extensively for irrigation, municipal, and domestic supply. Groundwater is one of Lake County's most important natural resources. On average, groundwater supplies approximately 60 percent of the County's combined urban and agricultural water demand (Lake County, 2025c). Countywide demand for groundwater is expected to increase substantially over the coming decades. Urban water demand is projected to rise from an average of 10,900 acre-feet per year to 19,738 acre-feet per year by 2040, an 81 percent increase. Agricultural demand, depending on future crop types and expansion, may rise from the current average of 39,817 acre-feet per year to as much as 48,387 acre-feet per year by 2040, representing a 21 percent increase. With the exception of areas adjacent to Clear Lake, nearly all of this additional demand is anticipated to be met through increased groundwater extraction (Lake County, 2025c).

4.10.3 Impact Assessment

a) Would the Project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

Construction

Less-than-Significant Impact with Mitigation. Construction activities have the potential to impact water quality through soil erosion and increased silt and debris discharged into runoff. Additionally, the use of construction materials such as fuels, solvents, and paints may present a risk to surface water quality. Temporary storage of construction material and equipment in work areas or staging areas could create the potential for a release of hazardous materials, trash, or sediment to the storm drain system. Furthermore, construction-related erosion and discharges could occur. The Proposed Project would involve limited and localized ground disturbance, consisting primarily of small excavation areas for waterline and watermain repairs that would be backfilled shortly after installation. Ground disturbance would not occur over large contiguous areas, and the total disturbed area would be less than one acre. To minimize the potential for erosion and sediment transport during construction along with other forms of pollution runoff, standard erosion and sediment control BMPs and refueling practices would be implemented as **Mitigation Measures GEO-1**, **HM-1**, and **HM-2**, including surface re-vegetation after construction and utilizing Standard Fueling Practices. With implementation of these BMPs included as mitigation measures, impacts due to construction activities would be less than significant.

During operation, the upgraded water system, water mains, water lines, tanks, and associated improvements would improve the reliability and integrity of water conveyance. These upgrades would reduce the likelihood of water quality issues and leaks and would not violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality. This impact is less than significant with mitigation.

b) Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Less-than-Significant Impact. The Proposed Project would only add minor new water-demands uses due to the water infrastructure related upgrades and would not significantly increase groundwater withdrawals during operation. Construction would use only small, short-term amounts of water (e.g., for dust control) that would not measurably affect groundwater supplies. Furthermore, it would also not significantly alter infiltration or recharge, as soils would be restored after construction and the Proposed Project does not add meaningful impervious area. Therefore, the Proposed Project would not interfere with groundwater recharge or conflict with local or State groundwater plans. This impact is less than significant.

c) Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i. Result in a substantial erosion or siltation on- or off-site?

Less-than-Significant Impact with Mitigation. Construction activities (trenching, grading, vehicle movement) could increase erosion and sediment transport, particularly near Schindler Creek and Clear Lake. However, implementation of **Mitigation Measures GEO-1, HM-1,** and **HM-2** would require the use of standard erosion and sediment control measures during ground-disturbing activities, including installation of straw wattles or similar sediment capture devices where appropriate, proper management of excavated materials, spill prevention practices, and immediate backfilling and surface restoration following construction. Upon completion, the site would return to pre-project drainage conditions, and no long-term erosion impacts are anticipated. This impact is less than significant with mitigation.

ii. Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite?

Less-than-Significant Impact. The Proposed Project consists primarily of water infrastructure improvements, most of which are underground (water mains and priority water lines) or aboveground elements (water tanks). These facilities introduce minimal new impervious surfaces and would not increase runoff volumes or alter hydrology in a way that increases flood risk. This impact is less than significant.

iii. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Less-than-Significant Impact. The Proposed Project does not include substantial new impervious surfaces or new drainage infrastructure that would increase stormwater flows beyond existing system capacity. Construction BMPs would control potential pollutants during construction, and long-term water system improvements would not generate substantial new stormwater discharges during operations. This impact is less than significant.

iv. Impede or redirect flood flows?

Less-than-Significant Impact. The Proposed Project improvement areas lie within FEMA Flood Zone X with a small portion in Zone AE. Project components within these areas include underground water lines and water mains, which do not obstruct flood flows. No structures, grading, or embankments would be introduced that could alter flood conveyance or redirect floodwaters associated with Schindler Creek or Clear Lake. Therefore, the Proposed Project would not impede or redirect flood flows.

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

Less-than-Significant Impact. The Proposed Project improvement areas lie within FEMA Flood Zone X with a small portion in Zone AE. Project components within these areas include underground water lines and

water mains, which are designed to be watertight and not leak during flooding. The Proposed Project does not introduce significant new sources of pollution, such as chemical storage, fuel facilities, or other above-ground pollutant sources that could be mobilized by floodwaters. Therefore, inundation would not result in the release of pollutants. This impact is less than significant.

e) Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Less-than-Significant Impact. The Proposed Project consists of upgrades to existing water infrastructure and would not introduce new discharges or land uses that conflict with local surface or groundwater plans. Instead, by reducing the potential for leaks and overflows from aging infrastructure, the Proposed Project supports rather than conflicts with applicable water quality and groundwater management plans. Furthermore, the Proposed Project does not involve groundwater pumping for consumptive use and would not affect groundwater management actions under the Sustainable Groundwater Management Act (SGMA). This impact is less than significant.

4.10.4 Compliance with Federal Environmental Laws and Regulations

As discussed above, preventative measures shall be taken to avoid surface water contamination (see **Mitigation Measures GEO-1, HM-1**, and **HM-2**) and there are no waters of the U.S. located within the Proposed Project improvement areas. Therefore, permits under the CWA and Porter-Cologne Water Quality Act are not required. Additionally, no nearby waters are classified as wild and scenic. No new structures or grades would be introduced that could impact flood flows or result in significant impacts to the drainage patterns of the sites. The Proposed Project would comply with all federal regulations relating to hydrology and water quality.

4.11 LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Physically divide an established community?	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐

4.11.1 Regulatory Setting

Local

Lake County General Plan

The Lake County General Plan, Land Use Element establishes the land use diagram and density/intensity standards that dictate the distribution of different uses and their allowed development capacity. It guides

the future development pattern of unincorporated Lake County, which links to infrastructure. The Land Use Element focuses on where and how land can be developed, but its policies have direct implications for necessary infrastructure improvements and rehabilitation (Lake County, 2008).

The Public Facilities and Services Element specifically establishes goals and policies that address the vital infrastructure and public services needed. It works with the Land Use Element to ensure infrastructure is planned to support the designated land uses (Lake County, 2008).

Lake County Code of Ordinances

The Lake County Code of Ordinances Title 18 is the primary tool used by the County to regulate the use and development of land in unincorporated areas. The purpose is to implement the goals and policies of the Lake County General Plan by promoting public health, safety, and general welfare. The ordinance establishes a comprehensive system of zoning districts, development standards, and permitting procedures that dictate what activities are allowed on a particular piece of property. The ordinance has two main types of zoning designations including Base Zoning Districts and Combining Zoning Districts. Base Zoning districts include agricultural zones, residential zones, commercial zones, industrial zones, and other zones like open space.

Lake County Multi-Jurisdictional Hazard Mitigation Plan

The Lake County Multi-Jurisdictional HMP 2025 is prepared by multiple organizations including the auditor-controller's office, Lake County sheriff, and the cities of Lakeport and Clearlake amongst others. The plans mission is to enhance the County's resilience in disasters by focusing on mitigation, preparation, response and recovery. It identifies and prioritizes a list of fourteen major natural hazards of concern including wildfire, drought and water shortage, earthquake, severe weather from storms, severe weather from heat, aquatic biologic hazards, flood, tree mortality, climate change, levee failure, agriculture hazards, dam failure, volcano and geothermal gases, and subsidence. Chapter 9 Flood specifically evaluates the County's flood hazard profile, location and extent, previous occurrences, probability of future events, and exposure and vulnerability. The HMP outlines strategies to minimize flood hazards, including regulating development within flood-prone areas, preserving natural floodplain functions, and implementing infrastructure improvements to manage stormwater and reduce flood risk (Lake County, 2025b).

4.11.2 Environmental Setting

The majority of the Proposed Project is located in the vicinity of Clearlake Oaks in Lake County, California, while the Harvey Tank DBP system and meter data consolidation and water loss system are located in the unincorporated community of Glenhaven, and the Paradise Tank THM reduction piping is located in Lucerne, a census-designated place (CDP) in Lake County. All of the project components are predominantly within disturbed and developed areas. The General Plan Land Use Designations for lands in the vicinity of the improvement areas include: Community Commercial (Cc), Low Density Residential (LDR), Medium Density Residential (MDR), High Density Residential (HDR), Rural Residential (RR), Rural Lands (RL), Service Commercial (Cs), Suburban Residential Reserve (SRe), Resort Commercial (Cr), and Public Facilities (PF) (Lake County, 2008). The Proposed Project improvement areas have the following zoning designations as determined by Lake County: Rural Residential (RR), Single-Family Residential (R1), Community Commercial (C2), Two-Family Residential (R2), Multi-Family Residential (R3), Open Space (O), Suburban Reserve (SR), Resort Commercial (CR), Service Commercial (C3), Planned Development Commercial (PDC), Planned Development Residential (PDR), and Rural Lands (RL).

Surrounding land uses include local commercial (Cl), Rural Lands (RL), Suburban Residential Reserve (SRe), Medium Density Residential (MDR), Public Facilities (PF), High Density Residential (HDR), Resort Commercial (Cr), Low Density Residential (LDR), Resource Conservation (RC), and Community Commercial (Cc). Surrounding zoning and land use designations are illustrated in **Figures 9** and **10**.

Portions of the Proposed Project are located within a 100-year floodplain, with Schindler Creek flowing through the western portion of the Proposed Project and draining into Clear Lake. Regional access to the Proposed Project is provided by State Highway 20, adjacent to the site's northern boundary.

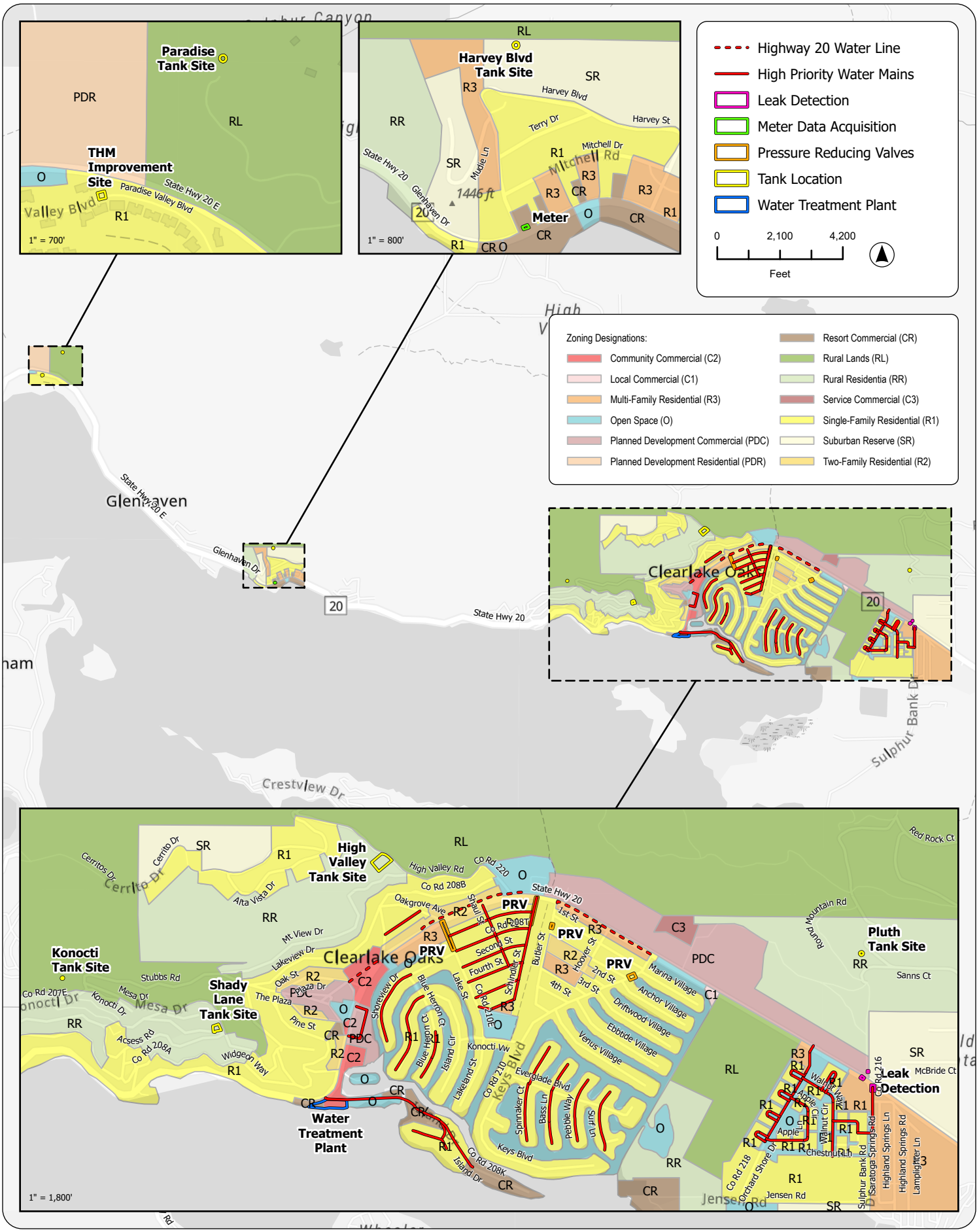
4.11.3 Impact Assessment

a) Would the project physically divide an established community?

No Impact. Some of the improvement and rehabilitation components of the Proposed Project could involve temporary closures of small residential roadways but would not divide an established community. There would be no impact.

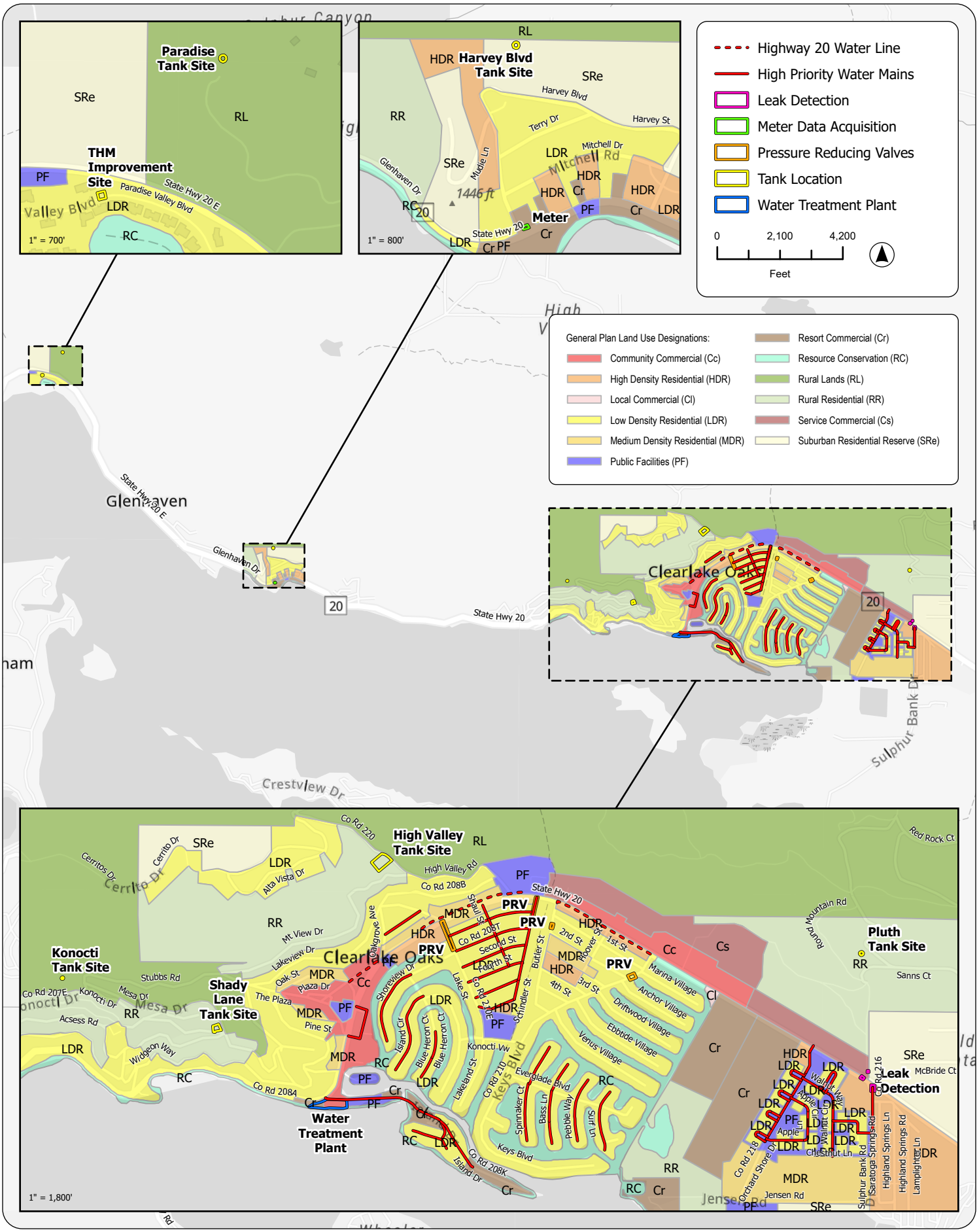
b) Would the project cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

Less than Significant Impact. As discussed in **Section 4.10.3**, the Proposed Project does include some development components within the floodplain; however, the proposed earthwork was designed to avoid fill within Clear Lake, which demonstrates that the Proposed Project will not have any significant impact to the base flood elevation during the 100 year storm event. The Proposed Project is consistent with the underlying land use and zoning designations, and historical use of the area and the proposed infrastructure upgrades would not conflict with any applicable land use plan or policy. There are no habitat conservation plans or natural community conservation plans that are applicable to the Proposed Project. There would be less than significant impact.



SOURCE: CLOCWD, 2025; Lake County, 2025; ESRI, 2026; Acorn Environmental, 2/10/2026

Figure 9
Zoning Designations



SOURCE: CLOCWD, 2025; Lake County, 2025; ESRI, 2026; Acorn Environmental, 2/10/2026

Figure 10

General Plan Land Use Designations

4.12 MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

4.12.1 Regulatory Setting

State

Surface Mining and Reclamation Act of 1975

The Surface Mining and Reclamation Act (PRC Chapter 9, Division 2) provides a comprehensive surface mining and reclamation policy to ensure that adverse environmental impacts are minimized and mined lands are reclaimed to a usable condition. Mineral Resource Zones (MRZs) are applied to sites determined by the California Geological Survey (CGS) as being a resource of regional significance and are intended to help maintain mining operations and protect them from encroachment of incompatible uses.

Local

Lake County General Plan

The Lake County General Plan aims to protect and enhance the natural and cultural resources that make Lake County unique. The goals and policies designed to address mineral resources are as follows:

Goal OSC-4: Protect the current and future extraction of mineral resources that are important to the County's economy while minimizing impacts of this use on the public and the environment.

Policy OSC-4.3 – Minimize Land Conflicts: The County shall require that new development adjacent to existing mining operations be designed to provide a buffer between the proposed use and mining operations. Similarly, new mining operations shall be designed to provide a buffer between existing or likely adjacent uses to minimize incompatibility with nearby uses and adequately mitigate their environmental and aesthetic impacts. The buffer distance will be based upon an evaluation of noise, aesthetics, drainage, operating conditions, topography, lighting, traffic, operating hours, and air quality.

4.12.2 Environmental Setting

The CGS is responsible for the classification and designation of areas within California containing or potentially containing significant mineral resources. The CGS classifies lands into Aggregate and MRZs

based on guidelines adopted by the California State Mining and Geologic Board, as mandated by the Surface Mining and Reclamation Act of 1975. The CGS has not classified Lake County as within any designated MRZs, although Lake County Adopted an Aggregate Resource Management Plan in 1992 as an element of its General Plan (Lake County, 1992).

Gold and mercury mining activities have historically occurred in Lake County, however, there are currently no mercury mines within the County. Today, the major mineral operations in the County are sand and gravel extractions for aggregate, both in terms of quantity of materials produced and value of extracted resources. These aggregate operations occur near the major creeks in the County.

While the Proposed Project improvement areas are not within a designated Quarry Resource Area, there are quarries within the vicinity of the Proposed Project. The Bailey Quarry, Clearlake Lava Quarry, and Clearlake Quarry are located just south (Bailey) and north (Clearlake Lava and Clearlake) of Highway 20 between Clearlake Oaks and the intersection of Highways 20 and 53. The Bailey Quarry, which operated as a hard rock quarry, is idle, whereas the Clearlake Lava Quarry and Clearlake Quarry are operating facilities. These active quarries also operate as hard rock quarries, producing red, light weight, scoria cinders.

4.12.3 Impact Assessment

a) Would the project result in the loss of availability of a known mineral resource that would be a value to the region and the residents of the state?

No Impact. There are no known mineral resources located in the vicinity of the Proposed Project improvement areas and the areas proposed for infrastructure rehabilitation have already been developed. Therefore, the Proposed Project would not result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state. As such, there would be no impact.

b) Would the project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

No Impact. No mineral resources of significant value have been identified within the Proposed Project improvement areas. Although there is aggregate extraction within the vicinity of the Proposed Project, the improvement areas are not under consideration for use for mineral resource extraction by the County General Plan. Therefore, the Proposed Project would not result in the loss of availability of a locally important mineral resource recovery site as delineated on a local general plan, specific plan, or other land use plan. As such, there would be no impact.

4.13 NOISE

Would the project result in:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☒	☐	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

4.13.1 Regulatory Setting

Federal

Federal Noise Abatement Criteria

Operational noise standards used in this study are Federal Highway Administration (FHWA) Noise Abatement Criteria (NAC) for the assessment of noise consequences related to surface traffic and other project-related noise sources. These standards are discussed below. The FHWA establishes NAC for various land uses that have been categorized based upon activity. Land uses are categorized on the basis of their sensitivity to noise as indicated in **Table 4.13-1**. The FHWA NAC is based on peak traffic hour noise levels. Sensitive receptors with the potential to be impacted by the project alternatives primarily consist of residential land uses; thus, the Category B noise standard (67 dBA Leq) would apply to those uses.

Table 4.13-1: Federal Noise Abatement Criteria Hourly A-Weighted Sound Level Decibels

Activity Category	Activity Criteria Leq (h), dBA	Evaluation Location	Activity Category Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	Exterior	Residential.
C	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	Interior	Auditoriums, daycare centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	--	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, shipyards, utilities (water resources, water treatment, electricity), and warehousing.
G	--	--	Undeveloped lands that are not permitted.

Source: Title 23 CFR Part 772, Table 1 to Part 772 – Noise Abatement Criteria

Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual (2018)

The Federal Transit Authority (FTA) has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. The vibration damage criteria adopted by the FTA are shown in **Table 4.13 2**. The FTA has also adopted standards associated with human annoyance for groundborne vibration impacts for three land use categories: (1) High Sensitivity; (2) Residential; and (3) Institutional. **Table 4.13 3** describes these three categories as well the associated vibration thresholds associated with human annoyance for these categories.

Table 4.13-2: Construction Vibration Damage Criteria

Building Category	Peak Particle Velocity (inches/second)
Reinforced concrete, steel or timber (no plaster)	0.5
Engineered concrete and masonry (no plaster)	0.3
Non-engineered timber and masonry buildings	0.2
Buildings extremely susceptible to vibration damage	0.12

Source: FTA, 2018

Table 4.13-3: Groundborne Vibration Impact Criteria for General Assessment

Land Use Category	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB	65 VdB	65 VdB
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

Source: FTA, 2018
[1] More than 70 events per day
[2] 30-70 events per day
[3] Fewer than 30 events per day
VdB = Vibration decibels

Local

Lake County General Plan

The Lake County General Plan contains the following policies and implementation measures related to noise that are relevant to the Proposed Project:

Goal N-1: To protect County residents from the harmful exposure of excessive noise and prevent incompatible land uses from encroaching upon existing and planned land uses.

Policy N-1.3: Indoor noise levels for residential uses shall not exceed 45 dBA CNEL.

Policy N-1.4: The County should encourage proper site planning, architectural layout, and use of building materials as methods of noise attenuation. The following techniques should be considered to reduce noise impacts.

- Increase the distance between noise source and receiver through the use of building setbacks and/or dedication of noise easements.
- Place noise tolerant land uses such as parking lots, maintenance facilities, and utility areas between noise source and receiver.
- Use noise tolerant structures, such as garages or carports, to shield noise sensitive areas. Orient buildings to shield outdoor spaces from a noise source.
- Use berming and heavy landscaping to reduce noise levels.
- Cluster office, commercial, or multiple family residential structures to reduce interior open-space noise levels.
- Locate automobile and delivery access to commercial or industrial uses abutting residential parcels at the maximum practical distance from residential uses.
- Use multi-glazed or multi-pane windows, tight-fitting doors, and dense building materials where feasible.

Policy N-1.7: The County shall require contractors to implement noise-reducing mitigation measures during construction when residential uses or other sensitive receptors are located within 500 feet.

Policy N-1.10: The County shall enforce the State Noise Insulation Standards (California Administrative Code, Title 24) and Chapter 35 of the Uniform Building Code.

Lake County Code

The Lake County Code establishes performance standards intended to ensure compatibility among land uses and to protect public health, safety, welfare, and the County's rural-resort character. Chapter 21, Article 41 (Performance Standards) provides countywide operational noise requirements applicable to all land uses unless otherwise exempted. The purpose of these standards is to control noise, vibration, dust, odor, smoke, and other nuisance conditions that may adversely affect surrounding properties. The ordinance includes several exemptions from local noise limits when standard, reasonable practices are followed. These exemptions include:

- Emergency equipment operated on an irregular or unscheduled basis.
- Warning devices (e.g., alarms and sirens) operated continuously for no more than five minutes.
- Bells, chimes, or carillons.
- Non-electronically amplified sounds at sporting, amusement, and entertainment events.
- Construction site noise generated between 7:00 a.m. and 7:00 p.m.
- Lawn and plant care equipment with functioning sound-suppression devices operated between 7:00 a.m. and 8:00 p.m.
- Aircraft subject to federal or state regulation.
- Agricultural equipment used on property zoned for agricultural activities.

The ordinance also provides a process for exceptions. Upon written application by an industrial or commercial noise source, the Zoning Administrator or Planning Commission may authorize conditional exceptions to local noise emission standards under the following circumstances:

- The noise is infrequent;
- Noise levels beyond the property line are already exceeded by an exempt noise source in the same location; or
- A legally existing use predating the ordinance cannot comply with noise standards even after implementing Best Available Control Technology.

4.13.2 Environmental Setting

Acoustical Background and Terminology

Fundamentals of Sound

Sound is defined as any pressure variation in air that the human ear can detect and is technically described in terms of loudness (amplitude) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). The dB scale uses the hearing threshold (20 micropascals of pressure), as a point of reference, defined as 0 dB. Other sound pressures are then compared to the reference pressure, and the logarithm is taken to keep the numbers in a practical range. The dB scale allows a million-fold increase in pressure to be expressed as 120 dB.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by weighing the frequency response of a sound level meter by means of the standardized A-weighing network. There is a strong correlation between A-weighted sound levels (expressed as dBA) and community response to noise. For this reason, the dBA

sound level has become the standard tool of environmental noise assessment. Noise levels reported in this section are in terms of A-weighted levels in dB.

Community noise is commonly described in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment. A common statistical tool to measure the ambient noise level is the average, or equivalent sound level (L_{eq}) over a given time period (usually one hour). The L_{eq} is the foundation of the Day-Night Average Level (L_{dn}) noise descriptor and shows very good correlation with community response to noise. The L_{dn} is based upon the average noise level over a 24-hour day, with a +10 dB weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were louder than daytime exposures. Because L_{dn} represents a 24-hour average, it tends to disguise short-term variations in the noise environment. L_{dn}-based noise standards are commonly used to assess noise effects associated with traffic, railroad, and aircraft noise sources.

Effects of Noise on People

The effects of noise on people can be placed in three categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction;
- Interference with activities such as speech, sleep, and learning; and
- Physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure the subjective effects of noise or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists and different tolerances to noise tend to develop based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the ambient noise level.

In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and can cause an adverse response.

Generally, most noise is generated by transportation systems, principally motor vehicle noise, but also including aircraft noise and rail noise. The level of traffic noise depends on three things: l) the volume of the traffic, 2) the speed of the traffic, and 3) the number of trucks in the flow of the traffic. Because noise is measured on a logarithmic scale, 70 dBA plus 70 dBA does not equal 140 dBA. Instead, two sources of equal noise added together have been found to result in an increase of 3 dBA. That is, if a certain volume of traffic results in a noise level of 70 dBA the addition of the same volume of traffic, or doubling, would result in a noise level of 73 dBA. As stated above, 3 dBA is just audible; therefore, if a project doubles the traffic volume there would be an audible increase in the ambient noise level.

Noise attenuates (lessens) at a rate of 6 to 9 dBA per doubling of distance from the source, depending on environmental conditions (i.e., atmospheric conditions and noise barriers, vegetative or manufactured, etc.). Widely distributed noises, such as a large industrial facility or a street with moving vehicles would typically attenuate at a lower rate, approximately 4 to 6 dBA per doubling of distance.

Ambient Noise and Sensitive Receptors

The Improvement areas are located within the community of Clearlake Oaks and surrounded primarily by low-density residential uses, rural land, rural residential uses, roadway corridors, and utility infrastructure. Ambient noise in the area is dominated by vehicular traffic along SR-20, which runs east–west through Clearlake Oaks and passes near several tank locations. Local traffic along Sulphur Bank Drive, Keys Boulevard, Lakeland Street, Harvey Boulevard, and other neighborhood streets also contributes to baseline noise levels, though at substantially lower volumes. No industrial noise sources are present near the Improvement areas. Based on this, the ambient noise level was estimated to be 55 dBA based on the U.S. Department of Transportation National Transportation Noise Map since SR-20 is the dominant source of noise (U.S. Department of Transportation, 2025).

Noise sensitive receptors are land uses that are considered to be more sensitive to noise impacts. Examples of noise sensitive receptors include schools, residences, and hospitals. Sensitive receptors near project components include adjacent single-family homes and East Lake Elementary School, located approximately 0.10 miles north of the nearest project component.

4.13.3 Impact Assessment

a) Would the project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Construction

Less than Significant Impact with Mitigation. Construction activities associated with the Proposed Project would include grading, excavation, filling, and the installation of water tanks, water mains, water lines, and associated infrastructure. This would require the use of work trucks, graders, earthmovers, backhoes, excavators, water trucks, and welding equipment along with other supporting equipment. The majority of construction activities would be temporary in any given location, and the proposed facilities will be located within mostly public rights-of-way or areas already developed. Furthermore, for example, high priority water main and highway 20 water line replacements would progress continuously along each alignment, meaning crews would not remain in one location for extended periods. As a result, construction noise near any individual residence would be temporary until work shifts farther along the roadway or utility corridor. When construction is occurring, activities could generate noise levels that could reach 74 to 90 dBA L_{max} at a distance of 50 feet (**Table 4.13-4**).

Table 4.13-4: Construction Equipment Noise Levels

Construction Equipment	Typical Maximum Noise Levels (dBA) at 50 feet	Typical Maximum Noise Levels (dBA) at 25 feet with 6 dBA Attenuation
Backhoe	80	86
Compactor	82	88
Concrete Mixer	85	91
Pavement Saw	90	96
Excavator	81	87
Generator Set	82	88
Grader	85	91
Paver	85	91
Truck	84	90
Dozer	85	91
Roller	85	91
Scraper	85	91
Tractors/Loaders	80	86
Welders	74	80

Sources: FTA, 2018; FHWA, 2006

For the sensitive receptors adjacent to the project components, construction could be as close as 25 feet to construction activities, exposing them to noise levels ranging from 80 to 96 dBA L_{max} from construction activities, raising the ambient noise environment significantly from the current levels of 55 dBA while high noise generating equipment is being used. However, with implementation of **Mitigation Measure NOI-1**, construction activities associated with the Proposed Project would comply with Lake County's noise regulations, which exempt construction site noise occurring between 7:00 a.m. and 7:00 p.m. under Article 41 of the County Code. All project construction—including highway 20 water line, high priority water mains, leak detection, pressure reducing valves, tank replacements and repairs—would be restricted to these allowed daytime hours. Furthermore, **Mitigation Measure NOI-1** has other measures to reduce noise, such as equipping construction equipment with properly fitting mufflers if applicable. Finally, because work along the would move continuously near the sensitive receptors and would not remain at any single location for an extended period, exposure for nearby sensitive receptors would be temporary. With implementation of **Mitigation Measure NOI-1** to reduce potential noise levels and restrict construction hours, construction noise impacts would be less than significant.

Operation

Less than Significant. Operational noise generated by the upgraded water facilities would be comparable to existing conditions. The rehabilitated leak detection, pressure reducing valves and water tanks would continue to result in low-level mechanical noise that is consistent with current operations. Water lines and water main pipelines would not generate noise during normal use, similar to existing conditions. Routine operation and monitoring would also be similar to existing maintenance and operation practices. Because the Proposed Project would not introduce new noise-producing equipment or increase operating

hours, overall operational noise levels would remain essentially unchanged and would not exceed applicable County standards. Therefore, operational noise impacts would be less than significant.

b) Would the project generate excessive groundborne vibration or groundborne noise levels?

Less than Significant with Mitigation. The Proposed Project involves construction activities that could generate ground-borne vibration, including excavation, use of heavy machinery such as pavement saw cutters and jackhammers, and compactors. Several project components—particularly water line and water main construction—are located adjacent to existing single-family residences and other sensitive receptors. Therefore, nearby receptors could temporarily experience minor levels of construction-related vibration. The County does not establish specific quantitative vibration limits; therefore, the FTA Transit Noise and Vibration Impact Assessment Manual provides the appropriate reference thresholds. Humans typically perceive vibration at approximately 65 VdB, with the threshold for annoyance occurring at roughly 80 VdB, and the potential for building damage beginning around 0.2 inch/sec ppv. **Table 4.13-5** presents typical vibration levels for standard construction equipment at a reference distance of 25 feet.

All construction vibrations would be below the structural damage threshold (100 VdB) at this distance or greater. However, the majority of the equipment listed exceeds the human annoyance threshold (80 VdB) at 25 feet (FTA, 2018). Given that sensitive receptors are adjacent to the Proposed Project improvement areas, construction activities within 100 feet of sensitive receptors could cause potential annoyance. However, construction activities would not remain in one location for extended periods because rehabilitation of Highway 20 water line and high priority water main segments would advance continuously along each alignment. As a result, any perceptible vibration at adjacent receptors would be of very short duration. In addition, construction would comply with Lake County Code Article 41 due to **Mitigation Measure NOI-1**, which exempts construction noise occurring between 7:00 a.m. and 7:00 p.m., thereby limiting vibration-generating activities to acceptable daytime hours.

Given the temporary nature of the work at each location, the mobile progression of construction crews, and compliance with the County's permitted construction hours by implementing **Mitigation Measure NOI-1**, vibration generated by the Proposed Project would not result in structural damage and any short-term annoyance would be minimal. Therefore, this impact would be less than significant with mitigation.

Table 4.13-5: Vibration Source Levels for Construction Equipment

Equipment	Maximum Vibration Level at 25 feet [VdB (rms)]
Hoe Ram	87
Large bulldozer	87
Loaded trucks	86
Jackhammer	79
Small bulldozer	58

Source: FTA, 2018
rms: root mean square

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

No Impact. The Improvement areas are not located within two miles the vicinity of a private airstrip or public airport, or within an airport land use plan. The nearest airport is Hoberg Airport, located approximately 9.5 miles south of the Improvement areas. As the Proposed Project is primarily focused on upgrading water infrastructure and would not introduce new noise sources that would exacerbate existing airport noise, there would be no impact.

4.13.4 Mitigation Measures

NOI-1

- All construction hours would take place between the hours of 7:00 a.m. and 7:00 p.m.
- All construction vehicles or equipment, fixed or mobile, shall be equipped with properly operating and maintained mufflers and acoustical shields or shrouds in accordance with manufacturers' specifications.
- Loud stationary construction equipment shall be located as far away from sensitive receptor areas as feasible. To the extent feasible, existing barrier features (structures) shall be used to block sound transmission between noise sources and noise sensitive land uses.
- Maintenance of construction equipment and machinery, including noise reducing components such as mufflers, silencers, covers, guards, vibration isolators, etc., shall be performed regularly to reduce excess noise.
- Construction equipment and machinery that produce reduced noise and vibration levels shall be utilized to the extent feasible.
- Construction equipment and machinery shall only be operated by trained and qualified personnel.
- Haul trucks shall be operated in accordance with posted speed limits.
- The contractor shall monitor construction noise and vibration and designate a disturbance coordinator, post the coordinator's contact telephone number conspicuously around the improvement areas, and provide the number to nearby sensitive receptors. The disturbance coordinator shall receive all public complaints, be responsible for determining the cause of the complaints, and implement any feasible measures to alleviate the problem.

4.13.5 Compliance with Federal Environmental Laws and Regulations

Since the Proposed Project would integrate **Mitigation Measure NOI-1** to reduce construction-generated noise, the Proposed Project would not raise the ambient noise level beyond the FHWA construction noise threshold at sensitive receptors. The Proposed Project would comply with all federal regulations relating to noise, including the FHWA.

4.14 POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

4.14.1 Environmental Setting

Clearlake Oaks, a CDP in Lake County, had an estimated population of 2,174 in 2023 (Census Reporter, 2023). The estimated population of Lake County was 68,163 in the 2020 Decennial Census (US Census, 2025). A majority of the proposed infrastructure rehabilitation are located within the Clearlake Oaks Community Growth Boundary as outlined in the 2008 General Plan (Lake County, 2008).

The Harvey Tank DBP system and meter data consolidation and water loss system are both located in the unincorporated community of Glenhaven, while the Paradise Tank THM reduction piping would be located in Lucerne, a CDP in Lake County. The estimated population of Lucerne CDP is 3,156 as of 2023 (U.S. Census Bureau, 2023).

4.14.2 Impact Assessment

a) Would the project induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

No Impact. All growth and development regulations within the vicinity of the Proposed Project are controlled through the Lake County General Plan. Implementation of the Proposed Project would not result in a direct increase in population or housing. No additional indirect impacts to population and housing are anticipated as a result of the Proposed Project beyond those identified in the General Plan. As such, the Proposed Project would have no impact on population growth.

b) Would the project displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

No Impact. The Proposed Project does not include land uses that would displace the existing residences or otherwise necessitate the displacement or construction of replacement housing elsewhere. Therefore, the Proposed Project would have no impact.

4.15 PUBLIC SERVICES

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

4.15.1 Environmental Setting

Fire protection and emergency medical services within the vicinity of the Proposed Project are provided by the Lake County Fire Protection District (LCFPD). Additionally, the Northshore Fire Protection District Station 75 is adjacent to portions of the Proposed Project. CAL FIRE also has a seasonal fire station located approximately 0.5 miles east of the Meter Data Acquisition Site. The nearest hospital to the Proposed Project is Adventist Health Clear Lake, which is located at 15630 18th Avenue, Clearlake, approximately 5.8 miles southeast of the Proposed Project. Adventist Health Clear Lake is a general acute care hospital with a standby emergency room that provides a comprehensive range of inpatient and outpatient medical services to the local population as well as numerous specialized services (California Department of Health Care Access and Information, 2025).

Lake County, including unincorporated Clearlake Oaks, Glenhaven, and Lucerne, receives law enforcement provisions from the County Sheriff's Office to protect citizens and property within the County. The Lake County Sheriff's Department has of 10 sworn command officers, with the Sheriff's office nearest to the Proposed Project being in Lucerne, approximately 4 miles northwest of the THM Improvement Site (Lake County Sheriff, 2025). This office responds to calls in the region of the Proposed Project.

The Konocti Unified School District (KUSD) serves the community through seven separate schools, with a total of 4,014 enrolled students (KUSD, 2025). East Lake Elementary School is the nearest school, located less than 0.10 miles from the Proposed Project. The THM Improvement Site is the only project component located in the Lucerne Elementary School District (Lake County Office of Education, 2026).

Lake County offers numerous parks and recreational areas. The nearest located parks to the Proposed Project are Clark's Island and Nylander County Park, located approximately 0.08 and 0.17 miles from the Clearlake Keys portion of the Proposed Project, respectively (Lake County Parks, Recreation, & Trails, 2025). These parks are managed by the Lake County Parks, Recreation, & Trails Department.

4.15.2 Impact Assessment

a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Fire protection?

No Impact. The vicinity of the Proposed Project is served by the LCFPD and the Northshore Fire Protection District Station 75. The nearest fire station is approximately 0.4 miles north of the WTP and adjacent to some of the Proposed Project improvement areas. The Proposed Project would be required to comply with standard requirements including the current California Fire Code which Lake County Fire Protection District has adopted. The implementation of the Proposed Project would not require additional fire facilities or necessitate new or altered facilities, resulting in no impact.

Police protection?

No Impact. The vicinity of the Proposed Project improvement areas are served by the County Sherrif's Office. The nearest Sheriff's Office is located approximately 4 miles northwest of the THM Improvement Site of the Proposed Project. The Proposed Project would not result in the need for new or altered services, or alteration to the patrol requirements from the Sheriff's Office. Impacts related to emergency vehicle access along roadways during construction is discussed in **Section 4.17**. Therefore, the Proposed Project would have no impact.

Schools?

No Impact. No new employment would be created by the Proposed Project, and the Proposed Project is not anticipated to otherwise induce unplanned population growth. Accordingly, the Proposed Project would not result in adverse physical impacts associated with the provision of new or physically altered school facilities. Therefore, the Proposed Project would have no impact on school facilities.

Parks?

No Impact. The Proposed Project would not result in the construction of new residences or the addition of employees to operate and maintain the Proposed Project. Thus, it is not anticipated that increases in population would occur that would result in increased use of existing parks. Therefore, the Proposed Project would have no impact on parks.

Other public facilities?

No Impact. The Proposed Project would not result in a need for additional or other public facilities. Therefore, the Proposed Project would have no impact.

4.16 RECREATION

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

4.16.1 Environmental Setting

Lake County operates and maintains a number of recreational activities. The nearest recreational facility to the Proposed Project is Clark's Island, located approximately 0.08 miles west of the Clear Lake Keys portion of the Proposed Project improvement areas. In addition to County-maintained parks, regional recreational opportunities include the Anderson Marsh State Historic Park and Mount Konocti. Clear Lake and surrounding terrain support a large variety of recreation opportunities. The southernmost region of the Mendocino National Forest begins less than 4 miles north of the Proposed Project.

4.16.2 Impact Assessment

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

No Impact. Increased demand for existing parks or other recreational facilities is typically driven by an increase in population. The Proposed Project would not result in an increase of residents. Therefore, the Proposed Project would not contribute to the substantial deterioration of existing facilities or require the construction of new facilities or expansion of existing facilities. Therefore, there would be no impact.

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

No Impact. As discussed above, the Proposed Project would not include or result in the construction or expansion of recreational facilities that might have adverse physical effect in the environment. Therefore, the Proposed Project would have no impact.

4.17 TRANSPORTATION

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☐	☒	☐	☐
b) Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?	☐	☒	☐	☐
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d) Result in inadequate emergency access?	☐	☒	☐	☐

4.17.1 Regulatory Setting

Federal

Federal Highway Administration

The FHWA regulates the construction, maintenance, and operation of the nation's roadways. FHWA guidelines ensure that transportation projects funded or overseen by the federal government comply with safety standards, minimize environmental impacts, and enhance mobility. Compliance with FHWA standards is required for any project impacting federal highways or receiving federal transportation funds.

Manual on Uniform Traffic Control Devices

The Manual on Uniform Traffic Control Devices (MUTCD), administered by the FHWA, sets forth standards for traffic signs, signals, and pavement markings in the United States. These guidelines ensure uniformity in traffic control devices, enhancing road safety and efficiency. Adherence to MUTCD standards is mandatory for all public roads.

State

California Department of Transportation

Caltrans is responsible for the design, construction, maintenance, and operation of the California state highway system. Caltrans regulations and guidelines govern traffic management, road safety, and environmental protection for projects affecting state highways. Any roadwork or infrastructure improvements within state highway right-of-way must comply with Caltrans standards.

Senate Bill 743

Senate Bill 743 was signed into law in 2013, with the intent to better align CEQA practices with statewide sustainability goals related to efficient land use, greater multimodal choices, and GHG reductions. The provisions of SB 743 became effective on July 1, 2020. Under SB 743, automobile delay, traditionally measured as level of service (LOS), is no longer used to establish the significance of a transportation impact under CEQA. Instead, impacts are determined by evaluating how VMT would change with implementation of a project.

Local

2022 Lake County Final Regional Transportation Plan/ Active Transportation Plan

The Regional Transportation Plan (RTP) is Lake County's long-range, 20-year strategy for developing and managing a safe, efficient, multimodal transportation system. Prepared by the Lake County/City Area Planning Council in coordination with federal, state, local, and tribal partners, the RTP guides improvements that support regional mobility and goods movement while aligning transportation planning with land use goals. The 2022 RTP update reflects changes since 2017, including new laws, policies, and emerging issues. It evaluates these developments and identifies related challenges and opportunities for maintaining and improving the region's transportation network. The Plan is organized into elements covering the State highway system, local streets and roads, public transit, active transportation, tribal transportation, and aviation, as well as an overarching issues element that addresses cross-cutting regional topics. Each element describes current conditions and issues, defines performance measures, outlines both constrained and unconstrained project lists, identifies potential funding sources, and provides goals, objectives, policies, and estimated costs relative to expected funding availability. Key topics include the five SRs in the region; city and county road systems; bicycle and pedestrian infrastructure guided by the Active Transportation Plan; fixed-route and specialized transit services; transportation needs on tribal lands; and aviation issues centered on Lampson Field, the region's public airport.

Lake County General Plan

The Transportation and Circulation Element included in the Lake County General Plan was prepared pursuant to Section 65302(b) of the California Government Code. The Transportation and Circulation Element addresses the location and extent of existing and planned transportation routes, terminals, and other local public utilities and facilities. The General Plan identifies roadway and transit goals and policies that have been adopted to ensure that the transportation system of the County will have adequate capacity to serve planned growth. These goals and policies are intended to provide a plan and implementation measures for an integrated, multi-modal transportation system that will safely and efficiently meet the transportation needs of all economic and social segments of the County. Applicable goals and policies are as follows:

Goal T-1: Roads and Highways. To provide and plan for a unified, coordinated, cost efficient countywide road and highway system that ensures safety, maintains adequate levels of service, and the efficient movement of people and goods.

Policy T-1.2: Roads should be improved and constructed to the design standards recommended by the County Department of Public Works, as shown in Table 6-1 (reproduced as **Table 4.17-1**), Lake County Road Design and Construction Standards. Road design standards shall be based on the American Association of State Highway and Transportation Officials standards and supplemented by Caltrans and County standards.

Table 4.17-1: Lake County Road Standards

Category	Minor Arterial	Major Collector	Minor Collector	Local	Category
Design Speed	60 mph	50 mph	40 mph	30 mph	Design Speed
Number of Lanes	2-4	2-4	2	2	Number of Lanes
Lane Width	12 ft	12 ft	11 ft	11 ft	Lane Width
Right-of-Way Width	60 ft	50 ft (min)	50 ft	50 ft	Right-of-Way Width

Source: Lake County, 2008

Policy T-1.7: Impact of New Development on Roadways. Facilities constructed or utilized for new development shall comply with County standards in order to minimize initial and subsequent maintenance costs.

Policy T-1.8: Level of Service. County maintained roadways should be improved and maintained to provide an adequate peak period LOS of "C" or better for existing and anticipated traffic volumes if roadway upgrades are feasible, such as roadway widening, addition of lanes via re-striping, and other safety and operational improvements. The County shall allow a limited number of County roadway segments to operate at a level of service of "E" or better where improving the segment to LOS C are deemed infeasible due to cost, negative community and/or environmental impacts, and constructability issues. This "E" level of service for certain roadways shall not include any State Highway unless approved by Caltrans.

4.17.2 Environmental Setting

Roadway Network

SR-20, a major east–west state highway, is located north of the residential area and serves as the primary regional travel corridor through Clearlake Oaks, Glenhaven, and Lucerne.

The WTP is located just west of the Clearlake Keys community and is accessed from Island Drive (208K), a two-lane local roadway running east–west off of SR-20. The WTP Is located on the southernmost peninsula of Clear Lake Keys and is only accessible via Island Drive.

Northeast of the WTP, the Proposed Project includes replacement of a portion of the Highway 20 water line pipes and high priority water main replacements within established residential neighborhoods. These neighborhoods are accessed from SR-20 via different roadways, including Keys Boulevard, Butler Street,

Schindler Street, and Lakeland Street. Furthermore, local circulation is provided by a network of narrow residential streets, including 1st through 6th Streets, Venus Village, Ebbtide Village, and Anchor Village.

Bicycle and Pedestrian Facilities, and Public Transportation

Local roads in the Improvement areas primarily serve low-speed residential traffic and do not include striped bicycle lanes. Pedestrian facilities are limited with many roads not including formal pedestrian infrastructure.

Public transit service in the area is provided by the Lake Transit Authority (LTA). While no bus stops are located directly adjacent to the WTP or within the interior residential neighborhoods, LTA operates transit routes along SR-20, including stops near the Clearlake Keys components. These stops provide east–west regional transit connections within the Clearlake Oaks, Glenhaven, and Lucerne areas and beyond.

4.17.3 Impact Assessment

a) Would the project conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?

Less than Significant with Mitigation. The Proposed Project would involve improvements at the WTP, water storage tank and booster pump improvements, water distribution system improvements, and upgrades to the operational maintenance management. Construction would occur primarily within existing public roadways and ROWs—examples being SR-20, 1st through 6th Street, Shoul Street, Schindler Street, Orchard Shore Drive, Apple Lane, Island Drive, and Paradise Valley Boulevard—and within previously disturbed areas at the WTP or tank locations. Construction activity would generate temporary increases in vehicle trips related to worker commutes, delivery of equipment and materials, and movement of construction vehicles such as excavators, trucks, and compactors. For residential areas that would be impacted by the improvements and replacements, work areas would shift continuously along the alignment, and hence construction traffic demands would be dispersed over time and location. Short-term lane closures and temporary traffic controls would be required in some segments. However, these closures would be localized, brief, and managed using standard traffic control measures included in **Mitigation Measure T-1**, minimizing disruption to the circulation system. Staging areas would be located at or near the WTP and other suitable areas near project components so that equipment can be parked and materials delivered efficiently, reducing the need for additional haul trips along local roads. Construction vehicles would access the improvement areas via SR-20, which is designed to accommodate regional travel, and then via local roadways depending on the location of the project component. Because operational activity would not expand system capacity or introduce new traffic-generating land uses, long-term traffic would be limited to periodic maintenance trips, similar to existing conditions. The Proposed Project would therefore not result in long-term increases in traffic. Traffic-related impacts would be less than significant with mitigation.

b) Would the project conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?

Less than Significant with Mitigation. CEQA Guidelines section 15064.3(b) relates to evaluating the transportation impacts of land use and transportation project based on vehicle miles traveled (VMT). The Proposed Project does not include any changes in land use that would significantly increase VMT nor significant new facilities but the replacement of mostly existing facilities. Instead, the goal of the Proposed

Project is to upgrade existing water infrastructure instead of substantial expansion of it, consequently it will not lead to increased development or a significant increase in traffic volumes or VMT. Temporary increases in traffic due to construction activities will be managed through traffic control measures included as **Mitigation Measure T-1**, minimizing any potential impact. Therefore, the project would not conflict with CEQA Guidelines section 15064.3(b), and the impact is less than significant with mitigation.

c) Would the project substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Less than Significant. Construction of the Proposed Project—including improvements at the WTP, water storage tank and booster pump improvements, water distribution system improvements, and upgrades to the operational maintenance management—would require temporary trenching and excavation within existing public roadways. All disturbed pavement and shoulders would be restored to pre-project conditions following installation. The Proposed Project does not include any changes to roadway alignment, lane configurations, intersection controls, or traffic circulation patterns. Construction zones would be managed through standard traffic control measures to maintain safe speeds, sight distance, and travel paths for motorists, bicyclists, and pedestrians. As a result, the Proposed Project would not create or exacerbate hazards due to a geometric design feature or incompatible use. This impact would be less than significant.

d) Result in inadequate emergency access?

Less than Significant with Mitigation. Construction of the Proposed Project— including improvements at the WTP, water storage tank and booster pump improvements, water distribution system improvements, and upgrades to the operational maintenance management—would require temporary, localized lane closures on streets such as 1st through 6th Street, Shoul Street, Schindler Street, Orchard Shore Drive, Apple Lane, Island Drive, Paradise Valley Boulevard, and others. These closures would be short in duration and would shift as work progresses, minimizing the amount of time any single roadway segment is impacted. **Mitigation Measure T-1** would ensure that CLOCWD complies with all rules and regulations contained in encroachment permits issued by Lake County and Caltrans. This includes but is not limited to providing advance notice to the designated Permit Inspector prior to initiating work, obtaining approval for any work that would interrupt the normal flow of public traffic, and maintaining a minimum of one paved traffic lane not less than 12 feet wide with a contiguous 4-foot shoulder open to public traffic at all times.

Because construction activities would be temporary, localized, and **Mitigation Measure T-1** would ensure access throughout construction, the Proposed Project would not result in inadequate emergency access. Impacts would be less than significant with mitigation.

4.17.4 Mitigation Measures

T-1

CLOCWD shall follow all rules and regulations within the encroachment permits issued by Lake County and Caltrans. These measures may include, but are not limited to:

- At least 48 hours before starting any work, or 5 working days if any lane closures or traffic control will be necessary, the CLOCWD shall notify the designated Permit Inspector;

- Work that will interrupt the normal flow of public traffic is not authorized without prior approval from the State's Representative;
- A minimum of one paved traffic lane not less than 12 feet wide and a contiguous 4 foot shoulder shall be open for use by public traffic at all times, and when construction operations are not actively in progress, all lanes shall be open to public traffic;
- Whenever vehicles or equipment are parked on the shoulder outside of the traveled way between 6 feet to 15 feet of a traffic lane, the shoulder area shall be closed with fluorescent traffic cones or portable delineators placed on a taper in advance of the parked vehicles or equipment;
- Excavation of any trench 5 feet or more in depth shall not begin until the contractor has submitted and received written approval of the contractor's Trench Excavation Safety Plan; and
- The District shall provide and maintain through the work area at all times ADA compliant safe walk way for pedestrians and bicycles, which shall be: a minimum of four feet wide, clearly defined, and maintained in a smooth unobstructed condition free of tripping hazard, unless a pedestrian detour is in place.

4.18 TRIBAL CULTURAL RESOURCES

Would the project:	**Potentially Significant Impact**	**Less than Significant Impact with Mitigation Incorporated**	**Less than Significant Impact**	**No Impact**
a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code § 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☒	☐	☐
ii. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code § 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code § 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐

4.18.1 Regulatory Setting

Federal

NHPA Section 106

Section 106 of the NHPA of 1966 requires tribal consultation in all steps of the process when a federal agency project or effort may affect historic properties that are either located on tribal lands, or when any Native American tribe or Native Hawaiian organization attaches religious or cultural significance to the historic property (traditional cultural property [TCP]), regardless of the property's location. When such an undertaking occurs on tribal land, the federal agency must notify appropriate Native American tribes of the undertaking and give those tribal groups the opportunity to consult, should they wish to do so.

State

AB 52

AB 52, enacted in 2014, introduced a new category of resources in CEQA known as TCRs, which incorporates tribal cultural values alongside scientific and archaeological considerations when assessing impacts and mitigation. According to PRC, Division 13, Section 21074, TCRs are defined as either:

1. Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either: a. Included or determined to be eligible for inclusion in the CRHR, or b. Included in a local register of historical resources as defined in subdivision (k) of PRC Section 5020.1.
2. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying these criteria, the lead agency shall consider the significance of the resource to a California Native American tribe.

Native American tribes with cultural ties to a geographic area may have specialized knowledge about their TCRs. Therefore, AB 52 mandates that within 14 days of deciding to move forward with a project or deeming a project application complete, the lead agency must notify California Native American tribes that have requested to be on the agency's notification list. The notice must include a brief description of the project, its location, contact information for the lead agency, and inform the tribe that they have 30 days to request a consultation. The lead agency is required to initiate the consultation process within 30 days of receiving such a request.

Local

Lake County General Plan

The Lake County General Plan aims to protect and enhance the natural and cultural resources that make Lake County unique. The goals and policies designed to address cultural resources are as follows:

Goal OSC-8: To manage and project sites of cultural and archaeological importance for the benefit of present and future generations.

Policy OSC-8.1 – Evaluation of Cultural and Archaeological Resources: The County should participate in and support efforts to identify its significant cultural and archaeological resources using appropriate State and Federal standards.

Policy OSC-8.2 – Protection of Resources with Potential State or Federal Designations: The County should encourage the protection of cultural and archaeological sites with potential for placement on the National Register of Historic Places and/or inclusion in the California State Office of Historic Preservation's California Points of Interest and California Inventory of Historic Resources. Such sites may be of statewide or local significance and have anthropological, cultural, military, political, architectural, economic, scientific, religious, or other values.

4.18.2 Environmental Setting

The Proposed Project improvement areas lie within the traditional territory of the Southeastern Pomo. Pomo speakers have been sub-divided into seven distinct language groups: Kashaya, Southern, Central, Northern, Northeastern, Eastern, and Southeastern, and can be linked to the larger family of Hokan speakers (Acorn Environmental, 2026). Southeastern Pomo speakers occupied the area around East Lake and Lower Lake, on the eastern margin of Clear Lake.

The Pomo peoples organized themselves into small tribelets or village communities, and the social and political organization of these individual groups showed considerable variation. The Pomo economy was based on a seasonal round of fishing, hunting, and the collection of a variety of plants for food, tools, structures and trade (Acorn Environmental, 2026). Beads (also called *po* or *pol*), made from magnesite, were also an important part of the Pomo economy. These beads were of such high value that they were traded individually rather than in a necklace like the Pomo did with the clam shell coins they made. The Pomo were also known for their expertise in basket making. The types of houses used by the Pomo varied depending on the climate and vegetation of each district. In the Kashaya Pomo region, single-family dwellings were typically made of redwood bark slabs erected in conical fashion to create a structure 8 to 15 feet in diameter and 6 to 8 feet high (Acorn Environmental, 2026).

Typical weapons used in hunting were the bow and arrow for larger game, club for bear, and spears for sea lions and seals. Smaller animals were captured by bola, low brush fences, nets, snares, and basketry traps. Lake, stream, and ocean fish were caught in traps, with lines or weirs. The traditional mortar and pestle were used for processing of acorns, Buckeye nuts and other seeds, grasses, and roots. Knives were made from obsidian or chert and could be attached to handles and used as axes (Acorn Environmental, 2026).

A request for a record search of the California NAHC SLF and for a list of local Native American contacts was made on October 27, 2025. The results of the NAHC records search were positive (Acorn Environmental, 2026). The NAHC stated the Elem Indian Colony Pomo Tribe should be contacted for more information. The NAHC also provided a list of an additional 34 representatives from 20 another Native American tribes that are traditionally and culturally affiliated with the Project area. Tribes were contacted on January 20, 2026 (see **Section 4.5.3** for a list of Tribes). Letters were sent to all listed Tribes. The initial communication introduced the Proposed Project, provided maps of the Proposed Project improvement areas, and stated the methodology to be used in the records search and pedestrian survey. One response has been received from Clifford Mota of the Elem Indian Colony stating he would review the project information.

In accordance with AB 52, invitations were sent to consult with the following Tribes in January 2026 requesting consultation in compliance with the CEQA review process: Big Valley Band of Pomo Indians of the Big Valley Rancheria, Cahto Tribe, Cloverdale Rancheria of Pomo Indians, Coyote Valley Band of Pomo Indians, Dry Creek Rancheria of Pomo Indians, Elem Indian Colony Pomo Tribe, Estom Yumeka Maidu Tribe of the Enterprise Rancheria, Guidiville Rancheria of California, Habematolel Pomo of Upper Lake, Hopland Band of Pomo Indians, Koi Nation of Northern California, Manchester Band of Pomo Indians of the Manchester Rancheria, Middletown Rancheria of Pomo Indians of California, Noyo River Indian Community, Pinoleville Pomo Nation, Potter Valley Tribe, Redwood Valley or Little River Band of Pomo Indians, Robinson Rancheria of Pomo Indians, Round Valley Reservation/Covelo Indian Community, Scotts Valley Band of Pomo, and Yokayo Tribe. As of January 28, 2026, the Clearlake Oaks County Water District has received one response in regards to request for consultation from the Elem Indian Colony Pomo Tribe THPO. The response acknowledged receipt of the letter and stated the project information would be reviewed.

4.18.3 Impact Assessment

a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code § 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or

Less-than-Significant with Mitigation. The Proposed Project improvement areas were found to contain two previously documented cultural resources that are intersected by project components, both of which were considered eligible for the NRHP and thus eligible for the CRHR for the purposes of the cultural assessment. As described in **Section 3.5**, known tribal cultural resources as defined in PRC Section 21074 have been identified on the site through background research. Resources in the immediate vicinity are dominated by obsidian lithic scatters, with the large occupation site of Elem just to the south.

The proposed water main replacement in front of the WTP on Island Drive and the proposed meter data acquisition at the corner of Harvey Boulevard and SR-20 are intersected by cultural resources. New ground disturbance beyond the limits of prior installations near/through the resource area is expected to be minimal. While the nature of the lithic scatters, prior ground disturbance, and minimal ground disturbance would likely not result in a substantial adverse change to the resource, archaeological and tribal monitoring under **Mitigation Measure CUL-3** would be utilized to avoid or minimize adverse impacts in the event of an inadvertent discovery. Consultation with Native American tribes under AB 52 has not resulted in the identification of new TCRs. However, because construction of the Proposed Project would require ground-disturbing activities, there is the potential of unanticipated discoveries of subsurface archaeological deposits or human remains, which would be a potentially significant impact. The conclusion of consultation under Section 106 and AB 52 and the application of **Mitigation Measures CUL-1**, **CUL-2**, and **CUL-3** would reduce impacts to TCPs or TCRs to a less-than-significant level.

ii. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code § 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code § 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

Less-than-Significant Impact with Mitigation. The Proposed Project improvement areas are not listed as a historical resource in the CRHR, although there are resources that have been identified as eligible for the NRHP and thus the CRHR. As described above, tribal cultural resources have been identified in the vicinity of the Project area and mitigation has been provided to resolve potentially significant impacts. It is possible that unknown buried archaeological materials could be found during ground disturbing activities at the development site, including unrecorded Native American materials. If such resources are discovered, the impact on cultural resources could be significant. If human remains are uncovered, compliance with Section 15064.5 I (1) of the CEQA Guidelines and Health and Safety Code Section 7050.5 is required. The application of **Mitigation Measures CUL-1**, **CUL-2**, and **CUL-3** would reduce impacts to TCPs or TCRs to a less-than-significant level. Therefore, the Proposed Project will have a less than significant impact with mitigation.

4.19 UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	☐	☐	☒	☐
c) Result in a determination by the waste water treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
d) Generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☒	☐

4.19.1 Regulatory Setting

Local

Lake County General Plan

The Lake County General Plan aims to establish the framework for the provision of public facilities and services to meet the needs of the County's future development. The following are the goals and policies related to utilities and service systems that apply to the Proposed Project:

Goal PFS-3: To ensure the provision of adequate wastewater collection and treatment within the County.

> **Policy PSF-3.5 – Water Conservation**: The County shall minimize wastewater flows through water conservation efforts. Consideration should be given to allow use of gray water for landscape irritation.

Goal PFS-5: To ensure the safe and efficient disposal or recycling of solid and hazardous waste generated in the County.

> **Policy PSF-5.1 – Solid Waste Reduction**: The County shall promote the maximum feasible use of solid waste reduction, recycling, and composting of wastes, strive to reduce commercial and industrial waste on an annual basis, and pursue a financing mechanism for solid waste reduction programs in order to meet the requirements of Public Resources Code 41780 and 41780.1.

> **Policy PSF-5.3 – Provisions for Solid Waste Storage, Handling, and Collection**: The County shall ensure that all new facilities have the necessary provisions for solid waste storage, handling, and collection prior to using building permits.

Goal PFS-6: To ensure that adequate and efficient public utilities are provided to meet the needs of residents and businesses in the County.

> **Policy PSF-6.1 – Electric Service**: The County shall coordinate with electricity providers in planning for the timely expansion of electrical facilities to meet future demand, and for projects affecting public health, schools, or for significant air emissions reductions.

Policy PFS-6.6 – Watershed Protection During New Public Facilities Expansion: Extension of public facilities shall be designed to minimize or avoid potential adverse impacts to the watersheds within the County.

4.19.2 Environmental Setting

Water and Wastewater Services

The CLOCWD is the only supplier of potable water in the community of Clearlake Oaks. The District provides water and wastewater treatment to approximately 2,359 people within its 2.1-square mile service area as of 2018. The WWTP has a maximum daily flow of 2.1 million gallons per day.

Solid Waste Collection and Disposal

Solid waste collection and recycling services for Clearlake Oaks are provided by Lake County Waste Solutions through C&S Waste Solutions. Solid waste is collected and taken to the Lake County Transfer Station and Recycling Center (C&S Waste Solutions, 2025).

Natural Gas, Electricity, and Communication Services

Pacific Gas & Electric (PG&E) provides electrical and natural gas services in the vicinity of the Proposed Project. PG&E provides service to approximately 16 million customers. There are existing electrical lines throughout the Proposed Project. Telecommunication service in the area is provided by Mediacom, while multiple carriers provide mobile service.

4.19.3 Impact Assessment

a) Would the project require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

Less-than-Significant Impact.

Water and Wastewater Services. The Project Proposed includes the rehabilitation of water infrastructure across the CLOCWD service area. The Proposed Project would not require new or expanded water or wastewater treatment as the project components support an improved water treatment system and would not require additional infrastructure construction. The High Valley Tank and Booster Station will involve the construction of a new 180,000-gallon water storage tank, although this is to replace two previous water storage tanks which have been removed due to structural deficiencies. The District has sufficient capacity to serve the community with water and wastewater treatment. The water demands of the Proposed Project would be minimal and temporary, relating only to construction needs for dust abatement. Therefore, the Proposed Project would not result in the construction or relocation of water or wastewater utilities which could cause significant environmental effects. This is a less-than-significant impact.

Stormwater. The Proposed Project would cause some ground disturbance for the WTP improvements, water storage tank and booster pump improvements, and distribution system improvements, although any disturbance would be returned to the original condition of the site and all disturbance would occur in previously disturbed areas. The effects of stormwater runoff are addressed in **Section 4.10**. The Proposed Project would not warrant stormwater collection infrastructure as the project would mostly return the surface of the improvement areas to their original condition and the Proposed Project would not add

meaningful impervious area. Therefore, the impacts related to stormwater would be less-than-significant impact.

Natural Gas, Electricity, and Communication Services. The Proposed Project would not require additional natural gas, electricity, or communication service connections. There would be no relocation or construction of new or expanded electric power, natural gas, or telecommunications facilities which could cause significant environmental effects and therefore no impact.

b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?

Less-than-Significant Impact. The water demands for the Proposed Project improvement areas would be limited to the construction period. Operation of the infrastructure improvements would not require additional water demand. There is sufficient water supplies available from the District to meet these minimal needs. The increase in water demand would be temporary and therefore the impact would be less than significant.

c) Would the project result in a determination by the waste water treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

No Impact. The District provides wastewater treatment services and maintains a WWTP for the community. The Proposed Project would not cause an increase in wastewater treatment demands and the WWTP has adequate capacity to continue serving the community. Therefore, there would be no impact.

d) Would the project generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

Less-than-Significant Impact. Lake County Waste Solutions provides solid waste collection services to the vicinity of the Proposed Project. The Proposed Project would generate solid waste during construction. Construction has the potential to generate solid waste related to the replacement of pipes and water tanks. Construction waste would be contained in designated bins and picked up by the waste hauler for disposal. Operation of the Proposed Project would not generate solid waste. Lake County Waste Solutions, operated by C&S Waste Solutions, has adequate capacity to accept the limited waste produced through construction of the Proposed Project. The Proposed Project would not generate solid waste in excess of any standards or in excess of the capacity of local infrastructure. Therefore, the impact would be less than significant.

e) Would the project comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

Less-than-Significant Impact. Proposed Project construction and operation would not generate substantial amounts of solid waste and thus, the Proposed Project would not conflict with any federal, State, and local management and reduction statutes and regulations related to solid waste. Further, the Proposed Project would be subject to compliance with existing statutes and regulations by the County, State, or federal law. Therefore, the Proposed Project would have a less-than-significant impact.

4.20 WILDFIRE

Would the project:	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☒	☐	☐
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☒	☐	☐
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☒

4.20.1 Regulatory Setting

State

California Department Forestry and Fire Protection

State Responsibility Areas (SRAs) are lands in California where CAL FIRE holds legal and financial responsibility for wildfire protection and administers fire hazard classifications and building standards. Local Responsibility Areas (LRAs), on the other hand, include city lands, cultivated agricultural areas, unincorporated non-flammable regions, and lands not meeting the criteria for SRAs or Federal Responsible Areas. CAL FIRE is directed by California PRC Section 4201 through 4204 and California Government Code Section 51175-51189 to map fire hazard zones within both SRAs and LRAs based on factors such as fuels, terrain, and weather. These Fire Hazard Severity Zones (FHSZs) reflect the likelihood of an area burning over a 30- to 50-year period without considering fuel reduction efforts, and they also influence building code requirements aimed at reducing ignition risks in wildland-urban interface areas. Additionally, these maps rate wildlife hazards as “moderate,” “high,” or “very high” based on factors such as fuel loading, slope, and fire weather.

Local

Lake County General Plan

The Lake County General Plan aims to maintain a high quality of life for Lake County Residents through minimizing natural hazard risks. The following goals and policies are designed to address urban and wildland fire hazards:

Goal HS-7: To minimize the possibility of the loss of life, injury, or damage to property as a result of urban wildland fire hazards.

Policy HS-7.1 – Consultation with Fire Service District: The County shall consult with the appropriate fire service district or California Division of Forestry in areas designated as high and extreme fire hazard, for particular regulations or design requirements prior to issuance of a building permit or approval of subdivisions.

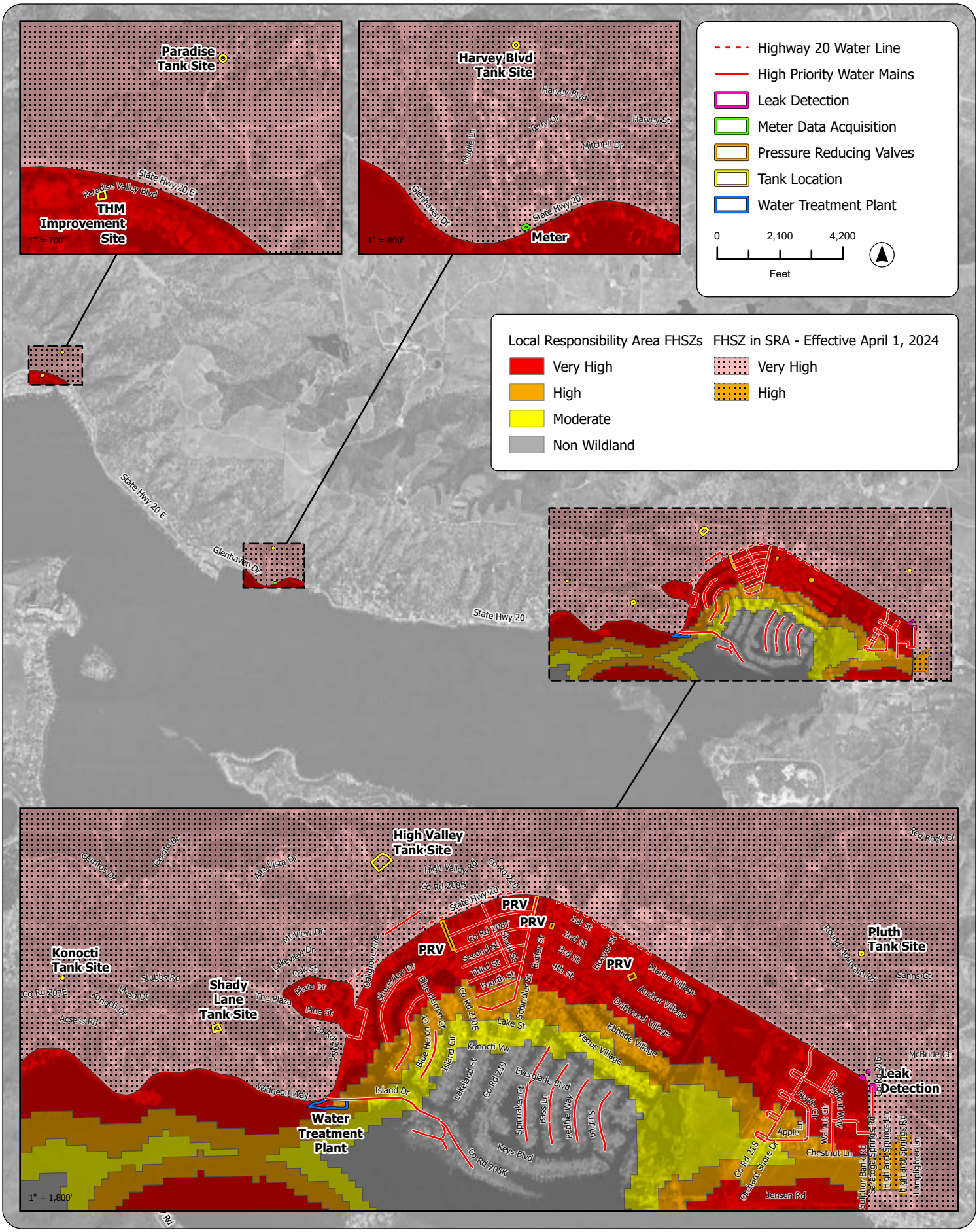
Policy HS-7.4 – Wildland Fire Management Plans: The County shall require the development of wildland fire management plans for projects adjoining significant areas of open space that may have high fuel loads..

Lake County Community Wildfire Protection Plan

The Lake County Community Wildfire Protection Plan (CWPP) is a collaborative strategy developed by local citizens, state, and federal agencies to address wildfire risks. The plan helps the community identify their specific wildfire protection needs and priorities, such as hazard mitigation, community preparedness, and structure protection. The CWPP reflects community input on actions and projects that will assist not only local residents, but also first responders in their efforts to protect lives, property, and the environment. The plan's purpose is to streamline the previous CWPP in accordance with newer guidelines, provide fire safety information to residents, provide information to homeowners to reduce ignitability of their homes, identify recommended fuel reduction projects throughout Lake County, identify Fire Safety resources and groups throughout Lake County, and to promote comprehensive and community-based adaptation to living in a fire adapted ecosystem.

4.20.2 Environmental Setting

The portions of the Proposed Project located in the Clear Lake Keys are on relatively flat land. The water storage tanks that are proposed to undergo improvements or replacements are elevated in the hills, although the individual Proposed Project improvement areas are relatively flat. The Proposed Project components identified by CAL FIRE as being within an LRA include a majority of the high priority water mains, the water treatment plant, the THM Improvement Site, the eastern half of the Highway 20 water mains, and the pressure reducing valves. The FHSZ for these components range from moderate to very high, with some components not being identified as within a FHSZ. The easternmost high priority water main, leak detection facilities, meter data acquisition site, western half of the Highway 20 water mains, and all of the tank sites (except for THM Improvement Site) are in a State Responsibility Area (SRA) and have a Very High FHSZ ranking. The FHSZ for the entire Proposed Project, as recommended by the State Fire Marshal, ranges from a no FHSZ to a Very High FHSZ as shown in **Figure 11** (CAL FIRE, 2026).



SOURCE: ESRI, 2026; Google Earth Aerial Photograph, 5/2024; CalFire, 2024/2025; Acorn Environmental, 2/10/2026

Figure 11

Fire Hazard Severity Zones

4.20.3 Impact Assessment

a) Would the project substantially impair an adopted emergency response plan or emergency evacuation plan?

Less-than-Significant Impact. Implementation of the Proposed Project would not alter the existing land use in the improvement areas. Additional vehicles would be required during construction, that would increase evacuation traffic in case of an emergency, but operation of the Proposed Project would not impact any adopted emergency response plan or emergency evacuation plan. Impacts related to construction traffic are discussed in **Section 4.17**. As such, the Proposed Project would have less-than-significant impact.

b) Due to slope, prevailing winds, and other factors, would the project exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

Less-than-Significant Impact with Mitigation. The Proposed Project is located on relatively flat land with minimal slope and are not subject to strong prevailing winds or other factors that would exacerbate wildfire risks. Additionally, a large portion of the Proposed Project improvement areas are bordered by Clear Lake. However, the Proposed Project was identified by the State Fire Marshal as a Very High FHSZ in some areas (CAL FIRE, 2026). While there are no strong prevailing winds, in order to reduce the potential risk of wildfire, **Mitigation Measure WILD-1** mandates actions to reduce fire risk during construction. Furthermore, the Proposed Project would be developed and operated in compliance with all current California Fire Code regulations Therefore, the Proposed Project would have a less-than-significant impact with mitigation incorporated.

c) Would the project require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

Less-than-Significant Impact with Mitigation. The Proposed Project includes the installation of a new 130,000-gallon tank at the High Valley Tank and Booster Station on a previously graded lot. Maintenance of the existing infrastructure, including replacement and repair of tanks and piping, would not exacerbate fire risk as the ground would be restored to the current condition following necessary trenching. As discussed above, construction of the Proposed Project could increase the risk of a wildfire, although **Mitigation Measure WILD-1** would be incorporated to reduce these impacts. The nature of the Proposed Project would not require maintenance that would exacerbate fire risk or result in impacts to the environment. Therefore, the Proposed Project would have a less-than-significant impact with mitigation.

d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

No Impact. The Proposed Project is located on relatively flat terrain and would not involve significant ground disturbance that would alter the existing conditions of the improvement areas. The existing conditions of the Proposed Project improvement areas do not expose people or structures to significant risks, including downslope, downstream flooding, or landslides as a result of fire impacts. The Proposed Project would also not result in drainage changes. Therefore, the Proposed Project would have no impact.

4.20.4 Mitigation Measures

WILD-1: During construction, staging areas, welding areas, or areas slated for development using spark-producing equipment shall be cleared of dried vegetation or other materials that could serve as fire fuel. To the extent feasible, the contractor shall keep these areas clear of combustible materials in order to maintain a fire break. Any construction equipment that normally includes a spark arrester shall be equipped with an arrester in good working order. This includes, but is not limited to, vehicles, heavy equipment, and chainsaws.

4.21 MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less than Significant Impact with Mitigation Incorporated	Less than Significant Impact	No Impact
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☒	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

4.21.1 Impact Assessment

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Less-than-Significant Impact with Mitigation. The potential project-related impacts to the habitats of plant and wildlife species is addressed in **Section 4.4** of this document. **Mitigation Measure BIO-1** and **Mitigation Measure GEO-1** have been identified to address potential impacts to biological resources and reduce these impacts to a less-than-significant level. The Proposed Project would not substantially restrict the range or number of endangered plants or animals, nor would it impact historical resources.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Less-than-Significant Impact with Mitigation. CEQA Guidelines Section 15064(i) states that a Lead Agency shall consider whether the cumulative impact of a project is significant and whether the effects of a project are cumulatively considerable. The Proposed Project would have the potential to result in impacts to the environment, but these impacts, in addition to being fully mitigated, are primarily related to construction and are therefore short-term and temporary. Long-term operation impacts of the Proposed Project are minimal and existing ordinances and regulations exist to ensure that compliance with statutory and regulatory standards is maintained throughout the operational life of the Project. Where applicable, the Initial Study identifies mitigation measures to potential environmental impacts resulting from implementation of the Proposed Project. Potential impacts resulting from Project are therefore considered less than significant with incorporation of mitigation measures.

c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Less-than-Significant Impact with Mitigation. The analyses of environmental issues contained in this Initial Study indicate that the Proposed Project is not expected to have substantial adverse impact on human beings, either directly or indirectly. Mitigation Measures listed above will be enacted to reduce potential impacts to less than significant. Standard requirements and conditions of approval have been incorporated in the Proposed Project to reduce all potentially significant impacts to less than significant. Therefore, the Proposed Project would have a less-than-significant impact.

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Appendix A

Amended Water Master Plan and Engineers Report

Clearlake Oaks County Water District

AMENDED WATER MASTER PLAN and ENGINEER'S REPORT



SEPTEMBER 2025

Prepared by:

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Table of Contents

ABBREVIATIONS ..... **ix**

BACKGROUND AND PURPOSE ..... **xi**

DISTRICT INFORMATION ..... **xii**

ORGANIZATION OF WATER MASTER PLAN ..... **xii**

AUTHORIZATION ..... **xiii**

ACKNOWLEDGEMENTS ..... **xiii**

SECTION 1 – Clearlake Oaks County Water District Overview **1**

1.1 Background Information 1

1.2 Hydrology and Geology 3

1.3 Population, Land Use, and Water Demand 3

1.3.1 Population and Growth 4

1.3.2 Land Use 5

1.3.3 Water Demand 6

1.4 District Finances 12

1.4.1 Rate Structure 12

1.4.2 Annual Budget 12

1.4.3 Net Position 13

SECTION 2 – Water Quality and Infrastructure **14**

2.1 Drinking Water Quality and Compliance 14

2.1.1 Consumer Confidence Reports 15

2.1.2 Disinfection By-Products 15

2.2 System Operating Pressures 17

2.3 Raw Water Source 20

2.3.1 Water Allocation Rights 20

2.3.2 Source Supply Capacity 20

2.3.3 Groundwater Supply 20

2.3.4 Raw Water Quality 21

2.4 Water Treatment Plant 22

2.4.1 Water Treatment Capacity 22

2.4.2 WTP Process Description 23

2.5 Water Distribution System and Appurtenances 29
2.5.1 Mains, Service Laterals, and Valves 29
2.5.2 Fire Hydrants 31
2.5.3 Flow Meters 31
2.5.3.1 2024 Flow Meter Update 34
2.5.4 Control Valves 35
2.6 Pump Stations and Water Storage 36
2.6.1 Pump Stations 36
2.6.1.1 2024 Pump Station Update 40
2.6.2 Water Storage Tanks 41
2.6.2.1 2024 Water Storage Tank Update 43
2.7 Operation and Management Systems 44
2.7.1 SCADA System 44
2.7.1.1 2024 SCADA System Update 44
2.7.2 Operational Effectiveness 45
2.8 Summary Table of Water Infrastructure 46

SECTION 3 – System Analysis, Mapping, and Deficiencies 48
3.1 Analysis Criteria 48
3.1.1 Water Demand Criteria 48
3.1.1.1 2024 Water Demand Criteria Update 49
3.1.2 Fire Flow Demand Criteria 50
3.1.3 Storage Criteria 50
3.1.3.1 2024 Storage Criteria Update 51
3.2 Hydraulic Model 52
3.2.1 Pipe Material and Loss Coefficients 53
3.2.2 Operating and Control Criteria 53
3.2.3 Hydraulic Model Scenario Results 55
3.2.4 Hydraulic Model Conclusions 66
3.2.4.1 Additional Fire Flow Modeling 66
3.2.4.2 Konocti Fire Flow Analysis 67
3.2.4.3 Cerrito Fire Flow Analysis 68
3.2.4.4 West Highway 20 Fire Flow Analysis 69

3.2.4.5 Additional Fire Flow Hydraulic Model Conclusions 74
3.3 Water System Mapping and Analysis 77
3.4 AWWA Water Audit 79
3.4.1 System Input Volume 79
3.4.1.1 2024 System Input Volume Update 79
3.4.2 Consumption 80
3.4.2.1 2024 Consumption Update 80
3.4.3 Water Losses 80
3.4.3.1 2024 Water Losses Update 81
3.4.4 Non-Revenue Water 81
3.4.4.1 2024 Non-Revenue Water Update 82
3.4.5 Performance Indicators 82
3.4.5.1 2024 Performance Indicators Update 83
3.4.6 District Metered Areas (DMAs) 83
3.4.6.1 2024 District Metered Areas (DMAs) Update 86
3.4.7 Component Analysis Conclusions and Recommendations 89
3.5 Water Loss Management System 91
3.5.1 2024 Water Loss Management System Update 91
3.6 Water Treatment Analysis 93
3.6.1 Overview 93
3.6.2 Treatment Capacity 93
3.6.2.1 2024 Treatment Capacity Update 93
3.6.3 Raw Water Intake 94
3.6.3.1 2024 Raw Water Intake Update 95
3.6.4 Pre-treatment 96
3.6.4.1 2024 Pre-treatment Update 96
3.6.5 Corrosion Protection 97
3.6.5.1 2024 Corrosion Protection Update 100
3.6.6 Disinfection Byproducts 101
3.6.6.1 2024 Disinfection Byproducts Update 103
3.6.7 Granular Activated Carbon Filtration 105
3.6.8 High Service Pumps 106
3.6.8.1 2024 High Service Pumps Update 107

3.6.9 Washwater Recovery System 108
3.6.10 Backup Generator 108
3.7 Water Distribution System Analysis 109
3.7.1 Water Main Replacement Program 119
3.7.1.1 2024 Water Main Replacement Program 116
3.7.2 Proposed Paradise Cove Service Area Annexation 123
3.7.3 Acoustic Leak Survey 123
3.7.3.1 2024 Acoustic Leak Survey Update 124
3.7.4 Backflow Prevention 129
3.7.4.1 2024 Update 130
3.7.5 Flow Meters 130
3.7.5.1 2024 Flow Meters Update 134
3.7.6 Pressure Reducing Valve Analysis 136
3.8 Pump Stations and Water Storage Analysis 137
3.8.1 Pump Stations 137
3.8.2 Water Storage Tanks 137
3.8.2.1 2024 Water Storage Tanks Update 139
3.8.3 Water Storage Corrosion Protection 140
3.8.3.1 2024 Water Storage Corrosion Protection Update 143
3.8.4 Storage Disinfection Byproducts 144
3.8.4.1 2024 Storage Disinfection Byproducts 146
3.9 Operation and Management Systems Analysis 156
3.9.1 Advanced Meter Reading/Advanced Meter Infrastructure 156
3.9.1.1 2024 Advanced Meter Reading/Advanced Meter Infrastructure Update 158
3.9.2 Miscellaneous Equipment 159

SECTION 4 – Project Alternatives Evaluations 160
4.1 Raw Water Supply 160
4.2 Water Treatment Plant 164
4.2.1 Ozone Generation 164
4.2.2 High Service Pumps 164
4.2.3 Equalization Tank 166
4.2.4 Disinfection Byproducts Mitigation 170

4.2.5 Corrosion Protection 173
4.3 Water Distribution 174
4.3.1 Pipelines 174
4.3.2 Meter Replacement Program and AMI Services 181
4.3.3 Flow Meters 191
4.3.3.1 Flow Meters 2024 Update 193
4.3.4 Pressure Reducing Valves 194
4.3.4.4 Pressure Reducing Valves 2024 Update 195
4.4 Water Storage and Pump Stations 197
4.4.1 Booster Pump Stations 197
4.4.2 Water Storage Tanks 199
4.4.3 Disinfection Byproduct Mitigation 202
4.4.3.1 2024 Disinfection Byproduct Mitigation Update 203
4.4.4 Corrosion Protection 205
4.5 Operational Improvements 205
4.6.1 Filter Feed Pump Room 205
4.6.2 Granular Activated Carbon Filter 206
4.6 Alternative Evaluation Matrix 206

SECTION 5 – Recommended Projects and Prioritization 213
5.1 Raw Water Supply 215
5.2 Water Treatment Plant Improvement Projects 215
5.2.1 Ozone Generation 215
5.2.2 Post Ozonation 217
5.2.3 High Service Pumps VFD 217
5.2.4 High Service Pump 2 Replacement 220
5.2.5 Equalization Tank 222
5.2.6 Clearwell THM Removal System 224
5.2.7 Acid Feed System 226
5.2.8 Facility Corrosion Protection 229
5.2.9 Dissolved Air Floatation Pretreatment 230
5.3 Distribution System Improvement Projects 231
5.3.1 Pipeline Improvement and Replacement 231

5.3.1.1 Paradise Cove Pipeline Rehabilitation 235
5.3.2 Small Meter Replacement 235
5.3.3 400 Sulphur Springs Road Meter Testing 236
5.3.4 Backflow Prevention 237
5.3.4.1 Phase 2 Backflow Prevention 238
5.3.5 AMI Improvement 240
5.3.5.1 AMI / AMR Improvements Update 241
5.4 Water Storage and Pump Station System Improvement Projects 242
5.4.0 Booster Pump Station Control System 242
5.4.1 Shady Lane Pump Station 243
5.4.2 High Valley Tank and Pump Station 247
5.4.3 Cerrito Tank and Pump Station 253
5.4.4 Harvey Tank and Pump Station 258
5.4.5 Pluth Tank Site 266
5.4.6 Summary of Tank and Booster Pump Improvements 267
5.4.7 Storage Corrosion Protection 268
5.4.8 Storage THM Removal System 270
5.5 Operational Improvement Projects 273
5.5.1 GAC Filter Media Replacement 273
5.5.2 Filter Building HVAC Installation Project 275
5.5.3 Institute Comprehensive Leak Detection Program 276
5.5.4 Miscellaneous Equipment 276
5.5.4.1 2024 Miscellaneous Equipment and Instrumentation Update 276
5.5.5 Short-Term Asset Reserves 277
5.5.6 SCADA System Upgrades 278
5.6 Environmental Impacts 279

SECTION 6 – Project Costs and Financing 280
6.1 Phase 1 (Immediate Projects) 281
6.1.1 Pipeline Replacement, and Pressure Management Project 281
6.1.2 Paradise Tank Rehabilitation Project (THM Removal) 281
6.1.3 Shady Lane Pump Station Improvements 282
6.1.4 High Valley Pump Station 282

6.1.5 High Valley Tank 282
6.1.6 Shady Lane Tank Rehabilitation 283
6.1.7 Konocti Tank Rehabilitation and THM Removal System 283
6.1.8 WTP Equalization Tank 284
6.2 Phase 1a (Immediate Projects) 284
6.2.1 WTP Dissolved Air Floatation Pilot Plant 284
6.2.2 SCADA System Upgrades 285
6.2.3 Meter Data Consolidation & Water Loss Management System 285
6.2.4 Leak Detection Program Project 285
6.2.5 Cross Connection Control Plan and Cross Connection Hazard Assessment 286
6.3 Phase 2 (5-Year Projects) 287
6.3.1 Phase 2 Pipeline Replacement Project 287
6.3.2 Phase 2 Backflow Prevention Project 288
6.3.3 Cerrito Tanks and Pump Station Improvement Project 288
6.3.4 Harvey THM Removal Project 288
6.3.5 High Valley THM Removal Project 289
6.3.6 Pluth Rehabilitation Project 289
6.3.7 Dissolved Air Floatation Pretreatment 290
6.3.8 WTP Valve and Actuator Rehabilitation Project 290

Appendices

Appendix A - Water Regulations
Appendix B - Consumer Confidence Reports (Updated 2024)
Appendix C - Raw Water Quality Test Results
Appendix D - Diurnal Demand Curves
Appendix E - Demand Factor Development
Appendix F - Hydraulic Modeling
Appendix G - Digitized Water System
Appendix H - AWWA Water Audit (Updated 2024)
Appendix I - Yolo County Water Agreement
Appendix J - Backflow Ordinance
Appendix K - Small Meter Testing
Appendix L - Large and Intermediate Meter Survey Results
Appendix M - Meter Change-Out and AMI Analysis
Appendix N – STS Tank Reports
Appendix O – CLOCWD Source Capacity Study

Abbreviations
ADD – Average Day Demand
AES – Analytical Environmental Services
AMI – Advanced metering infrastructure
AMR – Automatic meter reading
AWWA – American Water Works Association
CCR – Consumer Confidence Report
CDP – Census-Designated Place
CDPH – California Department of Public Health
CEQA – California Environmental Quality Act
CFR – Code of Federal Regulations
CLOCWD - Clearlake Oaks County Water District
CLWSS – Clear Lake Watershed Sanitary Survey
CT – contact time
DBP's – Disinfection Byproducts
DHS – Department of Health Services (California)
DMA – District Metered Area
EDU – Equivalent Dwelling Unit
FPS - feet per second
GAC – Granular Activated Carbon
gpd – gallons per day
gpm – gallons per minute
ILI – Infrastructure Leakage Index
LACOSAN – Lake County Sanitation District
LAFCO – Local Agency Formation Commission
MCL – Maximum Contaminant Level
MDD – Maximum Day Demand
MFD – multi-family dwelling
MGD – million gallons per day
MPN – Most Probable Number
MSR – Municipal Service Review
NEPA – National Environmental Policy Act
NRW – Non-Revenue Water
NTU – Nephelometric Turbidity Unit
OSHA – Occupational Safety and Health Administration
PCA – possible contaminating activities
PER – Preliminary Engineering Report
PHD – Peak Hourly Demand
PLC – Programmable Logic Controller
PSI - Pounds per square inch
PVC – Polyvinyl Chloride
RDA – Rural Development Agency
SIV – System Input Volume
SCADA – Supervisory Control and Data Acquisition

SFD – single-family dwelling
TDH – Total Dynamic Head
TGB – Tower Gateway Basestation
USDA - United States Department of Agriculture
USGS – United States Geological Survey
VFD – variable frequency drive
WTP - Water Treatment Plant

BACKGROUND AND PURPOSE

I. Introduction

In the Spring of 2016, Clearlake Oaks County Water District (District) retained MC Engineering, Inc. based in Orangevale, California, to prepare a Water Master Plan. This Water Master Plan includes an engineering report that includes a comprehensive analysis of the District's water system, identifies projects that are necessary to keep the District in compliance with State drinking water regulations, and provides planning level information for the proposed projects. This information includes preliminary layouts of proposed facilities and unit processes, cost estimates, and proposed site plans for key facilities.

Prior to the preparation of this report, the District had no recent Water Master Plan. This report examines the current state of the water infrastructure owned and operated by the District, analyzes the deficiencies and inefficiencies found in the water systems, in both quantity and quality, and provides a recommended plan of action. Based on field investigations, document research, and staff interviews, a list of projects that should be implemented have been recommended. Proposed implementation schedules are given for these projects; the timing for construction ranges from immediate implementation to implementation in 5 years, 10 years, and/or 25 years.

This Master Water Plan is a continuation of the engineering analysis and design work that MC Engineering, Inc. completed on behalf of the District in March of 2014. At that time, MC Engineering, Inc. submitted a Preliminary Engineering Report (PER) for the District's water system that identified needed water system improvement projects in accordance with the guidelines provided by the United States Department of Agriculture (USDA) Rural Development Agency (RDA) at a very cursory level.

The original PER from 2014 provided an analysis and list of recommended projects with related factors that included the following: environmental impacts, project sustainability, technical feasibility, water and energy efficiency, economic feasibility, life-cycle analysis, and the awareness and support of the general public. An environmental document was prepared for the original projects recommended in the PER. Subsequent environmental review, based on the updated information and new projects, is included in a separate environmental document prepared by AES, the assigned environmental consultant for the project/s.

For a copy of the District's 2014 PER, please contact the District office.

II. District Information

Basic information for the District is provided the table below.

Clearlake Oaks County Water District **12952 E. Hwy 20** **Clearlake Oaks, CA 95423** **Phone: (707) 998-3322**	
District Manager	Alan Gardner
Water System Number	1710001
Year of Incorporation	1960
Employees	19
Connections	2,002 Total, 1,731 Active[1]
Population Served	2,359[2]
WTP Capacity	1,000 GPM
Note: ***CLOCWD Management (August 2016)*** ***US Census 2010***	

III. Organization of Water Master Plan

The Water Master Plan is organized into eight sections. Each section is briefly described below:

Section 1 – Clearlake Oaks County Water District Overview

This section describes the organization of the Clearlake Oaks County Water District and its history. Current population and future growth trends are described and their anticipated impact on water demand is examined. Other components of the District's operations, including finances and rate structures, are also described in this section.

Section 2 – Water Quality and Infrastructure

This section describes the infrastructure comprising the water system including the water treatment plant, booster pump stations, distribution system, and water storage tanks. Raw and treated water quality are described, and the District's current methods of operation are examined in the context of meeting drinking water standards.

Section 3 – System Analysis and Deficiency Findings

This section examines each component of the District's water system to provide a comprehensive review and analysis of adequacy. Criteria and methods of analysis are detailed and each component is examined for adequacy and compliance with current standards. The components of the 2014 AWWA water audit are presented with pertinent findings described pertaining to water losses.

Section 4 – Project Alternatives Evaluation

Engineered solutions are presented for each major deficiency found as described in Section 3, and a recommended project is selected for each. Also included in this section are recommended operational improvements.

Section 5 – Recommended Projects and Prioritizations

This section details recommended projects from Section 4, and provides a prioritized list for proposed projects based on a criteria system that weighs cost, need, and other selection factors.

Section 6 – Project Costs and Financing
This section examines costs for each project detailed in Section 5. Cost estimates are presented and total project costs are estimated. A financial plan for the District is outlined which includes local, state, and federal level financing options.

Section 7 - Recommended Capital Improvement Projects
This section provides a recommended Capital Improvement Plan (CIP) based on the findings and recommendations of the previous sections. A proposed schedule is provided which details the recommended timeline for initiating projects over the next 25 years (2016-2041).

IV. Authorization

This study and project report was prepared in accordance to the contractual agreement between the Clearlake Oaks Water District and MC Engineering, dated March 23, 2015.

Contract No.: 154-101

The study was funded by the State Water Resources Control Board – Clean Water State Revolving Fund.

(Add details based on receiving a copy of the grant agreement from Dianna Mann).

V. Acknowledgements

Several individuals with the Clearlake Oaks County Water District have provided valuable information and assisted on this project. The contributories of the following people are gratefully acknowledged:

Clearlake Oaks County Water District
Dianna Mann – Current District Manager
Alan Gardner – Past District Manager
Karl Hosier – Past District Manager
Meghan Estep – Finance
Jeremy Backus – Distribution Operator
Kurt Jensen – WTP Chief Operator

The following individuals contributed to the completion of this study and preparation of the report:

MC Engineering, Inc.
Mark Carey, P.E. – Principal
John Pedri, P.E. – Project Manager
Jacobus Prins, PhD, P.E. – Modeling Analyst
Christopher Inferrera, EIT – Project Engineer
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Southport Controls
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SECTION 1 – Clearlake Oaks County Water District Overview

1.1 Background Information

The Clearlake Oaks County Water District (CLOCWD) was formed in 1960 under section 300000 *et seq*. of the California Water Code. The District service area is located on the southeastern shore of Clearlake in Lake County, California. The District currently serves the unincorporated community of Clearlake Oaks, which has an estimated population of 2,359, based on the 2010 US Census. Clearlake Oaks is approximately 40 miles north of Santa Rosa in Lake County. Clearlake Oaks is approximately 2.1 square miles in size, with an average elevation of 1,335 feet above sea level (US Census, USGS). It is a popular summer destination as it is located directly on Clear Lake, which draws tourists for watersports and fishing. As such, the population rises in the summer.

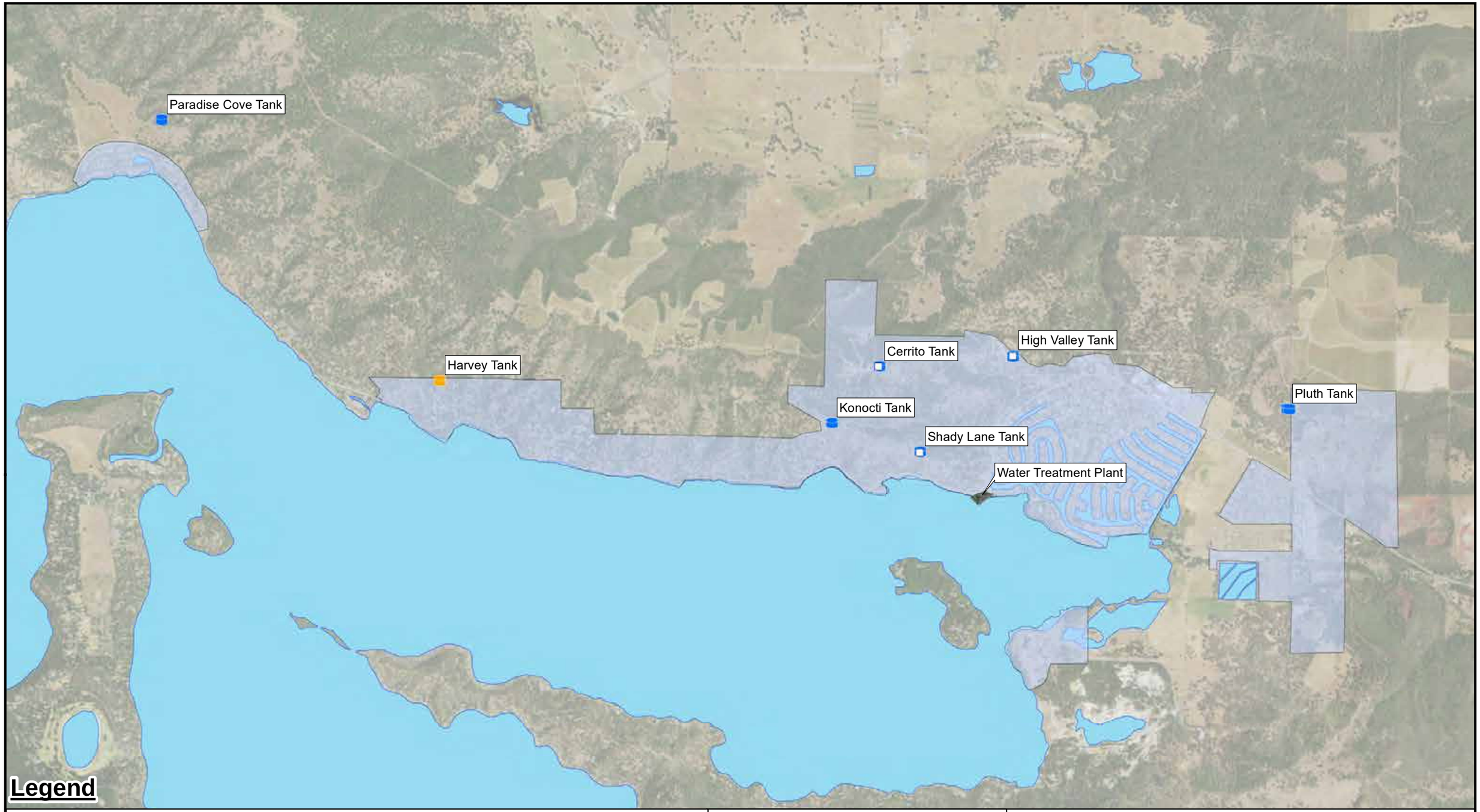
The District owns and operates the water treatment plant, storage facilities, booster stations, and water distribution system, along with the wastewater treatment plant, sewage collection system, and effluent pump station and pipeline. The water treatment plant (WTP) is located on the northeast shoreline of Clear Lake at 12545 East Highway 20 near the intersection of Highway 20 and Island Drive. Water storage tanks are located at various high points around the community. The District's wastewater treatment plant (WWTP) is located on the southern end of Clearlake Oaks.

The primary source of water for the District is surface water from Clear Lake. The District owns two groundwater wells at the water treatment plant that are currently inactive. Water obtained from Clear Lake is pre-treated with ozone and sodium hypochlorite. Coagulant is added and flocculation occurs in two circular up-flow clarifiers. Water is then filtered via sand/anthracite pressure filters. It is then processed through a granular activated carbon (GAC) system and disinfected with a solution of sodium hypochlorite.

Water is stored in five storage tanks in the distribution system, in addition to the clearwell tank at the water treatment plant. The combined working storage capacity in the distribution system is 694,894 gallons, while the clearwell tank provides 200,000 gallons of storage for a total storage capacity of 894,894 gallons. **Update 2024: With the addition of the harvey and cerritos tanks, the total storage capacity is increased to 990,000 Gallons.**

Treated effluent from the WWTP is pumped to the Lake County Sanitation District (LACOSAN) Southeast Reservoir, which is located over a ridgeline to the south-east of Clearlake Oaks, and from there it is pumped to the Geysers by Lake County, where it is used for injection into geothermal steam fields for the production of electricity. The Geysers, CA is located approximately 20 miles south of Clearlake Oaks.

The water facilities are governed and monitored by regulations and actions as imposed by various state and federal agencies. See **Appendix A** for a listing of regulations and actions under which the District operates. **Figure 1.0** following page contains a GIS generated map of the CLOCWD water system with pertinent infrastructure labeled.



Objects

- Pump
- Tank
- Proposed Tank
- Water Treatment Plant
- CLOCWD Service Boundary

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FIGURE 1.0 CLOCWD SERVICE AREA

0 0.25 0.5 1 Miles

N

Document Path: C:\Projects\CLOCWD\Water Master Plan\GIS\Maps\Water Master Plan_Legend Bottom.mxd

1.2 Hydrology and Geology

As described in the Clear Lake Watershed Sanitary Survey 2012 Update completed by Forsgren Associates, Inc., Clear Lake has an average annual precipitation of 25 inches. Clear Lake is fed by the Upper Cache Creek Watershed. Approximately 75 percent of drainage into Clear Lake is from its northern arm (Upper Arm). Clear Lake is California's largest freshwater lake at approximately 68 square miles of surface area and 110 miles of shoreline.

Clear Lake sits on a foundation of bedrock that slowly tilts north at approximately the same rate that sedimentation fills lake. This geological coincidence keeps Clear Lake at approximately the same depth (average depth is 27 feet) and is the reason Clear Lake is considered by geologists to be one of the oldest lakes in North America.[1]

Clear Lake's shallow depth and westerly prevailing winds, along with underwater thermal springs and gas vents encourage vertical mixing. Clear Lake stratifies on warm days, typically in the summer, and usually recirculates at night during cooler temperatures. Clear Lake is susceptible to blue-green algae (cyanobacteria) blooms in the late summer and early fall. The east shoreline of the lake is particularly susceptible to high levels of algae concentration as prevailing winds push the floating algae to the eastern side of the lake.[2]

The region around Clear Lake has intense geothermal activity. Many volcanoes are present in the vicinity of Clear Lake. The largest of these is Mt. Konocti, which last erupted 10,000 years ago. The Clear Lake volcanic field consists of lava dome complexes, cinder cones, and lower relief craters. An active silicic magma chamber approximately 14 km wide and 7 km below the surface provides geothermal power for the Geysers, a complex of geothermal power plants that generate 2,000 megawatt of power, the largest complex of its kind in the world.[3]

The San Andreas and Healdsburg-Rodgers Creek faults are within 50 miles of Clear Lake, making seismic effects of a major earthquake along these faults possible in Clearlake Oaks. The probability of an earthquake with a magnitude of 6.7 or greater along the Healdsburg-Rodgers Creek is 62 percent in the next 30 years.[4] In addition to the risk posed by earthquakes, the area around Clear Lake is prone to landslides and mudslides.[5]

1.3 Population, Land Use, and Water Demand

Accurate population data, projected population growth, and information regarding the use of land is critical for determining current and future water demands. The following section examines population and land use records and its effects on water demand in the District's service area.

1) *USGS*
2) *Clear Lake Watershed Sanitary Survey 2012 Update*
3) *Northern California Geological Society*
4) *USGS*
5) *Lake County Natural Hazard Mitigation Plan, 2012*

1.3.1 Population and Growth

Clearlake Oaks is a Census Designated Place (CDP) located in Lake County, CA. According to the 2010 US Census, Clearlake Oaks has a population of 2,359[6]. This is down from a population of 2,402[7] in the year 2000 as shown in **Table 1.1**. In 2010, the median age in Clearlake Oaks was 54.9. Approximately 23% of the housing of Clearlake Oaks is classified as seasonal, recreational, or occasional use as shown in **Table 1.2**. This is due to the fact that many residents are present in the summer for vacation only (non-permanent residents).

***Table 1.1**, US Census Population Data for Clearlake Oaks CDP*

US Census Year	Population
2010	2,359
2000	2,402
1990	2,419

Source: US Census

***Table 1.2**, US Census Housing Data for Clearlake Oaks CDP*

Housing Data
Total Housing Units, 2010 – 1,823
Housing Units for seasonal, recreational, or occasional use, 2010 – 427
Percentage of Housing for seasonal, rec., or occas. use, 2010 – 23%

Source: US Census

The **Median Household Income** (MHI) for the Clearlake Oaks CDP in 2014 as reported by the American Community Survey (ACS) is estimated at **$27,500**, as shown in **Table 1.3**.

***Table 1.3**, American Community Survey 2014 - Estimates for Clearlake Oaks CDP*

Parameter	Value
Total Population	1,547
Median Household Income	$27,500
Housing Units	1,799
Median Value of Home	$153,400
Occupied Homes	814
Vacant Homes	985

Note: Values provided by the American Community Survey are estimates only. They are based on a sampled subset of the total population.

The total year-round population for 2014 is estimated to be 1,547, which is considerably lower than was measured in 2010. This decrease can be attributed, at least partly, to the nature of the data collection. The ACS are not complete counts of population data as is the US Census. As such, the given margin of error for the ACS population estimate is +/-368.

[6] *US Census, 2010, Clearlake Oaks CDP*
[7] *US Census, 2000, Clearlake Oaks CDP*

Population Increase

The Water Demand Forecast Report produced by Lake County in 2006 has estimated the population of Clearlake Oaks CDP to be 2,932 in 2040, based on historical growth rates. This requires an approximate increase in population of 0.9% per year from 2015 to 2040. As described above, the Clearlake Oaks CDP experienced a decrease in population between the 2000 and 2010 US Censuses; this decrease is attributed primarily to the economic downturn in the latter half of the previous decade.

Lake County Special District CSA-16 (Paradise Cove)

Lake County Special District CSA-16 is a small area north west of Clearlake Oaks. The Clearlake Oaks County Water District is scheduled to provide service to the residents of CSA-16 in 2017. CSA-16 is comprised of two housing developments, Paradise Cove and Paradise Valley Ranch. There are approximately 133 water system customers in this area.[8] For information on how the addition of CSA-16 increases water demand, see **Section 1.3.3** Water Demand**.**

1.3.2 Land Use

Information on land use is used to help determine water demands. Agriculture and industrial land uses typically consume more water than residential and commercial land use. Land use parcel data, in the form of GIS shape files, was provided by the Lake County Planning Department. Zoning designations tied to each parcel were used as a basis for modeling water demand for the system in conjunction with actual billed water usage and results of flow metering. This information was a central part of the computerized hydraulic model (EPA Net Model) that was prepared to identify hydraulic bottlenecks and the available system-wide pipeline and pump station capacity for existing and future populations. More information on the water model developed as part of the project is provided in **Section 3.0**.

Table 1.4 below includes a list and description of the various land use zoning categories provided by the Lake County planning department, the number of dwelling units (where applicable), and the current developed acres.

***Table 1.4**, Lake County Planning Department Land Use Categories*

Land Use Code	Land Use Category	No. Dwelling Units	Developed Acres
RR	Rural Residential	12	61
SFR	Single-Family Residential	1,758	482
MFR	Multi-Family Residential	68	7
HDR	High-Density Residential	38	2
MHP	Mobile Home Parks	138	55
CG	General/Local Commercial	-	13
CK	Community Commercial	-	7
CO	Office/Service Commercial	-	15
FS	Public Facilities	-	11
PSCH	Schools	1	4

[8] *Lake County Special Districts Administration*

1.3.3 Water Demand

The potable water demands established in this report are based on existing District billing data, land use designations discussed in the previous section, and projected Paradise Cove and Paradise Valley Ranch demand information provided by BKF Engineers in a separate technical memo titled "Service Expansion from Clearlake Oaks County Water District Westerly to Serve Paradise Cove and Paradise Valley Ranch" dated June 2014.

Historical Demands

The total volume of water produced and supplied to the CLOCWD water system is recorded by the production meters at the District water treatment plant. The District recorded 177.88 million gallons of water produced and supplied for 2014. In 2015, the District produced and supplied 183.96 million gallons of water.

Table 1.5 presented below lists yearly production data from the water treatment plant for the years 2009 to 2015.

***Table 1.5**, District Water Production Data*

	2009	2010	2011	2012	2013	2014	2015
Total Year (MG)	234.59	183.16	159.70	182.15	178.38	177.88	183.96
Average Monthly (MG)	19.55	15.263	13.309	15.179	14.865	14.824	15.330
Average Daily (MG)	0.643	0.502	0.438	0.499	0.489	0.487	0.504

Source: 2015 District Production Data

2024 Updated Production Data

	2018	2019	2020	2021	2022
Total Year (MG)	233.6	266.45	284.7	281.05	237.25
Average Monthly (MG)	19.47	22.20	23.73	23.42	19.77
Average Daily (MG)	0.64	0.73	0.78	0.77	0.65

Connection Types

The District is composed of single family, multi-family, and commercial connections. The total number of water connections in the distribution system, as of August 2016, is 2,002[9]. The number of active connections is 1,731, supplied on Districts finance department. The majority of these are single family dwelling (SFD) accounts. Approximately 23% of the single family dwellings units are seasonal**. Table 1.6** presented below lists the number of customers for each type of connection for FY 2015/16.

***2024 Updated Table 1.6**, Connections per Water Type*

Customer Type	Amount
Single Family Dwellings	2009
Multi Family Dwellings	38
Commercial/Governmental	73
Total Connections	**2,120**

9) District Management database query, August 2016

Diurnal Curves

Typical diurnal curves were used for various land use categories in order to generate peak hour flows for the time series simulation in the hydraulic model. The diurnal flows include typical indoor use profiles and outside irrigation profiles. Under maximum month conditions, the additional flow is assumed to be attributed to outside irrigation and the typical diurnal irrigation hydrograph is adjusted accordingly. The complete series of figures for the diurnal curves can be found in **Appendix D**.

Average and Maximum Demands

Average Daily Demand (ADD), Maximum Monthly Demand, and Maximum Daily Demand (MDD) are used as design criteria to ensure that the water treatment plant, distribution system, pumping, and water storage infrastructure meet requirements for maintaining system pressures and firefighting capabilities.

Average Daily Demand of the system is defined as the mean average daily demand across the system as based on historical water usage data.

Maximum Monthly Demand and the Maximum Daily Demands were developed by multiplying the Average Daily Demand by the Maximum Monthly Peaking Factor or the Maximum Daily Peaking Factor, respectively.

The peaking factor may vary, depending upon the diurnal flow characteristics of each community under consideration. The maximum day peaking factor was found by taking the ratio of the average Maximum Monthly flow to the Annual Daily Average as shown in the following **Equation 1**.

Equation 1, *Maximum Day Peaking Factor*

$$MaxDayP.F. = \frac{MaxMonthlyAve}{AnnualDailyAve}$$

All parcels with a billing account history were utilized to determine the monthly averages. When the analysis was conducted there were approximately 300 residences that were not occupied. However, these residences still retain a billing account and a viable connection to the water distribution system. Because the existing conditions model scenario includes these inactive accounts, the average daily flows used to develop demands for the model are somewhat higher than the demands extracted directly from the billing data and, as a result, the modeled demands are slightly higher and more conservative.

The maximum month peaking factor was determined by the Goodrich Formula as presented below in **Equation 2**.

***Equation 2**, Maximum Month Peaking Factor*

$$MaxMonthP.F. = MaxDayP.F. \bullet t^{-0.10}$$

The calculated peaking factors, Average Daily Demand, Maximum Monthly Demand, and Maximum Daily Demand are presented below in **Table 1.7**.

The Average Daily Total is computed by multiplying the Average Daily Demand by the number of Dwelling Units for each category.

***Table 1.7**, Water Use based on Billing Data*

	Land Use		Peaking Factors		Net Unit Water Demand (gpd)			
Land Use Category	Dwelling Units	Developed Acres	Max Month	Max Day	Ave Day	Max Month	Max Day	Ave Daily Total
RR	12	61	1.28	1.80	550	704	990	6,600
SFR	1758	482	1.43	2.01	120	171	241	210,960
MFR	68	7	0.77	1.08	220	169	238	14,960
HDR	38	2	1.88	2.64	80	150	211	3,040
MHP	138	55	1.06	1.49	145	153	216	20,010
CG	-	13	1.67	2.35	400	667	939	5,200
CK	-	7	1.91	2.69	185	353	497	1,365
CO	-	15	1.28	1.81	500	642	903	7,565
FS	-	11	2.26	3.18	865	1954	2750	9,152
PSCH	1 (201 Students)	4	1.65	2.32	15	25	35	3,015
Point Q								18,480

Although efforts are currently underway to identify leaks and reduce water loss, the existing water system is experiencing losses of approximately 45 percent based on recent AWWA water audits. For a complete discussion of water loss and the AWWA water audit, see **Section 3.2**.

In order to account for the high water losses, a forty percent water loss is assumed and the Net Unit Water Demands are inflated to determine the system inputs for Average Daily Demand, Maximum Day Demand, and other parameters for modeling inputs as presented below in **Table 1.8**. These values are determined by dividing the demands from the billing data by a water loss factor of 0.4.

***Table 1.8**, Actual Unit Demands Including Losses 2015*

Net Unit Water Demand (w/losses) (gpd)				
Land Use Category	Ave Day	Max Month	Max Day	Ave Daily Total
RR	917	1,173	1,650	11000
SFR	200	285	402	351,600
MFR	367	282	397	24,933
HDR	133	250	352	5,067
MHP	242	256	360	33,350
CG	667	1,112	1,564	8,667
CK	308	589	828	2,278
CO	833	1,070	1,505	12,608
FS	1,442	3,257	4,583	15,253
PSCH	25	41	58	5,025
Point Q				28,467
Totals				**498,245**

2024 Updated: Unit Demands Including Losses 2022

Net Unit Water Demand (w/losses) (gpd)	
Land Use Category	Ave Daily Total
Residential	471,523
Multi-Family	2,064
Commercial	10,267
Total	**644,967**

There are a total of six existing water accounts that are modeled as point flows (Point Q) due to their relatively high billing demand. These locations include a carwash, various restaurants, a laundromat, a storage facility near Hwy 20 and Keys Blvd, and the District's water treatment plant and wastewater treatment plant. The cumulative point flow values are presented above in **Table 1.8** and are summarized on the next page in **Table 1.9** and **Table 1.10**.

The average daily demand determined from existing land use data, with inflation to account for water losses, is 0.515 MGD. This corresponds to a -2.3% difference compared to the 0.487 MGD average daily demand presented in the USDA Preliminary Engineering Report (PER) water system evaluation prepared by MC Engineering previously (2014).

Table 1.9, Point Flows Use Based on Billing Data

	2012-2014 Uses (gpd)		Estimated Peaking Demand Factors		Net Unit Water Demand (gpd)		
Point Q	Avg Daily	Max Month	Max Month	Max Day	Ave Day	Max Month	Max Day
Car Wash	1,070	1,641	1.53	2.16	1,070	1,640	2,308
Restaurant	3,257	4,145	1.27	1.79	3,250	4,136	5,820
WWTP	7,265	10,384	1.43	2.01	7,260	10,376	14,599
Big Oaks	2,691	5,357	1.99	2.80	2,700	5,375	7,563
Laundry	676	950	1.40	1.98	700	983	1,386
WTP	3438	3962	1.15	1.62	3,500	4,034	5,676
Totals					**18,480**	**26,544**	**37,352**

Table 1.10, Point Flow Use Based on Actual Use

	Net Unit Water Demand (w/losses) (gpd)		
Point Q	Ave Day	Max Month	Max Day
Car Wash	1,783	2,734	3,846
Restaurant	5,417	6,894	9,700
WWTP	12,100	17,293	24,332
Big Oaks	4,500	8,959	12,606
Laundry	1,167	1,639	2,308
WTP	3,500	4,034	5,676
Totals	**28467**	**41,553**	**58,468**

The complete calculation sheet used for demand factor development for the existing District's water system is located in **Appendix E**.

Lake County Special District CSA-16 (Paradise Cove)

The District anticipates a potential increase in demand when service to Paradise Cove begins (tentatively sometime after 2017). Current peak water demand for the Cove is estimated to be 25,000 gallons per day (peak flow of 17 gpm).[10] The number of active connections in CSA-16 is 72. The table below shows the estimated water demand at Build-Out for CSA-16.

Paradise Cove currently has 72 of the 88 existing lots developed and is under a building moratorium due to limitations on water supply. Paradise Valley Ranch is planned as a 92 Housing (HE) development directly to the north of the Paradise Cove development. **Table 1.11**, presented on the next page, details the anticipated water demand for each of these communities. The anticipated demands for the annexation area exclude irrigation demands that will be served by the secondary water supply system and are, therefore, conservative demand estimates.

10) Waterworks Engineering CSA-16 Feasibility Study, 2014

***Table 1.11**, Anticipated Water Demand at Build-out, Paradise Cove and Paradise Valley Ranch*

	Housing Equivalents	Unit Flow gpd/EDU	Max Day Peaking Factor	Daily Flow Average gpd	Daily Flow Peak gpd
Paradise Cove at Build-Out					
Residential	88	250	1.5	22,000	33,000
Paradise Valley Ranch at Build-Out					
Residential	77	250	1.5	19,250	28,875
Winery			4	522	2,087
Commercial (15,000 sf)			1.5	1,745	2,618
Equestrian Center			2	500	1,000
Total of Paradise Cove and Paradise Valley Ranch				44,017	67,579
Rounded Total Demand				**45,000**	**70,000**

Data taken from Waterworks Engineering CSA-16 Feasibility Study, 2014

1.4 District Finances

1.4.1 Rate Structure

Clearlake Oaks County Water District Ordinance No. 81 defines the usage rates for fiscal years 2015 through 2018. Effective date of implementation is July 2016.

Residential, multi-family, and commercial water customers are billed for water based on a volumetric usage charge along with a monthly meter charge. **Table 1.12** below presents the District's current water billing rates.

***2024 Updated: Table 1.12**, Water Billing Rates, Fiscal Years 2014/15/24*

User Categories		
Monthly Meter Charge	2014/2015	2024
Single-Family Dwelling (SFD)	$37.87	$51.37
Multi-Family Dwelling (MFD)	$37.87	$51.37
Mobile home SFD	$37.87	$51.37
Commercial – By Meter Size		
5/8" x 3/4" Meter	$37.87	$51.37
1" Meter	$118.63	$144.94
1-1/2" Meter	$237.08	$285.80
2" Meter	$379.22	$456.44
3" Meter	$711.08	$853.75
4" Meter	$1,185.17	$1,421.51
6" Meter	$2,370.23	NA
Volumetric Charge		
0-999,999,999 CF	NA	$2.23/100 cf
Tier 1 (Up to 1,500 CF)	$1.30/100 cf	NA
Tier 2 (1,501 to 2,000 CF)	$1.50/100 cf	NA
Tier 3 (2,001 and Over)	$2.00/100 cf	NA

Note: Annual Increase Beginning July 2016 of 3% and $2.00 for CIP
From Clearlake Oaks County Water District, County of Lake, Ordinance 81

1.4.2 Annual Budget

Table 1.13 presented below summarizes the District's annual operating revenue, operating expenses, and change in net position for water operations.

***2024 Updated: Table 1.13**, Annual Water Budget*

	2015	2016	2020	2021	2022	2023
Total Operating Revenue	$1,168,452	$1,067,122	$1,217,554	$1,267,621	$1,298,210	$1,336,960
Total Operating Expenses	$1,071,568	$904,498	$1,039,017	$1,150,876	$1,231,792	$1,316,662
Change in Net Position	$195,060	$64,456	$138,537	$76,745	$86,418	$76,798

Note: From Clearlake Oaks County Water District Yearly Budget Reports

1.4.3 Net Position

The total value of assets and liabilities, together with net position, based on the 2015 District audit, are presented in **Table 1.14** below.

***Table 1.14**, Assets, Liabilities, Net Position*

	2015
Total Assets	+$3,134,211
Total Liabilities	-$386,634
Total Deferred Inflows	-$89,916
Total Net Position[1]	**$2,657,661**

Note:
[1] Total Net Position is Total Assets less Total Liabilities less Total Deferred Inflows

SECTION 2 – Water Quality and Infrastructure

This section provides an overview of existing facilities including the water treatment plant, pump stations, water storage tanks, pipelines, and other associated components of the District's water system. Raw and treated water quality is also discussed.

The information presented is a summary of MC Engineering's findings based on required regulatory agency reporting, plan reviews, site visits, staff interviews, review of operational procedures, reviews of test results, internal memos, financial documents, and other material provided by the District.

2.1 Drinking Water Quality and Compliance

The regulation of drinking water within California is shared among several agencies including Federal, State, and Local Government authorities. Each level of government has its own drinking water standards. Clearlake Oaks is required to comply with Federal and State drinking water standards. These include but are not limited to the following:

- National Interim Primary Drinking Water Standards (1975, Federal)
- Phase I Regulations (1987, Federal)
- Surface Water Treatment Rule (1989, Federal)
- Phase II Regulations (1991, Federal)
- Lead and Copper Rule (1991, Federal)
- Phase V Regulations (1992, Federal)
- Total Coliform Rule (1992, Federal)
- California Title 22, Primary Drinking Water Standards (2016, State)
- California Title 22, Secondary Drinking Water Standards (2016, State)
- California Title 22, Disinfection Byproducts (2016, State
- California Title 22, Lead and Copper (2016, State)
- California Title 22, Surface Water Treatment (2016, State)

For a full listing of drinking water standards and regulations that are applicable to the Clearlake Oaks County Water District, see **Appendix A**.

The primary agency monitoring water quality compliance is the North Coast Region office of the California State Water Control Resources Board. They can be contacted at the following address:

North Coast Region
5550 Skylane Blvd, Suite A
Santa Rosa, CA 95403
707-576-2220

2.1.1 Consumer Confidence Reports (CCR's)

The District is required to prepare and submit to its customers a yearly Consumer Confidence Report (CCR). The CCR contains a detailed list of constituents found in the drinking water following an extensive water quality sampling program. Sampling is conducted on a required frequency for each constituent. During the preparation of this report, the District provided copies of CCR's from 2010 to 2015 which identify sample results for coliform bacteria, lead, copper, sodium, hardness, primary and secondary drinking water standards, turbidity, total organic carbon (TOC), and disinfection by-products. The CCR's for 2010 to 2015 & (2024 Update) 2020-2023 can be found in **Appendix B**.

Since 2007 the CLOCWD has been in compliance with the Maximum Contaminant Levels (MCL's) and Maximum Residual Disinfectant Levels (MRDL's) with the exception of the year 2010 when the boron level detected was 1,100 ppb. The notification level for boron is 1000 ppb. Boron is listed as an unregulated contaminant.

No significant concerns have been identified that have the potential of impacting water quality. Due to the high boron level detected in the drinking water in 2010, continued yearly testing of boron is recommended to identify trends and mitigate high levels before they become hazardous to the health of the public.

Microbiological
The CCRs indicate that no positive test results occurred from 2010 to 2015 for total coliform or fecal coliform.

Lead and Copper
The CCRs indicate that no samples taken from 2010 to 2015 exceeded the Regulatory Action Levels for lead and copper.

Primary Drinking Water Standards
The CCR's indicate that the maximum contaminate levels for contaminates regulated under primary drinking water standards (THMs, HAA5s, Chlorine, TOC, Bromate, Fluoride, Perchlorate) were not exceeded in 2010 through 2015.

Secondary Drinking Water Standards
The CCR's indicate that the maximum contaminate levels for contaminates regulated under secondary drinking water standards (Manganese, Iron, Specific Conductance, Color, Chloride) were not exceeded in 2010 through 2015.

2.1.2 Disinfection By-Products

Disinfection By-Products (DBPs) are contaminants that are found in the drinking water supply as a result/byproduct of the water treatment process. Because the District relies on surface water that seasonally contains high amounts of algae and organic material (as indicated by the total organic carbon, or TOC test results), the threat from DBPs in the CLOCWD is very relevant. Past monitoring data

suggests that the District is on the edge of violating the current standard of 80 µg/L for DBPs. DBP testing data for the year 2010 through 2015 is included in the table below. The values listed in **Table 2.0** below represent the upper and lower limits of the range of detections obtained via quarterly testing.

***Table 2.0**, Disinfection By-Product Test Results*

Constituent	2015	2014	2013	2012	2011	2010	MCL
TTHMs (ppb)	34-89	24-71	39-78	35-83	45-68	29-64	80
HAA5's (ppb)	13.9-20.7	9.1-26.9	14.8-28.4	9.1-27.5	11.6-24.6	11.1-33.4	60
Results are given in range of detected levels for year noted.							

Recently, samples were collected from the clearwell and the far west end of the system off Highway 20. The results showed that near half of the total THMs were formed within the clearwell and the remaining half formed in the distribution system. The samples also show that formation of Chloroform had the highest formation potential among the constituents and accounted for approximately 66% of the total THM concentration in the clearwell and roughly 75% of the concentration off Highway 20. The sample results are presented below in **Table 2.1**.

***Table 2.1**, THM Comparison at Clearwell and West End of System*

Constituent	Clearwell (µg/L)	West End (µg/L)	% Increase
Bromodichloromethane	7.43	10.35	39
Bromoform	ND*	ND	ND
Chloroform	22.96	51.35	124
Dibromochloromethane	4.20	4.90	17
Total THM	**34.59**	**66.60**	**93**
***Non Detect; tests were performed using EPA 542.2**			

Disregarding the chlorine residual and natural organic matter in the source water, variables that influence the formation of DBPs include pH, temperature, and time (i.e water age).

DBP control strategies can be divided into three control categories which include:

- Removal of DBP precursors
- Modification and optimization of treatment and disinfection practices to minimize DBP formation
- Removal of DBPs after formation

Further discussion of DBP mitigation and removal is included in **Section 3.6.6.**

2024 Update

Managing TTHM level's within the distribution system continues to be a challenge for operations staff since the addition of another sampling point on the far west end of the system within the Paradise Cove service area was mandated by the DDW, the average TTHM concentration in 2022 measured 83.47 µg/L and 18 µg/L HAA5 at the Paradise sample point . TTHM concentrations have also been measured near the MCL at the Mesa-Stubbs sample point as well. In 2022 the CLOCWD reported an average of 78.83 µg/L TTHM and 37.32 µg/L HAA5 at the Mesa / Stubbs sample point.

***Table 2.1.1**, 2023 – 2024 DBP Samples within Distribution System*

	Paradise Sample Point		Mesa / Stubbs Sample Point		Harvey Tank		Paradise Tank		Shady Tank	
Sample Date	TTHM, µg/L	HAA 5µg/L	TTHM, µg/L	HAA5 µg/L	TTHM, µg/L	HAA5 µg/L	TTHM, µg/L	HAA5 µg/L	TTHM, µg/L	HAA5 µg/L
4/19/23	61.72	45.7								
4/26/23	66.07	23.1								
5/3/23	54.34	19.4								
5/10/23	69.36	29								
5/31/23	64.88	25.2								
6/14/23	59.42	21.2	58.13	17.2						
7/6/23	71.77	17.1			64.23	21.4				
7/20/23	**79.26**	20.4			58.48	14.7				
8/16/23	**79.01**	ND			52.23	ND			48.7	ND
9/27/23	**107.6**	6.5	**78.41**	11.9						
11/8/23							2.24	35.5		
11/15/23	70.66	26								
12/14/23	**75.81**	28.9	51.68	17.5			3.62	26.8		
2/14/24	62.86	32.9								
3/20/24	52.59	22.5	64.95	40						

Further discussion of DBP mitigation and removal is included in **Section 3.6.6.**

2.2 System Operating Pressures

The District water system consists of 4 pressure zones. The pressure zones vary in elevation from 1,330 feet above sea level at the WTP to 2,200 feet above sea level at the highest point in zone 4. The difference between pressure zones (about 900 feet across 4 zones) necessitates the use of PRVs and booster pumps to maintain operational pressures and meet fire flow requirements.
The majority of customers are served by Zone 1, which is maintained at a pressure of approximately 125 psi near the lake level where much of the development is located. Finished water produced by the WTP is pumped directly to Zone 1 via the high-lift pump station at the water treatment plant (WTP). Pressure in Zone 1 is established by relying on two tank sites, Pluth and Shady Lane, with a cumulative storage of approximately 482,000 gallons at a base elevation of approximately 1580 ft. Originally, the system had an additional 200,000 gallons of storage at the High Valley tank site which has since been abandoned due to failure of the original redwood tanks.

The two current tank sites in Zone 1 work in unison, acting as a single open-surface establishing the hydraulic grade line for Zone 1 while providing service to the 1,560 connections in Zone 1. Water from Zone 1 is conveyed further to Zone 2 from the High Valley booster pump station (elevation 1580 ft); as well to Zone 3 from the booster pump at the Shady Lane tank site.

Pressure in Zone 2 is controlled from the Cerrito tank site with a working capacity of 95,000 gallons at a base elevation of 2,060 ft providing service to approximately 13 connections. The Cerrito tank site is also equipped with a 300-gallon hydro-pneumatic tank and booster pump to supply service to the 6 connections in Zone 4, the highest service zone within the system.

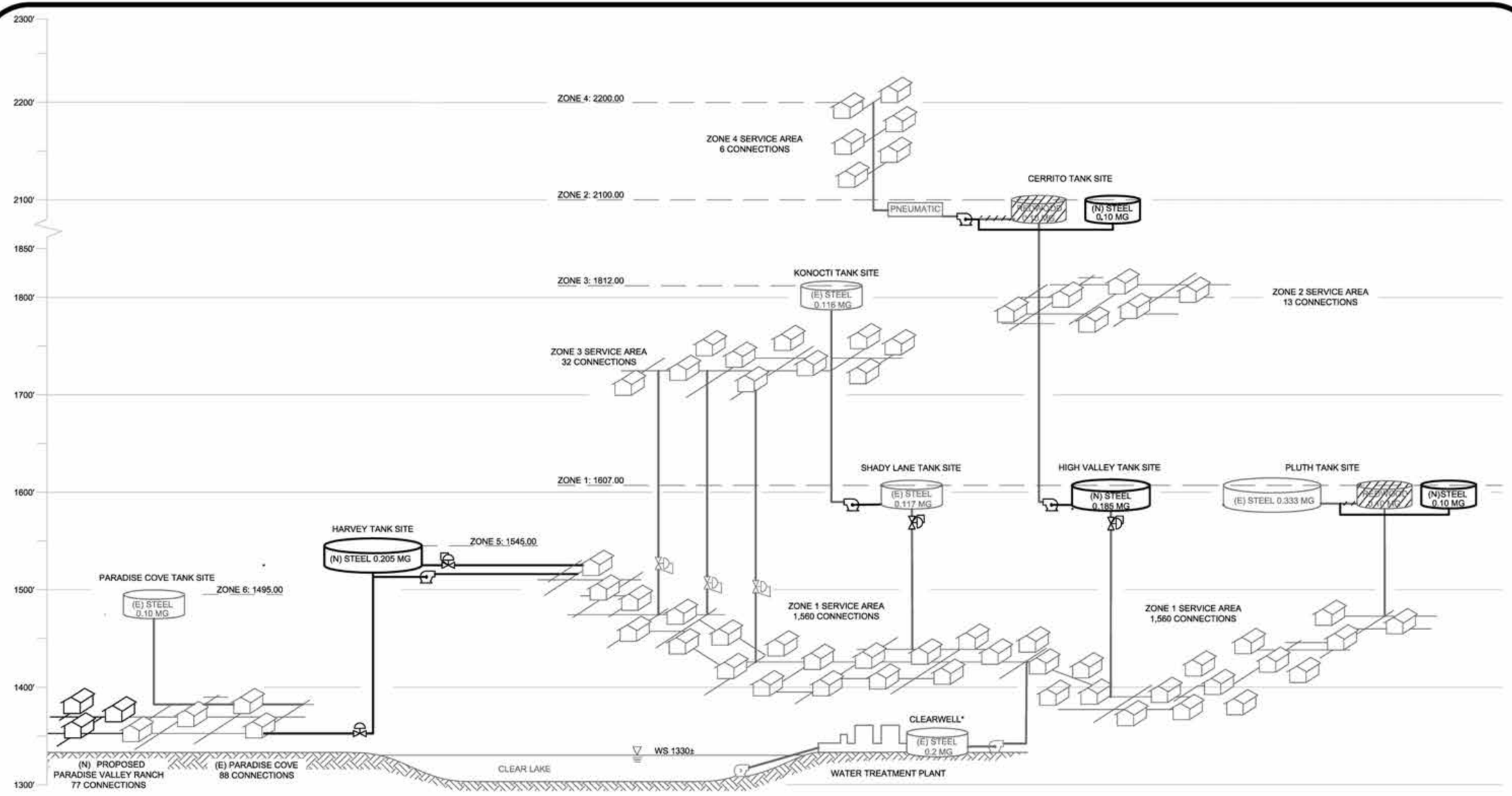
System pressure and storage for the 40 connections within Zone 3 are maintained by the Konocti tank site at a base elevation of 1820 ft with 92,000 gallons of working storage. Zone 3 has three pressure reducing valves that can back-feed to Zone 1 under peak flow conditions for distribution to the west or provide temporary back up if pressure is reduced in Zone 1.

Zone 4 is served by a hydro-pneumatic tank located adjecent to the Cerrito Tank. Zone 4 is comprised of 6 connections and ranges from an elevation of 2,060 feet to 2,200 feet above sea level. **Table 2.2** below outlines each of the zones in the District water system.

***Table 2.2**, Pressure Zone Summary*

Pressure Zone	Elevation Range	Supplied By	Storage Provided By
Zone 1	1330’ – 1607’	WTP High Service Pumps	Shady Lane Steel Tank, Pluth Steel Tank, Pluth Redwood Tank
Zone 2	1,607’ – 2,100’	Booster Pump at High Valley Site	Cerrito Redwood Tank
Zone 3	1,607’ – 1,812’	Booster Pump at Shady Lane Tank Site	Konocti Tank
Zone 4	2,100’ – 2,200’	Booster Pump at Cerrito Tank Site	Hydro-Pneumatic Tank at Cerrito Tank Site
Paradise Cove	1330’ – 1400’	Harvey Tank (Proposed)	Harvey Tank (Proposed), Paradise Cove Tank

Figure 2.1 on the following page presents a schematic diagram of the storage and booster pump system.



NOTES

1. ZONE ELEVATIONS SHOWN REPRESENT HGL LEVELS WITH TANKS FULL.
2. THE CLEARWELL VOLUME IS NOT CONSIDERED PART OF TOTAL SYSTEM STORAGE.

LEGEND	SYMBOL
CONTROL VALVE	
PRESSURE REDUCING VALVE	
ALTITUDE VALVE	
BOOSTER PUMP STATION	
DEMOLITION	

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PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 2.1

WATER SYSTEM SCHEMATIC

HORIZONAL SCALE: NONE
VERTICAL SCALE: 1" = 100'

2.3 Raw Water Source

The CLOCWD acquires surface water from Clear Lake in accordance with water allocation rights from Yolo County. Clear Lake is the sole source of water for the Clearlake Oaks County Water District distribution system, although some residents maintain private wells. The lake basin is managed by Lake County (State Lands Commission Granted Lands).

The lake is subject to severe algae blooms in the summer months that can lead to impaired water treatment plant performance and taste and odor concerns. The CLOCWD WTP utilizes a granular activated carbon (GAC) filtration process to mitigate the taste and odor issues. Sulphur Bank Mine is located adjacent to Clear Lake and is a source of mercury contamination in the lake due to seepage from underwater mine shafts and mine tailings. Sulphur Bank Mine is a superfund site and is currently allotted funding for waste cleanup work by the 2009 Recovery Act. Sulphur Bank Mine is located approximately 1 mile southeast of the Clearlake Oaks WTP raw water intake.

Despite the proximity of the superfund site, the water in Clear Lake is a relatively good source of drinking water and can be treated using conventional filtration processes to meet all California Code of Regulations Title 22 drinking water standards. Results of raw water quality testing can be found in **Appendix C**.

2.3.1 Water Allocation Rights

The Yolo County Flood Control and Water Conservation District holds most of the water rights to Clear Lake, with some limited water rights being held by the City of Lakeport and the Highlands Water Company. Most water purveyors, CLOCWD included, must enter into contracts with Yolo County for the purposes of procuring water for their customers (Lake County Water Inventory and Analysis). The raw water pumped from Clear Lake by CLOCWD is purchased from the Yolo County Flood Control and Water Conservation District at a cost of $57.00/acre-ft under a water sale agreement limiting non-littoral property water use within the District to 660 acre-feet annually. The water agreement between CLOCWD and Yolo County can be found in **Appendix I**.

2.3.2 Source Supply Capacity

According to the Lake County Water Inventory and Analysis report, Clear Lake has sufficient capacity to meet current demands, even in dry years. The lake's capacity ranges from approximately 680,000 to 1,200,000 acre-feet. Average year water use for all agricultural, municipal, and industrial uses by all water utilities that procure water from Clear Lake is about 51,330 acre-feet.

2.3.3 Groundwater Supply

While groundwater use is common throughout Lake County (60% of water use in Lake County is from groundwater sources - Lake County Water Resources Department), CLOCWD does not currently operate any groundwater wells. However, the District once relied on two groundwater wells located on the grounds of the water treatment plant. The existing wells are reportedly approximately 50' deep and contain one to three screened sections that are interceded with a blue clay/aquitard.

The District stopped using groundwater wells and switched to surface water in 1990s due to taste and odor problems reportedly associated with high iron and manganese in the water extracted from the wells.

MC Engineering conducted a preliminary investigation and evaluated the option of bringing the wells back into service to augment the surface water supply. Samples taken from the groundwater wells in February of 2013 indicated that the level of iron was 6 mg/L, while the level of manganese was 0.8 mg/L.

More extensive inquiries that included interviews with prior District staff indicated iron and manganese levels much higher than those detected during the 2013 sampling activities. It was found that treatment for removal of iron and manganese at the historic levels made the prospect of relying on the wells cost prohibitive as the District's surface water is more reliable source, both in terms of quality and quantity.

2.3.4 Raw Water Quality

A thorough assessment of Clear Lake as a raw water source for water districts was made in 2012 and may be found in the document titled "Clear Lake Watershed Sanitary Survey 2012 Update" by Forsgren Associates, Inc. This document examines specific potential contaminating activities (PCAs) and assesses Clear Lake's vulnerability to them and their effect on water quality.

Clear Lake was found to be vulnerable to the following PCAs:

- Agricultural drainage
- Aquatic Plant Growth
- Erosion
- *Hydrilla* Eradication
- Lake Recreation
- Mining
- Municipal Wastewater
- Quagga and Zebra Mussels
- Septic Systems
- Traffic Accidents/Spills

These PCAs affect Clear Lake by introducing the following *contaminates* into the water source:

- ✓ Turbidity
- ✓ Phosphorus
- ✓ Simazine
- ✓ Fluridone
- ✓ Methyl tert-butyl ether (MTBE)
- ✓ Coliform bacteria
- ✓ Giardia and Cryptosporidium
- ✓ Arsenic
- ✓ Mercury
- ✓ Boron

The Clear Lake Watershed Sanitary Survey 2012 Update did not find significant issues with the raw water used for the District's water system. It was noted that Arsenic was detected in raw water at a level of 2.2 µg/L. The Arsenic MCL for California drinking water is 10 µg/L (Title 22, Chapter 15, CCRs). Arsenic has not been detected in the treated water produced by the District.

2.4 Water Treatment Plant

The District operates a conventional filtration water treatment plant that supplies all of the potable water distributed in the Clearlake Oaks service area. The water treatment plant is located adjacent to State Highway 20 at the intersection of Island Drive near Shady Lane. See the service area map on page 11 for location of the WTP. The treatment plant was constructed in 1975 and placed into service in 1976. Various operational components were upgraded 1991, 1998, 2001, and 2012. These upgrades included new treated water pumps, a second clarifier, a granular activated carbon (GAC) system, renovations to the ozonator, replacement of filters, and addition of a used army-surplus backup generator. An image of the facility facing south from Highway 20, is presented below in **Figure 2.2**

Figure 2.2 *CLOCWD Water Treatment Plant*



2.4.1 Water Treatment Capacity

CLOCWD is supplied solely by surface water pumped from Clear Lake via two separate raw water intakes. The water treatment plant has a maximum treatment capacity of 1.22 MGD as limited by the capacity of the two upflow clarifiers which can treat up to 425 gpm each under ideal conditions when the raw water turbidity is relatively low. Unfortunately, peak day demands almost always occur during the summer when raw water turbidity is high to algae blooms restricting the treatment capacity of the clarifiers to 1.0 MGD or less. The primary reason for this is twofold: the high concentration of algae requires a significantly slower upflow rate to maintain the solids below the overflow weir; and the excessive solids which do pass over the weir overwhelm the downstream pressure filters requiring excessive backwash operations generating even more water demand.

The plant is currently staffed 8 hours a day. The pumps at the high lift pump station are set to run as required around the clock. During the summer, algae in the lake moves vertically in the water column

throughout a 24 hour period, often limiting production at night as the algae settles near the pump intakes and stresses the ability of the plant to treat the water and remove the algae. Staff has deferred the need to either relocate or modify the intake with the installation of self-cleaning intake screens to address the algae problem and possibly increase treatment capacity.

2.4.2 WTP Process Description

Raw water is pumped from Clear Lake via intakes that are located approximately 100 feet off-shore and at 1317 feet above sea level (a depth of approximately 13 feet below the average high water level). The water intake jetty is presented below in **Figure 2.3.** The intake is equipped with two (2) 25 hp submersible pumps, each rated at 1,200 gpm, and equipped with variable frequency drives (VFDs) that are controlled by flow set points via the plant SCADA system.

Figure 2.3, *Raw Water Intake Jetty*



The intake for each pump consists of a 6-inch diameter perforated pipe. The pumps discharge in parallel 8-inch ductile iron transmission lines that run from the intake to the plant approximately 100 feet from the pumps. One pump serves as a redundant unit allowing a pump to be taken out of service for maintenance and repairs while still meeting the reliable capacity of the plant.

2024 Update
In 2022 the CLOCWD installed a new intake pump and pipeline with grant funding by the DWR under the Drought Relief Funding program. Construction of the new intake was in direct response to the low lake levels experienced in 2021 which almost compromised the WTP's ability to provide potable water to

the Clearlake Oaks community. The new intake pipeline extends nearly 1,300 feet out into the lake where the depth is approximately 26 feet allowing raw water with significantly lower algae content to be conveyed to the plant. The intake also features an ISI self-cleaning intake screen which also provides primary filtration and fish protection. The pump consists of a 75 hp trailer mounted centrifugal pump capable of conveying up to 850 gpm. The pump may be mobilized to and from the shoreline as the lake level fluctuates.

The treatment plant process consists of the following components:

- Raw Water Intake and Pump Station
- Pre-treatment with ozone and sodium hypochlorite
- Coagulation, flocculation, and sedimentation in two circular up-flow clarifiers
- Filtration through pressure filters with a sand/anthracite media
- Granular activated carbon (GAC) filtration for taste and odor removal
- Addition of liquid sodium hypochlorite disinfection
- Clearwell and Treated Water Pumping

After the addition of the hypochlorite solution, treated water is pumped into a 200,000 gallon clearwell that provides contact time (CT) for the required log removal of pathogens. After leaving the clearwell, water is pumped from the high lift station to Zone 1, where it is subsequently lifted to Zones 2, 3, and 4 via booster pumps located at the Shady Lane, High Valley, and Cerritos tank sites.

Pre-Ozonation

There are two ozone contactors, each with a nominal volume of 7,600 gallons. An image of the contactors presented in **Figure 2.4** below. Assuming plug flow and one contractor in service, which is the current practice, the contact time is 11 minutes. With the single ozone generator producing 21 pounds of ozone per day (2.5 mg/l at 1 mgd), the CT is approximately 27.5 mg/l, which is an ideal treatment level for taste and odor control.

Figure 2.4, *Ozone Contactors*



Pre-Chlorination

The operators presently pre-chlorinate at 2.5 mg/l prior to clarification. Pre-chlorination probably aids in the performance of the clarifiers and filters, but it may worsen DBP issues at certain times of the year when the total organic carbon (TOC) is over 3 mg/l in the raw water, as discussed in **Section 3.6.4**.

Clarification

Normally both upflow clarifiers at the plant are in service. Each has a surface area of 800 square feet, resulting in an upflow rate of 0.43 gpm per square foot, which is a conservative rate. Performance is good based on turbidity removal, and TOC removal is typically well over the regulatory requirement of 25% under the enhanced coagulation guidelines. A polymer (ACH) is currently used at a fairly high dosage as the primary coagulant (up to 28 mg/l but normally 18 to 20 mg/l), and the resulting pH of the clarified water is typically over 8, which is a significant disadvantage for disinfection. There may be a significant advantage in switching to alum as the primary coagulant, which would drive the pH lower, as discussed below in the section concerning DBPs. The experience and insights of the operators would be very useful in analyzing the alternative of switching to alum. In **Figure 2.5** below, both clarifiers are visible, with Ozone contact towers behind. The blue temporary holding tank being used to equalize backwash flows is also visible in background.

***Figure 2.5**, East View of Facility Yard*



Filtration

The plant has one 8-foot diameter horizontal four cell pressure filter (288 square feet) and two 6-foot diameter similar filters (144 square feet each). An image of the filters are presented below in **Figure 2.6** Normally only the larger filter is in service, which results in a filter rate of 2.41 gpm per square foot, which is well below the upper regulatory limit of 3.0 gpm per square foot for this type of filter. Filter performance was excellent throughout 2015, with 100% of the filtered water turbidity measurements meeting regulatory requirements.

***Figure 2.6,** Pressure Filters*



Granular Activated Carbon (GAC)

The plant has two pressure GAC units, each 11 feet - 6 inches in diameter and piped to operate either in parallel or series. Normally they are operated in parallel which results in a surface loading rate of 3.35 gpm per square feet and an Empty Bed Contact Time (EBCT) of 10 minutes on the maximum day. Both are comfortably within recommended design criteria for fresh carbon.

Water Treatment Plant Finish Water Booster Pumps

Three high service pumps move finished water from the plant clearwell into pressure zone 1. The existing High Service Pumps consist of two 60 HP pumps and one 100 HP pump. Pumps 1 and 2 are located inside the combined electrical and pump room. Pump 3 is located outdoors in the treatment plant yard. High service pump data is presented in **Table 2.3** below.

***Table 2.3,** WTP Booster Pumps*

Pump	Size, Type	Date Installed
High Service Pump 1	100 HP, centrifugal pump (VFD Control)	2001
High Service Pump 2	60 HP, 620 gpm, centrifugal pump	Unknown >20yr
High Service Pump 3	60 HP, 610 gpm, turbine pump	2011

Normal operation is one pump operating (Pump 2 or 3) either at full flow or with the flow throttled by a valve downstream. The position of the valve is determined by operations staff. At times of high demand, both pumps can be operated. High Service Pump 1 is old and is reserved as a backup. An image of Pump 3 and the clearwell surge tank is presented on the following page in **Figure 2.7.**

***Figure 2.7**, High Service Pump 3 and Clearwell Surge Tank*



The pumps are controlled by the level in the Pluth redwood tank. When the level drops on the Pluth redwood tank to a low setting (11 feet in the winter and 13.5 feet in the summer) a call is made to turn on a high lift pump at the plant. When the level reaches 16 feet in the Pluth tank, the pumps are shut off at the plant. The total dynamic head (TDH) is estimated at approximately 125 psi at the WTP.

Because the clearwell is used to maintain contact time (CT) required for achieving the required disinfection levels, plant staff need to limit discharge flows in order to achieve the necessary detention time. Currently plant staff rely on throttling the discharge from the high lift pumps using a manually operated valve to reduce flows accordingly. This results in a loss of efficiency and higher energy costs for the District. An image of the clearwell is presented below in **Figure 2.8.**

***Figure 2.8**, WTP Clearwell*



2.5 Water Distribution System and Appurtenances

2.5.1 Mains, Service Laterals, and Valves

The District maintains approximately thirty-eight miles of water distribution pipelines. The majority of the pipes are asbestos concrete pipe (A/C pipe) that was installed in the 1960's. The remainder are polyvinyl chloride (PVC) pipe or galvanized steel pipe. **Table 2.3** lists the approximate length of each pipe type and size found in the system. A breakdown of the material, quantity, and diameter of pipe which constitutes the distribution system is presented in **Table 2.4** below.

***Table 2.4**, Length of Pipelines*

Pipe Type and Size	Approximate Length
Asbestos Cement Pipe	
12" Diameter	<1 mile
4" Diameter	10 miles
6" Diameter	10 miles
8" Diameter	1 miles
Total Asbestos Cement Pipe	22 miles
Cast Iron	
6" Diameter	<1 mile
Total Cast Iron Pipe	<1 mile
Galvanized Steel Pipe	
1 1/2" GI	<1 mile
2 1/2" GI	<1 mile
2" GI	5 miles
3/4" GI	<1 mile
Total Galvanized Steel Pipe	5 miles
PVC Pipe	
2" PVC	<1 mile
4" PVC	1 mile
6" PVC	6 miles
8" PVC	2 miles
Total PVC Pipe	10 miles
Total All Pipe Types	**38 miles**

Source: CLOCWD GIS Mapping Records

Most of the asbestos-cement water lines are around 50 years old. Asbestos-cement pipe has a life expectancy of about 70 years (Chrysotile Institute) though ground conditions, water quality, and other factors can reduce the usable life to 50 years or less.

Other than replacement of select mains (including a new 12" line in Highway 20 and a limited number of 4" lines at the west end of the system replaced with 6" PVC), there has been no large scale replacement or rehabilitation project for the existing distribution system to date. The distribution system, and particularly

old service laterals, are likely a major source of water loss. In some cases, the distribution mains run through the properties of residences making it difficult to maintain and repair and, in some instances, difficult to access the water meters, with the Harvey Area being a good example of this. Suspected leaks could pose a health hazard if they allow foreign contaminates to enter the system in the event of a line break or loss of system pressure. As mentioned above, the distribution system has not had any significant rehabilitation or replacement projects since its installation and much of the infrastructure is outdated and is in need of repair or replacement.

According to the Lake County Local Agency Formation Commission (LAFCO) Municipal Service Review (MSR), dated July 17, 2013, the capacity of the water distribution system is 1,224,000 gallons per day (gpd). There is a capacity for approximately 440 additional connections.

Paradise Cove Service Area Annexation Pipeline

To provide service to Paradise Cove, a 1.8-mile-long 8" pipeline was installed running from Paradise Cove to the western edge of the District's water system near Harvey Blvd. Construction of this pipeline was completed in November of 2015 by Lake County. This pipeline will provide water service for the communities of Paradise Cove and the proposed Paradise Valley Ranch (CSA-16 annexation area). As of this writing, the pipeline **has not** yet been connected to the District water system. The CLOCWD is requiring that certain conditions to be met and are as noted in **Section 5**.

The connection point is located at the intersection of Harvey Blvd. and Highway 20. Currently, potable water is supplied to Paradise Cove by three wells and a greensand pressure filter treatment facility. A secondary water supply and distribution system using surface water from the lake will reportedly continue to provide for most irrigation needs in Paradise Cove.

2024 Update

The three wells within Paradise Cove have since been abandoned and the Paradise Cove service area has since been annexed by the CLOCWD.

***Figure 2.9**, District Fire Hydrant (Wharf Hydrant)*

2.5.2 Fire Hydrants

The District maintains 216 hydrants for fire protection/suppression throughout the water system. Between 2005 and 2006, the District completed a hydrant flushing program to test for pressure and flow at select hydrants. The fire flows range from 200 gpm to as high as 1400 gpm depending on pipe sizes within various neighborhoods.

Some of the District's fire hydrants old and deteriorated and buried or non-operational, particularly at the higher elevations where landslides have damaged or buried them. The fire department is uncertain as to where some of the hydrants are located—some locations are missing from their database. A typical dry barrel hydrant is presented in **Figure 2.9** to the right.



2.5.3 Flow Meters

The District provides potable water to a total of 2,002 connections, of which 1,731 were active as of August 2016. Meters are used at most connections to record flows. The predominant meter manufacturer used by the District is Badger Meter, Inc. The majority of the small meters are Badger positive displacement disc meters. Most intermediate meters (1.5" and 2") are also Badger disc meters. There are two compound meters within the system, one 4-inch and one 6-inch. There are three 3-inch turbo meters and one 4-inch turbo meter.

Meters are read monthly through a combination of drive-by radio and manual reading depending upon meter age and location. There are approximately 300 radio read meters.

The meter population characteristics are presented below and are based on a combination of historical meter billing data and a field survey conducted by MC Engineering in January of 2016. Completed data sheets and photos of all large and intermediate meters surveyed can be found in **Appendix L**.

Figure 2.10 presents a breakdown of the existing meter ages. Meter age refers to the date the meter was installed as recorded in the District's customer meter/billing system database.

***Figure 2.10**, Meter Age Distribution*

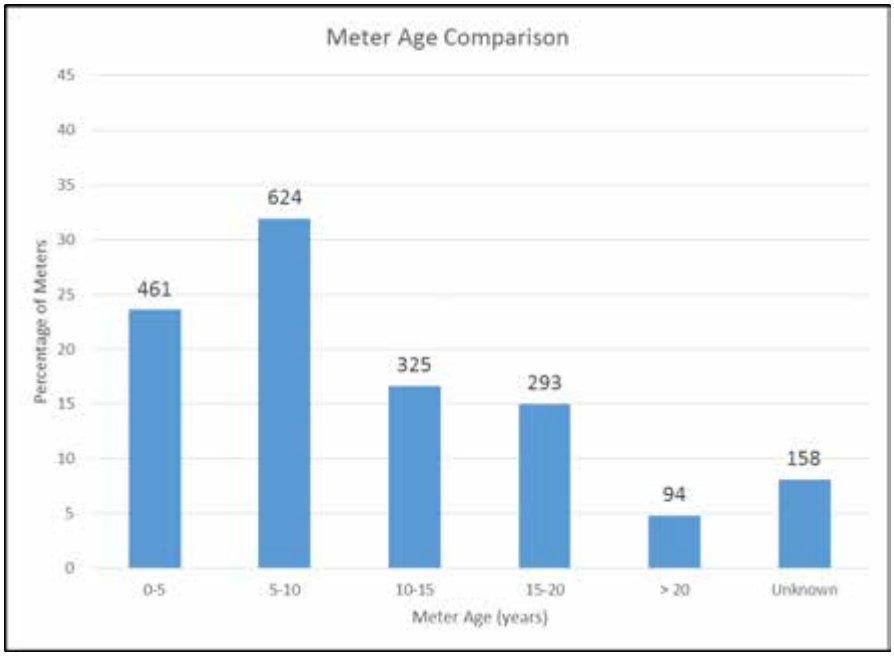


Table 2.5 presents a summary of the existing meter sizes with meter sizes range from 5/8" to 6".

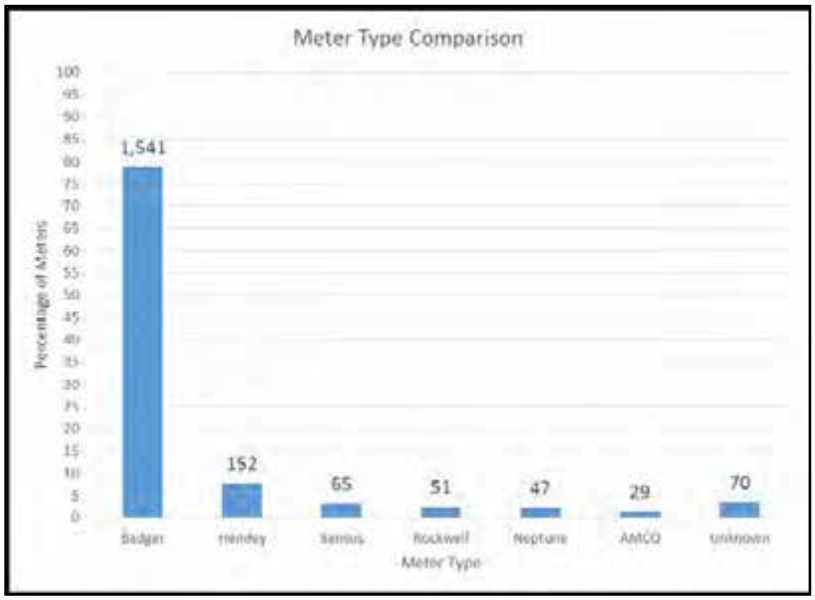
***Table 2.5**, Meter Size Comparison*

Meter Size	Total Number	Percent of Total
5/8 x 3/4-inch	1910	97.70%
¾-inch	6	0.31%
1-inch	16	0.82%
1.5-inch	7	0.36%
2-inch	10	0.51%
3-inch	3	0.15%
4-inch	2	0.10%
6-inch	1	0.05%
Total Meters	**1955**	**100%**

Section 3.8 includes an analysis of water meters and their estimated effect on Apparent Losses.

Figure 2.11 presents a comparison of the existing meter types. Approximately 80% of the meter types that were found based on the historical billing data and the field investigation were the Badger disc type meters. There are also smaller numbers of Henday, Sensus, Rockwell, Neptune and AMCO meters throughout the system. There are 70 meters within the system that are of unknown type based on the billing data.

Figure 2.11 *Meter Type Distribution*



2.5.3.1 2024 Flow Meter Update

A system-wide meter replacement program was implemented in 2021 as part of the USDA funded water system improvements project. The project included the installation of 1,530 5/8" to 1" Badger meters and retrofit of approximately 400 small meters with new radios and lids with a thru-pit antenna. **Table 2.5.1** below reflects the number of meters included in the original bid package.

***Table 2.5.1**, Meter Size Comparison*

Description	Badger Meter Type	Quantity
5/8" to 1" Replacement	Nutating Disc- Replacement	1,530
5/8" to 1" Retrofit	Nutating Disc- Retrofit	≈400
1-1/2" to 2" Replacement	E-Series Ultrasonic	12
3" Replacement	E-Series Ultrasonic	3
4" Replacement	E-Series Ultrasonic	4

The contractor took photos of the meter boxes, old meter, and new meter and this data is available in a GIS database.

Note: See related construction record drawings and database for additional details.

The project included installation of new Badger drive-by (AMR) endpoints with a thru-pit radio antenna for each installation. In addition to these meters, 4 new District Metered Area (DMA) meters were constructed that were installed with cellular end points in order to obtain real-time meter reads for select locations. The overall DMA program is discussed further in Section 3.4.6 of this updated report.
In order to provide more seamless DMA metering and analysis capabilities without the need for interfacing with existing PLCs, certain meters are recommended for replacement. The ultimate goal of proposed meter replacements is for all meters in the system to have the ability to transmit reads to the new Badger meter water usage database. This will require replacement of three meters which include the following:

1) Existing master meter used to record the flows leaving the water treatment plant, thus providing the basis for the overall System Input Volume.
2) Existing magmeter located at the Shady Lane tank site on the pump discharge that feeds the Konocti zone.
3) Existing magmeter located at the Harvey vault that measures the flows feeding the Paradise Cove area.

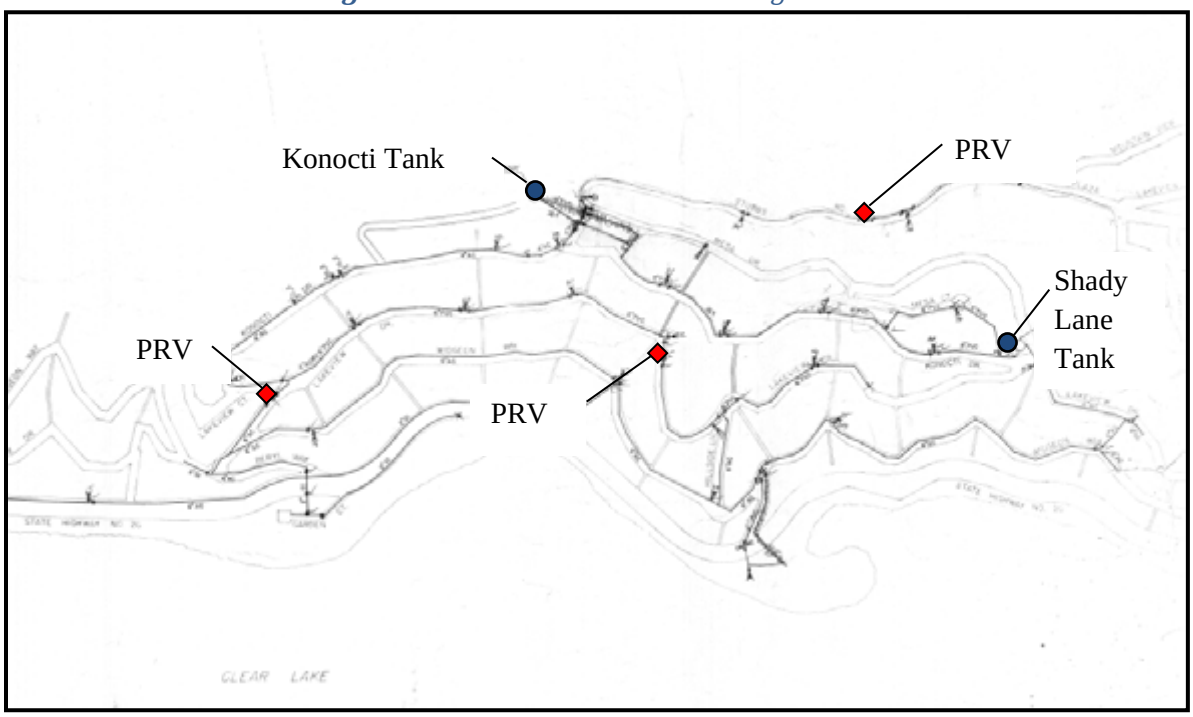
A more complete description of each of these existing meters, including size, lay lengths, and current manufacturer is presented below. The proposed replacement meters will have the capability of providing two forms of output, one being the pre-existing 4-20 mA signal into the respective PLC and the second being the Sensus protocol or similar Badger cellular endpoint compatible protocol that will allow the meter data to be transmitted via cellular endpoint into the Badger cloud-based database for subsequent meter DMA analysis.

2.5.4 Control Valves

Zone 3 Pressure Reducing Valves

There are three existing Cla-Val pressure reducing valves (PRVs) downstream of the Konocti tank connecting Zone 3 to the Zone 1 service area. The PRVs are located on Stubbs Road, Lakeview Drive (East), and Lakeview Dr (West) as presented in **Figure 2.12.**

***Figure 2.12** Zone 3 Pressure Reducing Valves*



The intent of the PRVs is to allow water from Zone 3 to flow back into Zone 1 if the pressure and/or reservoir levels in Zone 1 fall to critically low levels. Thus, Zone 3 can assist in maintaining adequate pressure within Zone 1 during low-pressure events. These self-actuating valves are designed to sustain a set pressure downstream of the valve independent of upstream pressure.

The PRVs are designed to open in order to activate a potential of 92,000 gallons within the Konocti tank in the event of a low-pressure emergency within Zone 1. These three connections can be critical to sustaining adequate pressure for fire flows within the higher elevations of Zone 1 as well as providing additional storage capacity for use in Zone 1 during emergencies. It should be noted, that at time of this writing, the three (3) PRVs, have been modified and upgraded (refer to **Section 5).**

Table 2.6 identifies the control valves in the water system. Operation points listed were those used in the hydraulic model described in **Section 3.1.**

Table 2.6, Valve Control Settings

Valve Information			Control Settings		
Location	**Junction**	**Valve Type**	**H_valve**	**H_control**	**Setting**
Lake View Dr (West)	V-00357	PRV	1505.00 ft	1588.50 ft	36.1 psi
Lake View Dr (East)	V-00079	PRV	1507.00 ft	1588.50 ft	35.3 psi
Stubbs Rd	V-00063	PRV	1510.00 ft	1588.50 ft	34.0 psi

Static pressure testing was conducted for the three PRV's separating Pressure Zone 3 and 1. **Table 2.7** lists the upstream and downstream pressures observed at hydrants during field testing along with adjusted pressures that take in account of the elevation difference between the PRV and hydrant test locations. During testing, the pressure upstream of the Shady Lane booster pump was 80 psi. Since the testing was performed the valves have undergone refurbishing and the District is encouraged to update the data below accordingly.

Table 2.7, Static Pressure Testing

Location of Test	PRV Elevation (ft)	Upstream Pressure (psi)	Upstream Pressure Elev. Diff. (ft)	Upstream Pressure Adj. (psi)	Downstream Pressure (psi)	Downstream Pressure Elev. Diff. (ft)	Downstream Pressure Adj. (psi)
PRV 1	1503	125	18	133	62	-37	78
PRV 2	1507	126	10	130	64	-24	74
PRV 3	1527	60	157	128	55	-28	67

2.6 Pump Stations and Water Storage

2.6.1 Pump Stations

In addition to the three High Service Pumps at the WTP, the District maintains three distinct pump stations for water supply in the system.

These pump stations are located at the Shady Lane, High Valley, and Cerrito sites. For more information on the High Service Pumps located at the WTP, see **Section 2.1.3**.

Table 2.8 on the following page presents a summary existing pump capacities.

***Table 2.8**, Summary of Existing Pump Capacities*

Pump Location	Pump No.	Pump HP	Approx. Pump TDH (ft)	Pump Flow (gpm)
WTP High Service	1	100	290[1]	Unknown
WTP High Service	2	60	290[1]	500[1]
WTP High Service	3	50	290[1]	610[1]
Shady Lane	1	40	225[2]	200[2]
High Valley	1	20	531[3]	100[3]
Cerrito	1	7.5	97[4]	180[4]

Notes:

1 ***Flows and pressures for high lift pumps at WTP are estimated from conversations with plant staff. Should be confirmed based on pump nameplates, curves, and modeling.***

2 ***Head for Shady Lane is based on an estimated 205 feet of static head from estimated tank elevations and an assumed 20 feet additional dynamic head (to be confirmed via hydraulic model). Flow is based on throttling and estimates of output from plant staff. Current pump expected to produce roughly 500 gpm in an un-throttled condition.***

3 ***Current pump parameters for TDH and flow taken from nameplate data which lists 100 gpm at 230 psi.***

4 ***Based on observed pressure on hydro tank gauge of 42 psi and estimated flow from calculations.***

Shady Lane Booster Pump Station

Water is delivered from Zone 1 to Zone 3 from a single 40 horsepower booster pump at the Shady Lane tank site. An image of the pump is presented below in **Figure 2.13**. The centrifugal booster pump is housed in a wood frame structure next to the Shady Lane Tank. The single speed pump produces a flow of over 500 gpm, however due to the surges created by the abrupt start-stop operation the flow has reportedly been throttled to less than 50% of the pump capacity (approximately 200 gpm according to plant staff) using a partially closed valve downstream of the pump in order to protect existing piping from damage. Recent modifications have reportedly improved the conditions related to the pump and controls.

***Figure 2.13**, Shady Lane 40 Horsepower Pump*



The Konocti tank signals the Shady Lane booster pump to start and stop via radio signals. Based on discussions with the WTP operator, the Konocti tank is filled in the morning with an initial water level of 15 feet (winter) or 18 feet (summer), until reaching a high-level of 23 ft. The tank is then automatically

refilled when the level drops to 21 ft. On a typical day, the tank requires a total of 11 ft of refill, with a tank capacity of 5,200 gal/ft it is estimated that Zone 3 consumes approximately 57,000 gal/day.

Using the District's historic average for a single family residence of 200 gal/day, a conservative estimate, and estimated 6,400 gal/day was assumed for the daily demand for Zone 3. The discrepancy between the amount of water that was being pumped up to Konocti, and the actual consumption by Zone 3 (50,600 gal/day) is thought to be mostly due to the unrestricted flow through the faulty 6" PRV and inoperable 2" bypass PRVs. The unrestricted flow from Zone 3 to Zone 1 was likely recirculating through the system causing unnecessary energy consumption and subsequent high energy costs. The recirculation through the PRV was later confirmed after repairs to the PRVs were made. The inefficiency is exacerbated by the relatively inefficient throttling of the existing 40 HP pump at the Shady Lane booster to achieve the desired flow rate. An image of the diaphram valve is presented below in **Figure 2.14.**

Figure 2.14, *Shady Lane Diaphram Control Valve*



Note that as of the time of this report, the District had repaired the non-operational PRVs between Zones 1 and 3. It was noted that Zone 3 consumption dropped considerably after the PRV valves were repaired, indicating that there was a significant amount of water recirculating between Zones 1 and 3 before the PRVs were repaired. There is currently no backup power or pump redundancy at this site.

High Valley Booster Pump Station

The booster pump at the High Valley Tank Site is used to convey flows to the Cerrito tank (Zone 2). A single 20 horsepower turbine pump pushes water from the High Valley Tank Site to the Cerrito Tank Site. The pump is operated based on level controls at the Cerrito tank that transmit via telephone line. The pump is called to start when the Cerrito tank reaches a low level of 12.5 feet and it is stopped when the tank level reaches 15.5 feet. An image of the booster pump and panel are presented on the following page in **Figure 2.15.**

Figure 2.15, High Valley Pump Station



There is currently no backup power or pump redundancy at this site. The pump is located outdoors and the existing piping is exposed and above ground in a very vulnerable condition from past maintenance and repair work.

Cerrito Booster Pump Station

The booster pump at the Cerrito Tank Site is used to fill a pressurized hydro pneumatic tank located adjacent to the pump. This hydro tank provides a limited amount of storage, dampens pressure fluctuations, and accommodates pump controls for the District's highest pressure zone.

The booster pump at Cerrito provides potable supply for the 6 residential dwellings served by a combination of 4" and 6" mains in the upper zone. The hydro tank is capable of storing 300 gallons of water at a maximum design pressure of 100 PSI. When MC Engineering visited the site, it was noted that the pressure of the tank was operating at 42 PSI. The existing booster pump is a 7.5 horsepower centrifugal type pump. At 42 PSI, the 7.5 hp pump is capable of sustaining a flow rate of approximately 180 gpm. An image of the pump is presented on the following page in **Figure 2.16.**

Figure 2.16, 7.5 Horsepower Booster Pump at Cerrito



There is currently no backup power or pump redundacy at this site and fireflows are very limited.

2.6.1.1 2024 Pump Stations Update

The pump station inventory within the distribution system have largely remained the same except for improvements at the Shady Lane Booster Pump Station, the Cerrito Booster Pump Station, and the addition of the Harvey Booster Pump Station.

Shady Lane Booster Pump Station

This pump station has essentially remained the same with the exception that the diaphragm control valve has been replaced by the use of a VFD for surge control.

Cerrito Booster Pump Station

This pump station still serves the same function as previously described in the original WMP except that it has undergone a few improvements including: replacement of the existing pump with (2) 20 hp pumps and installation of new motor control panel featuring soft start drives, replacement of small diameter suction and discharge piping with 6” and 4” ductile iron piping, replacement of isolation valves and check valves, replacement of single air compressor with two air compressors, replacement of pneumatic tank instrumentation (level probes and transducer), replacement of the building siding, and replacement of the service main and weather head conductors, and installation of a magnetic flow meter on the suction side of the piping.

Harvey Booster Pump Station

This pump station was constructed in 2022. The pump station consists of a 16' x 16' CMU building housing a Grundfos duplex packaged pump system which consists of (2) 7.5 hp multi-stage, vertical, in-line pumps and associated electrical equipment including a 3 phase 240V 200 amp power service panel, pump PLC, and general tank site PLC. The intent of this booster pump station is to provide the option of conveying flows from the Harvey tank back to Zone 1 to augment supply during times of high demand, if needed. Due to the limited pressure capacity of the AC main located on Highway 20, between the Harvey tank and the Shady Lane tank, the flow from this pump station is limited to a maximum pressure set point and thus flows are typically no greater than 100 to 150 gpm.

2.6.2 Water Storage Tanks

The District currently maintains five distribution water storage tanks which are located within 4 pressure zones throughout the system. These water storage tanks are in varying states of dis-repair. Additionally, as mentioned above, the District maintains one 300-gallon hydro-pneumatic tank at the Cerrito booster pump station to maintain zone 4 system pressure and limit pump starts and stops.

The oldest existing water storage tanks located in the distribution system were constructed in the 1960s. The newest tank in the system, the steel Konocti Tank, was constructed in 1992.

The five distribution storage tanks provide a total working capacity of 694,894 gallons. The clearwell tank at the water treatment plant is not considered to be distribution water storage per AWWA M42 from the standpoint of meeting minimum storage for emergencies and fire-flow. Images of the Pluth, Shady Lane, Cerrito, and Konocti tank are presented on the following page in **Figures 2.17** through **2.20** respectively.

***Figure 2.17**, Pluth Tank Site*



***Figure 2.18**, Shady Lane Tank Site and Pump-house*



***Figure 2.19**, Cerrito Tank Site with Pump-house on Left*



Figure 2.20, *Konocti Tank*



2.6.2.1 2024 Water Storage Tanks Update

Recent changes to the inventory of water storage include the following:

- Construction of the Harvey tank in 2022 (195,000 gallon bolted steel construction)
- Decommission of the Pluth redwood tank
- Replacement of the Cerrito redwood tank with a bolted steel tank of nearly equivalent capacity

Table 2.8 below presents the size and characteristics of the existing water distribution tanks maintained by the District. Recent changes are represented in red below.

Table 2.8*, Existing and Removed Tanks by Zone 2024 Update*

Site	Status	Zone	Date Installed	Tank Type	Total Capacity (gallons)	Working Capacity (gallons)	Tank Elevation (ft)
Pluth	In Use	1	1980	Steel	359,683	288,636	1580
Shady Lane	In Use	1	1980	Steel	144,390	102,204	1580
Cerrito	In Use	2	2023	Bolted Steel	97,560	95,059	2060
Konocti	In Use	3	1992	Steel	127,000	117,000	1780
Cerrito	In Use	4		Hydro Pneumatic	300	300	2060
Harvey	In Use	5	2022	Bolted Steel	200,000	197,950	1515
Paradise Tank	In Use	5	-	Bolted Steel	108,660	100,000	1,480
Total In-Use Storage					**1,037,593**	**901,150**	
Shady Lane	Removed	1	1963	Redwood	101,955	99,100	
High Valley	Removed	1	1961	Redwood	101,955	99,100	
High Valley	Removed	1	1963	Redwood	101,955	99,100	
Pluth	Removed	1	1974	Redwood	100,159	91,695	
				Total Storage Removed	**406,024**	**388,995**	

Table 2.9 below presents capacities by zone for each zone of the District's water system.

Table 2.9, *Pressure Zone Storage Totals 2024 Update*

Zone	Total Capacity (gal)	Working Capacity (gal)
1*	497,946	390,840
2	97,560	95,059
3 (Konocti)	127,000	117,000
4	300	300
5*	308,660	297,950
Total	**1,037,593**	**901,150**

**The Harvey tank is primarily designed to serve the Paradise Cove service area, but may also service Zone 1 under low pressure conditions.*

High Valley Tank Site History

The two tanks that were removed at the High Valley tank site originally provided approximately 200,000 gallons of storage for the District's system. Currently there is a check valve attached to the suction side of a single 20 horsepower pump that supplies pressures zones 2 & 4. The absence of these tanks creates durations of high pressure loss in the pipe network north of Hwy 20, east of Oak Grove lane, and west of High Valley Road. This reduced pressure causes pressure release valve (PRV) 3 to open and drain the Konocti tank with flow to the east through the pipeline running along Stubs Road as shown in modeling results located in **Appendix F**.

2.7 Operation and Management Systems

2.7.1 SCADA System

The District has a Supervisory Control and Data Acquisition (SCADA) system installed at the water treatment plant called "Lookout". It was developed by Control Microsystems and was discontinued shortly after they were purchased by Schneider Electric in 2010. Due to its discontinuation, there is no official support offered for "Lookout" nor are there any software updates available.

Signals from water tanks are transmitted via leased telephone lines to the booster stations. The local phone company (AT&T) has informed the District that they are abandoning the lines in 2014. Because of this, no maintenance of the phone lines can be expected in the future and the District has been installing radio telemetry at each remote site for future control communications.

2.7.1.1 2024 SCADA System Update

The most recent projects that involved updates to the SCADA system included generating weekly water loss reports to assist in the DMA analysis. Other work included the addition of the Harvey Tank monitoring and control along with monitoring and control of the disinfection byproduct equipment (mixers) in the clearwell. The Cerrito tank monitoring and control was added with the new Cerrito tank as well as SCADA control for the extended water intake at the water plant. The Pluth Tank Site was

added to transmit via radio signals (to replace discontinued telephone lines). Projects involved additional control system hardware and SCADA interface capabilities to allow remote control of motors, valves, setpoints, level monitoring, historic trending, alarming, and the alarm alert system for the on-call roster.

On June 30, 2023, the 300 Series SCADAPacks and 300E Smart RTUs reached the end of their useful life and are no longer being supported by or available for purchase from the manufacturer. Given the critical need for the SCADA system and related control capabilities, recommendations are included in Section 5 of this report for upgrading several of the SCADAPacks currently in use. This transition should begin as soon as possible in order to eliminate the risks associated with a loss of any of the existing controllers.

As refinements are made to the control system, the operators should be provided with the ability to monitor water losses in real time by adding an interface to the water loss monitoring system. Water loss related capabilities are discussed further in Section 3 of this report.

2.7.2 Operational Effectiveness

The District's ability to effectively operate and manage the water distribution system is currently plagued by failing infrastructure and responses to high priority repairs needed to keep the distribution system in service. This limits their ability to perform routine maintenance activities like main and hydrant flushing, valve exercising, logging and documenting all maintenance and repairs.

Crews are equipped with acoustic leak detection equipment; however, many of the problematic lines are in areas that are subject to noise interferences and/or limited access. This, combined with a limiting operating budget and resources, has created an immediate need for funding of the critical project components identified in this report. Once the recommended immediate improvements are constructed, it is anticipated that additional resources will be made available to increase preventative maintenance and further prioritize distribution system repairs and pipeline replacement projects.

New meter reading technology also has the potential to increase operational efficiency by providing real time water usage data and reducing the amount of staff labor required to obtain meter reads.

See **Section 3.8** for an analysis of improving the meter reading technology for the District.

2.8 Summary Table of Water Infrastructure

Table 3.1 below presents a summary of the water related infrastructure owned and operated by the District.

***Table 3.1,** Summary of District Water Infrastructure*

System Component	Date Built	Date Upgraded	Capacity
Water Treatment Plant	1975		1 - 1.2 MGD
Lake Intake Pumps			2 @ 1200 gpm ea.
Ozone Contactor	c. 1998		800 - 900 gpm
Ozonator	c. 1998	2012	405 gal/hr
Static Inline Flash Mixer			
Clarifiers			2 @ 425 gpm ea.
Filter Pumps			
Pump 1	1975	2015	20 hp (825 gpm)
Pump 2 – Pump 3	1975	2013	
Filters	1975	2012	1700 gpm
Granular Activated Carbon Sys.	1998		≈ 700 gpm
Clearwell	c. 2002		199,742 (effective)
Clearwell THM Removal Equipment	2022		(1) 1 hp power vent (2) 15 hp surface aerators (1) 0.5 Tank Mixer
Treated Water Pumps			
High Service Pump No. 1		2001	100 hp
High Service Pump No. 2		Unknown	50 hp
High Service Pump No. 3		2011	60 hp
Chemical Feed System			Sodium Hypochlorite, Zinc Phospate
Booster Pump Stations			
High Valley Pump Station	Unknown		20 hp @ 100 gpm
Cerrito Pump Station	2022		(2) 20 hp @ 250 gpm
Shady Lane Pump Station	Unknown		40 hp @ 400 gpm
Harvey Pump Station	2022		7.5 hp @ 100 gpm
Water Storage Tanks			
Pluth Tank Site			
Steel Tank	1980		288,636 gal (effective)
Redwood Tank	1974		91,695 gal (effective)
High Valley Tank Site			
Redwood Tank 1 (removed)	1961		99,100 gal (removed)
Redwood Tank 2 (removed)	1963		99,100 gal (removed)
Shady Lane Tank Site			
Redwood Tank (removed)	1963		99,100 gal (removed)
Welded Steel Tank	c. 1980		102,204 gal (effective)
Cerrito Tank Site			
Bolted Steel	2023		95,000 gal (effective)
Konocti Tank Site			
Steel Tank	1992		117,000 gal (effective)
Harvey Tank Site			
Bolted Steel Tank	2023		197,950 gal (effective)
Paradise Tank Site			
Bolted Steel Tank	unk		101,870 gal (effective)
THM Removal Equipment			(1) surface aerator (1) mixer
Distribution System			2,002/1,731 Active/Inactive Connections[3]

2" galv. Steel Pipe	1960's	1.35 miles[1]
4"-12" Asbestos Cement Pipe	1960's	29.50 miles[1]
6" - 8" PVC Pipe	1990's	7.7 miles[1]
Cla Val Valves		
Pressure Reducing Valves		(3) 6" separating Zone 1 and 2 (1) 8" separating Harvey Tank and the Paradise Cove pressure zone (Zone 5)
Altitude Valves		(1) 4"
Fire Hydrants – 216 Hydrants	Unknown	1200 gpm

Note:

1 ***Based on data from Adopted LAFCO Municipal Services Review dated July 17, 2013 and record drawings.***

2 ***Updated with current Plant and System Infrastructure per Site Surveys and Plan Reviews***

3 ***FromDistrict,June2016***

SECTION 3 – System Analysis, Mapping, and Deficiencies

This section details the engineering analysis conducted by MC Engineering, Inc. for the various components comprising the District's water system. The findings of the engineering analysis are presented in this section. Evaluations of project alternatives for the deficiencies identified in the course of this study are located in **Section 4**.

3.1 Analysis Criteria

A number of strategies were employed for the complete analysis of each component of the District water system. The following sections detail the criteria that was used for analysis.

Analysis criteria specific to 2024 is detailed accordingly within the amended herein. Where no criteria are provided within the amended sections, the original criteria can be assumed.

3.1.1 Water Demand Criteria

Water demand was calculated in **Section 1.2.3**, Water Demand. For convenience, the estimated water demand for the system, including water lost in the distribution system due to leaks and other types of losses, is presented below in **Table 3.1**. The daily totals equate to a total annual demand of 182 MG/year. Calculations are based on Title 22 – California Waterworks Standards, Section 64554.

***Table 3.1**, Water Demands Including Losses*

Net Unit Water Demand (gpd)				
Land Use Category	Ave Day	Max Month	Max Day	Ave Daily Total
RR	917	1,173	1,650	11,000
SFR	200	285	402	351,600
MFR	367	282	397	24,933
HDR	133	250	352	5,067
MHP	242	256	360	33,350
CG	667	1,112	1,564	8,667
CK	308	589	828	2,278
CO	833	1,070	1,505	12,608
FS	1,442	3,257	4,583	15,253
PSCH	25	41	58	5,025
Point Q				28,467
Totals				**498,245**

Table 3.2 below summarizes the estimated existing and buildout demands that were used for the water system storage assessment. The existing system demands are based on actual water use data from the District's customer billing system and water production data recorded by the SCADA system at the WTP. Actual water use and production data indicates that there is at least 40% non-revenue water in the system.

It is assumed that water losses in the system can be reduced by 25% or more as discussed in **Section 3.6**. Based on this assumption the system's buildout demands are projected assuming a reduction in losses of approximately 25%.

***Table 3.2**, Summary of Existing and Buildout System-wide Demands*

	Existing (2016) Land Use (gpd)		Buildout Land Use (gpd)[1]	
Demand Source	Average Day	Max. Day	Average Day	Max. Day
CLOCWD				
• Zone 1	480,000	940,000	622,000	1,205,000
• Zone 2	3,000	6,000	65,000	120,000
• Zone 3	8,000	16,000	18,000	35,000
• Zone 4[2]	4,000	8,000	9,000	18,000
Total CLOCWD	490,000	962,000	705,000	1,360,000
Paradise Cove	45,000	70,000	45,000	70,000
Total Demand	**535,000**	**1,032,000**	**750,000**	**1,430,000**

Notes:
[1] ***Assumes a future reduction in Real Losses of 25%.***
[2] ***Zone 4 demands were not included in Hydraulic Model.***

3.1.1.1 2024 Water Demand Criteria Update

Following installation of the DMA meters as part of the USDA funded water system improvements, flow data from August 2022 to August 2023 was used to establish an updated average day demand and approximate a maximum day demand for the demand zones shown below in **Table 3.2.1**. Since the DMA meters report daily demand, a max day demand peaking factor could be determined for each of these DMAs. These peaking factors were then averaged to establish a peaking factor which could then be applied to DMA areas where maximum day demand data was previously not available.

***Table 3.2.1**, Summary of Average and Maximum Day Demands 2022 to 2023*

Demand Source	Average Day Demand, gal	Max. Day Demand, gal
CLOCWD		
• Paradise	10,284	19,441
• Harvey	35,844	67,759
• Konocti	33,937	72,270
• Southeast Keys	27,026	48173
• West Keys	25,361	49214
• Elem	8,167	11,921
• Pluth	135,698	198,079
• Cerrito	4,486	6,459
• General	308,757	446,676
Total CLOCWD	590,491	919,992

3.1.2 Fire Flow Demand Criteria

The fire flow design criteria for pressure Zones 1, 2, and 3 are as follows:

- Fire flow demand of 1,000 gpm for four (4) hours (system-wide); and/or
- Fire flow demand of 1,200 gpm for two (2) hours (at a given hydrant).

The fire flow criteria required for Paradise Cove includes supplying 1,200 gpm for two (2) hours as approved by the local fire authority (Northshore Fire Protection District).

See **Section 3.1.4** - Hydraulic Model Results for information on current fire flow compliance. This criteria is also referenced within **Sections 3.2.4.1** through **3.2.4.5**.

3.1.3 Storage Criteria

AWWA Manual M42 storage capacity criteria address the need for accommodating daily fluctuations in demand, providing for fire flows, and maintaining a reserve for emergency outages.

Criteria for the combined storage in the system includes the following:

- Storage equaling 20% of the average day water demand; plus
- Storage to provide fire flow at 1,000 gpm for four (4) hours; plus
- Emergency storage equivalent to the average day water demand for one day.

For the Paradise Cove system, the criteria are as follows:

- Storage equaling 20% of the average day water demand; plus
- Storage to provide fire flow at 1,200 gpm for two (2) hours; plus
- Emergency storage equivalent to the average day water demand.

Based on demand assumptions listed above, the system-wide storage requirements for the District (not including Paradise Cove) are summarized below in **Table 3.3**.

***Table 3.3**, District Storage Requirements*

District (Not Including Paradise Cove)	Required Storage
Storage Required under Current Conditions[1]	828,000 gallons
Storage Required for Buildout Conditions[2]	1,131,000 gallons

Note:
[1] ***Equation: (20% of 490,000 gpd) + (4hrs @ 1000 gpm) + 490,000 gallons***
[2] ***Equation: (20% of 705,000 gpd) + (4hrs @ 1000 gpm) + 705,000 gallons***

The required storage for Paradise Cove sub-system is summarized below in **Table 3.4**.

***Table 3.4**, Paradise Cove Storage Requirements*

CSA-16 (Paradise Cove)	Required Storage
Storage Required for Buildout Conditions[1]	198,000 gallons.

Note:
[1] ***Equation: (20% of 45,000 gpd) + (2hrs @ 1200 gpm) + 45,000 gallons***

Total storage required for the District including the CSA-16 service area is summarized below in **Table 3.5**.

***Table 3.5**, Total Storage Requirements*

District including Paradise Cove	Required Storage
Total Storage Required[1]	**1,026,000 gallons**
Note: [1] ***Equation: 198,000 gallons + 828,000 gallons***	

As presented above, the minimum recommended system-wide water storage capacity is 1,026,000 gallons. The current storage capacity in the District's water system is estimated at only 694,894 gallons with an additional 100,000 at the Paradise Cove tank site.

The additional storage at Paradise Cove would meet the recommendations outlined above; however, restrictions in District's water distribution system limits the availability of the reserve capacity. Construction of new tanks to increase storage capacity is addressed in subsequent sections of this report.

3.1.3.1 2024 Storage Criteria Update

As previously discussed in Section 3.1.1.1, the average day demand is approximated to be 590,500 gpd. Following AWWA storage criteria, the required storage for current conditions equates to approximately 948,590 gallons. The current storage capacity in the District's water system is estimated at nearly 901,150 gallons, a deficit of nearly 47,440 gallons. Furthermore, not all the storage capacity is available to the greater part of the system. For example, currently there are no valves which allow the return of flow from the Cerrito tank back to the Keys pressure zone. Likewise, there are no pumping capabilities at the Paradise tank to return flows back to the Keys pressure zone either. Booster pumps were installed at the Harvey tank site in 2022 but these flows are limited to about 120 gpm.

At a minimum, an additional 60,000 gallons in storage must be constructed within the Keys pressure zone with valving modifications to allow the return of flow from the Cerrito tank. Previously, as shown in Table 3.3, the required storage under buildout conditions was estimated to be over 1.13 MG. Since neither Paradise Cove or the Clearlake Oaks community has shown any signs of development beyond a few homes, and water loss continues to be mitigated, any estimation of future storage requirements is relatively speculative, and these projections will not be re-evaluated.
A Source Capacity Study was completed in June of 2023. This study is included as an attachment to this water master plan update. The role of storage is critical in meeting the maximum daily demand as stipulated in Title 22 Section 64554 of the California Code of Regulations. Specifically, the system must be able to meet four hours of peak hourly demand through of a combination of source capacity, storage, and/or emergency source connections. Without continued investments in replacement of tanks and/or rehabilitation, the District is at risk of failing to provide sufficient capacity to meet the maximum daily demand, particularly during times when the quality of the raw water is compromised due to algae blooms.

3.2 Hydraulic Model

MC Engineering prepared a hydraulic network computer model to analyze the overall system including the impact of annexing CSA-16 to the District water system and the capacity of the District's water system infrastructure with respect to meeting current and buildout demands. The new supply to CSA-16 is considered a critical need in order to end the reliance on marginal existing groundwater wells in Paradise Cove.

EPA Net was used in conjunction with ArcView GIS to model the existing and proposed storage systems under initial and build-out conditions. Existing water demand and buildout water demand was modeled using diurnal demand curves based on land use parcel data provided by Lake County as noted in **Section 1.2.3**. This water demand data was lumped into aggregated demands at various strategically located nodes.

The hydraulic model performs a series of iterative calculations comparing flow vs head-loss in sections of pipes in the network using an hourly time series analysis. Once the values of the computations converge, the model has established sustained simulated flow. The various model simulations are presented as 72-hour time series in most instances.

Five modeling scenarios were evaluated for various conditions to address the immediate annexation of Paradise Cove from which deficiencies are identified under maximum day, fire flow and buildout conditions of the District's existing water system. For the initial modeling, MC Engineering received direction from Lake County and CLOCWD that peak fire flows are not required to be met via the 8-inch pipeline connection to the CLOCWD and that sufficient storage will ultimately be added to the Paradise Cove system in order to meet projected fire flow requirements. Various fire-flow related analysis were later conducted as part of the master planning effort which identified a new site near Harvey Blvd. and Highway 20 as a preferred location for a new 200,000-gallon storage tank.

The new proposed storage tank at Harvey Blvd. will benefit the existing system in the following ways:

- Providing additional fire flow storage for the existing CLOCWD east of the proposed Harvey tank site
- Improved service to accommodate outages in the westerly portions of the CLOCWD distribution system.
- Ability to provide future fire flow capacity to potential annexation areas that might include the Glenhaven area or other areas west of the proposed Harvey tank site.

Information used in constructing the hydraulic model includes input from members of the Lake County design team for the projected future demands in Paradise Cove.

3.2.1 Pipe Material and Headloss Coefficients

Water conveyed through the distribution system will incur head losses based the length and diameter of the respective pipeline segments, velocity in the pipe, and roughness coefficients. The headloss for each pipe section is calculated in the hydraulic modeling program as shown in **Equation 3** below.

***Equation 1**, Hazen-Williams Equation*

$$h_{f,\,feet} = \frac{10.44 L_{ft} V_{gpm}^{1.85}}{C^{1.85} d_{inches}^{4.87}}$$

Where,

L=length of pipeline (feet)
V=Velocity (gpm)
d=Diameter of Pipeline (in)
C=Roughness coefficient

Older pipelines typically experience higher head-losses and, therefore, are attributed a lower C coefficient. Field verification testing was used to calibrate the model and the resulting roughness coefficients used in the model are presented below **Table 3.6**.

***Table 3.6**, Hazen-Williams Roughness Coefficients*

Material	Description	C
Default	Default Pipe Material	105
AC	Asbestos Concrete Pipe (per EPANet Manual)	105
PVC	Polyvinyl Chloride Pipe (per EPANet Manual)	110
DI	Ductile Iron Pipe (per EPANet Manual)	90

3.2.2 Operating and Control Criteria

Table 3.7 below summarizes the operating criteria used for basic service levels. Model simulations relying on this criteria were used to identify deficiencies in the system under various scenarios.

***Table 3.7**, Operating Criteria Standards*

Criteria	Basic Service Level	Comments
Minimum Pressure	50 psi	This is the basic pressure the customer should observe in the street at each point of service.
Minimum Velocity	3.5 ft/sec	This is the minimum velocity required by the District's staff to conduct proper flushing operations of the proposed 8" main.
These criteria were established during the Modeling Staff Workshop held at the District's office on June 25th, 2015.		

In addition to the three High Service Pumps at the WTP, the District maintains three remote booster pump stations for supplying water to upper zones in the system. These pump stations are located at the Shady Lane, High Valley, and Cerrito sites. For more information on the High Service Pumps located at the WTP, see **Section 2.1.3**. The **Table 3.8** below summarizes existing pump capacities.

***Table 3.8**, Pump Locations and Sizes*

Pump Location	Pump No.	Pump HP	Approx. Pump TDH (ft)	Pump Flow (gpm)
WTP High Service	1	100	290	Unknown
WTP High Service	2	60	290	500
WTP High Service	3	50	290	610
Shady Lane	1	40	225[1]	200[1]
High Valley	1	20	531[2]	100[2]
Cerrito	1	7.5	97[3]	180[3]

Notes:
[1] ***Head for Shady Lane is based on an estimated 205 feet of static head from estimated tank elevations and an assumed 20 feet additional dynamic head. Flow is based on throttling and estimates of output from plant staff. Current pump expected to produce roughly 500 gpm in an un-throttled condition.***
[2] ***Current pump parameters for TDH and flow taken from nameplate data which lists 100 gpm at 230 psi.***
[3] ***Based on observed pressure on hydro tank gauge of 42 psi and estimated flow from calculations.***

Table 3.9 below identifies the existing pumps in the system along with their respective pump characteristics and operational set-points that are used in the model.

***Table 3.9**, Pump Station Specs and Operating Settings*

Pump	Pump Specs			Operation Point		Comments
	Motor	Type	Q Typ. (gpm)	Head (ft)	Q (gpm)	
HSP 3 (WTP Lead)	50 Hp	Turbine	608	276.8	600.0	Lead Pump
HSP 2 (WTP Lag)	60 Hp	Centrifugal	630	276.8	630.0	Lag Pump, different then stated in PER
HSP 1[1]	100 Hp	Centrifugal	700	276.8	700.0	Is an old pump backup only operated for exercising
Shady Lane	40 Hp	Centrifugal	225	276.8	225.0	Max capacity of 500 gpm throttled down a number of years ago because it was filling the Konocti tank too quickly.

Note:
[1] ***Not included in the model***

Table 3.10 summarizes the control strategies for the critical control points in the model along with corresponding set points. The High Valley booster pump is excluded due to the fact that Zones 2 & 4 are isolated from Zone 1.

***Table 3.10**, Hydraulic Model Control Strategies*

Control Point	Control Setting
HSP 3	ON when Pluth Tank Level BELOW 12 ft; OFF when Pluth Tank Level ABOVE 16.0 ft
HSP 2	ON when Pluth Tank Level BELOW 10 ft; OFF when Pluth Tank Level ABOVE 16.0 ft
Shady Ln PS	ON when Konocti Tank Level BELOW 19 ft; OFF when Konocti Tank Level ABOVE 23 ft; OFF when Shade Ln Tank Level BELOW 10 ft
Control Point Valve	OPEN after 2:00 PM daily OR when Paradise Tank BELOW 8 ft; CLOSE when Paradise Tank is ABOVE 15.0 OR when Connection Point Pressure BELOW 50 psi

3.2.3 Hydraulic Model Scenario Results

Verification Testing

Dynamic flow and static pressure testing was conducted in the field by District staff and an MC Engineering representative on July 16th, 2015 to provide calibration data for the model. **Table 3.11** shown below details the results for the Dynamic flow testing.

***Table 3.11**, Dynamic Flow Testing Results*

Location of drawn water	Flow (gpm)	Static Pressure (psi)	Dynamic Pressure (psi)	Pressure Drop (psi)
Hydrant at Eastern Harvey Blvd & Hwy 20	250	105	55	50
Hydrant at Harvey Blvd and Terry Ave	-	90	60	30

Existing CLOCWD System Hydraulic Model

The existing water system was modeled under Average Day and Maximum Day Demands. The following sections discuss the modeling results and relative correlation to the observed system performance.

***Scenario A* - Average Day Demand**

Under Average Day Demands, approximately 500,000 gallons (346 gpm) of water is produced per day as shown in the demand development summary included in **Appendix E**. This correlates to a -2.3% difference when compared to the average day demand calculated in the previous PER water system evaluation. Dynamic flow testing results were used to calibrate the roughness coefficients that resulted in an approximate 50 psi pressure loss near the point of connection at Harvey Blvd. Figures showing system flow, pressure and head profiles for Scenario A are located in **Appendix F**.

***Scenario B* - Maximum Day Demand**

Under Maximum Day Demands, 984,565 gallons (684 gpm) of water is produced per day as shown in the demand development outputs attached in **Appendix E**. This correlates to a 2% difference when compared to the maximum day demand observed on May 10, 2012 in the previous PER water system evaluation. Figures showing system flow, pressure and head profiles for Scenario B are located in **Appendix F**.

Existing CLOCWD System & Paradise Cove Annexation Area Hydraulic Model

Under Scenarios 1 through 5, the existing water system and the annexation area were modeled under various conditions to identify deficiencies based on the modeling and design criteria discussed in the previous sections. Specific modeling criteria are discussed below for each scenario along with key findings.

***Scenario 1* - Unrestricted Flow to Annexation Area**

Scenario 1 modeled the conveyance of water to the annexation area under unrestricted flow based on the modeling criteria presented below in **Table 3.12**.

***Table 3.12**, Scenario 1 Modeling Criteria*

Modeling Feature	Modeling Criteria
CLOCWD Demand	Existing ADD
Annexation Area Demand	Build-out ADD
Proposed Harvey Blvd Valve (Flow)	Unrestricted
Proposed Harvey Blvd Valve (Altitude)	Valve is switched to closed position when Paradise Cove Tank fills to 15 ft

The following modeling results were observed under these conditions:

- The average 24 hour demand was 543,379 gpd (377 gpm).
- A system demand peak of 540 gpm for Scenario 1 is an increase from 495 gpm under Scenario A to meet the additional demands of the annexation area. However, the peak production rate of 650 GPM is the same due to only one HSP pump being in operation.
- A temporary maximum flow of 280 gpm to the Paradise Cove storage tank is achievable.
- Due to relative steep gradient between the Shady Lane, Konocti, and Paradise Cove tank, the fill rate of the Paradise Cove tank is controlled only by an altitude valve and could exceed 250 gpm. The result is that if filling of the Paradise Cove tank occurs when the clearwell pumps are not running, the pressure drop in zone 1 near PRV #1 is sufficient to open and the demand will be met by the Konocti tank in pressure zone 3.
- The condition of demands in pressure zone 1 being meet by pressure zone 3 is not cost effective due to excess Shady Lane booster pump operation to replenish the Konocti tank.
- The Paradise Valley tank fills in approximately 1 to 1.5 hours.
- HSP 2 (lag pump) does not operate under this Scenario.

Figures showing system flow, pressure and head profiles for Scenario 1 are located in **Appendix F**.

***Scenario 2*: 100 GPM Flow Restriction to Annexation Area**

Scenario 2 modeled the conveyance of water to the annexation area under a restricted flow of 100 gpm based on the modeling criteria shown in **Table 3.13**.

***Table 3.13**, Scenario 2 Modeling Criteria*

Modeling Feature	Modeling Criteria
CLOCWD Demand	Existing ADD
Annexation Area Demand	Build-out ADD
Proposed Harvey Blvd Valve (Flow)	Not to exceed 100 gpm
Proposed Harvey Blvd Valve (Altitude)	Valve is switched to closed position when Paradise Cove Tank fills to 15 ft

The following modeling results were observed under these conditions:

- Average 24 hour and peak demands are the same as Scenario 1.
- The fill and drawdown schedule of the Paradise Cove tank is not synchronized with the existing fill schedule for other District tanks. These results can be found in **Appendix F**. This condition results in durations when demand for the annexation area occurs simultaneously with the drawdown of the Shady Lane tank. Both PRV #1 and #2 open and the majority of the annexation area demand is met from the Konocti tank in pressure zone 3.
- During times when the Paradise Cove tank is filling and the clearwell pump(s) are in operation, the PRV's from Zone 3 are closed for the majority of the time thus preventing flow from pressure Zone 3 to the Paradise Cove tank.
- The flow restrictions associated with the relatively small diameter transmission lines feeding the annexation area increases the Paradise Cove tank fill duration to approximately 6 hours.

Figures showing system flow, pressure and head profiles for Scenario 2 are located in **Appendix F**.

***Scenario 3* - 100 GPM and Timed Flow Restriction to Annexation Area**

Scenario 3 modeled the conveyance of water to the annexation area under a restricted flow of 100 gpm and a time restricted fill schedule of the Paradise Cove tank based on the modeling criteria shown **Table 3.14**.

***Table 3.14**, Scenario 3 Modeling Criteria*

Modeling Feature	Modeling Criteria
CLOCWD Demand	Existing ADD
Annexation Area Demand	Build-out ADD
Proposed Harvey Blvd Valve (Flow)	Not to exceed 100 gpm
Proposed Harvey Blvd Valve (Altitude)	Valve is switched to closed position when Paradise Cove Tank fills to 15 ft
Paradise Cove Tank Timed Fill Control	OPEN after 4:00 PM or when Paradise Cove tank is BELOW 8 ft

The following modeling results were observed under these conditions:

- Average 24 hour and peak demands are the same as Scenario 1.
- HSP 2 (lag pump) at the treatment plant does not operate under this scenario.
- The addition of the timed fill control strategy to a daily schedule changed the drawdown-fill schedule of the Paradise Cove tank to synchronize with the Pluth tank's daily fill pattern which can be found in **Appendix F**. Filling of the Paradise Cove tank occurs when the clearwell pumps are running and prevents the demands for the annexation area from being met from Pressure zone 3.
- The Paradise Cove tank fills in approximately 6 hours as modeled in Scenario 2.

Figures showing system flow, pressure and head profiles for Scenario 2 are located in **Appendix F**.

Scenario 4 - Existing Land use under Maximum Day Demand

Scenario 4 modeled the conveyance of water to the annexation area under a control strategy similar to Scenario 3 with the Maximum Day Demands for existing land use as shown below in **Table 3.15**.

***Table 3.15**, Scenario 4 Modeling Criteria*

Modeling Feature	Modeling Criteria
CLOCWD Demand	Existing MDD
Annexation Area Demand	Build-out MDD
Proposed Harvey Blvd Valve (Flow)	Not to exceed 100 gpm
Proposed Harvey Blvd Valve (Altitude)	Valve is switched to closed position when Paradise Cove Tank fills to 15 ft
Paradise Cove Tank Fill Time Control	OPEN after 2:00 PM or when Paradise Cove tank is BELOW 8 ft

The following modeling results were observed under these conditions:

- The average 24 hour demand was 1,054,565 gpd (732 gpm).
- The Peak water production of just under 650 gpm is almost double as compared to Scenarios 1 through 3 due to the condition that both HSP #3 & #2 pumps are in operation. The peak hourly MDD demand (approx. 1,120 gpm) is also more than double than that which was modeled under Scenarios 1 through 3.
- The fill time constraint for the Paradise Cove tank was adjusted to 2:00PM to relieve peak demands and therefore the occurrence of pressure zone 3 supplying water for pressure zone 1.
- The fill time for the Paradise Cove tank is approximately 12 hours, double when compared to Scenarios 1 through 3
- The timed fill control strategy discussed in Scenario 3 works well to synchronize the drawdown-fill schedule for the Paradise Cove and Pluth tanks. However, due to the fact that demands are doubled, pressure losses in Zone 1 cause the three PRV's to open and drain the Konocti tank.
- The District will be able to meet demands at the cost of increased Shady Lane booster pump operation.

Figures showing system flow, pressure and head profiles for Scenario 2 are located in **Appendix F**.

Scenario 5: Preliminary Buildout Analysis

Scenario 5 modeled the conveyance of water to the annexation area under the control strategies described in Scenario 3 with the Average Day and Max Demands for Build-out land use as shown below in **Table 3.16**.

***Table 3.16**, Scenario 5 Modeling Criteria*

Modeling Feature	Modeling Criteria
CLOCWD Demand	Build-out ADD & MDD
Annexation Area Demand	Build-out ADD & MDD
Proposed Harvey Blvd Valve (Flow)	Not to exceed 100 gpm
Proposed Harvey Blvd Valve (Altitude)	Valve is switched to closed position when Paradise Cove Tank fills to 15 ft
Paradise Cove Tank Fill Time Control	OPEN after 2:00 PM or when Paradise Cove tank is BELOW 8 ft

The following modeling results were observed under these conditions (precluding the addition of the proposed Harvey tank site):

- The average 24-hour demand was 982,453 gpd (682 gpm). This is in the same order of magnitude as modeled under Scenario 4. Therefore, it can be expected that the water system will be able to meet the projected Build-out Average Day Demands.
- The Peak water production is the same as Scenario 4 based on the condition that both HSP# 3 & 2 pumps are in operation.
- Preliminary modeling results for Build-out Maximum Day Demand resulted in an average 24-hour demand of 1,882,425 (1,307 gpm). Under these conditions the average daily demand exceeds the water supply capacity with the existing two clearwell pumps (HSP# 2 & 3).
- It is assumed Maximum Day Demands could be provided if the clearwell pumps at the treatment plant were replaced with increased volumetric capacity pumps. Alternatively, relying on additional storage at the Harvey tank site will aid in mitigating deficiencies.

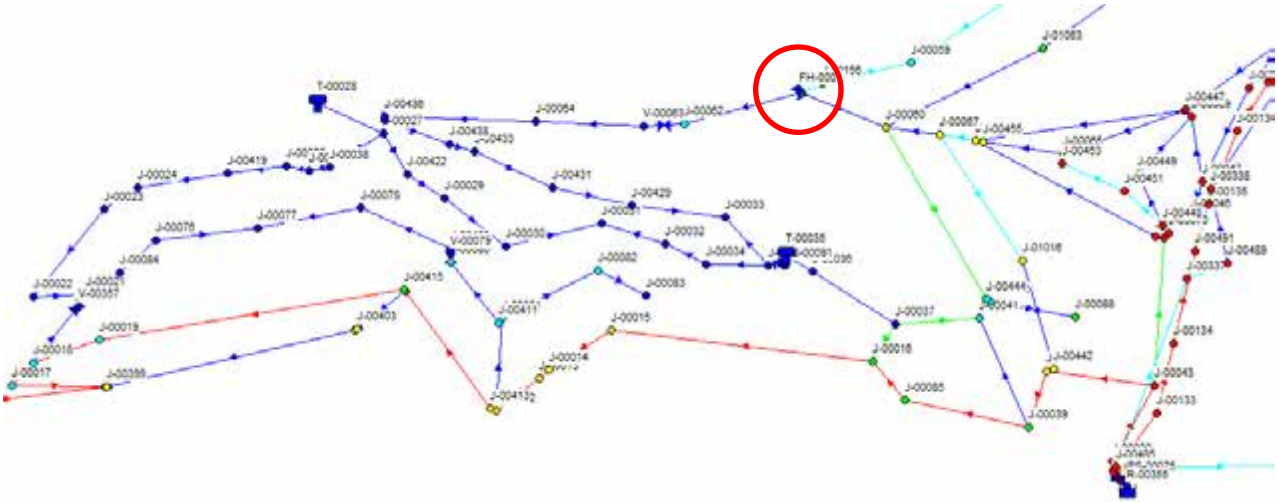
Fire Flow Analysis

A fire flow analysis was conducted to verify the distribution system is capable of providing minimum firefighting flows at select locations in the distribution system. Given the number of deficient mains, the fire flow analysis is considered preliminary and should be re-evaluated after recommended main replacements, as described further in Chapter 5, are constructed. As described in **Section 3.0.2**, the minimum flow required for firefighting is 1,000 gpm for 4 hours and 1,200 gpm for 2 hours (Paradise Cove is only required to meet 1,200 gpm for 2 hours). Two scenarios were examined. These include a fire flow event within the current District boundary, and a fire flow event at Paradise Cove (CSA-16).

***Fire Flow Analysis 1*: Current District Boundary**

The location where the fire flow event was simulated is marked with a red circle in **Figure 3.1** below (Node J-00061). Fire flow analysis described below assumed a new tank would be constructed at Harvey. This area corresponds to a location near Stubbs Road and Lakeview Drive. This location was selected for the fire flow analysis because it has relatively minimal accessibility to the Zone 1 storage, has a relatively high elevation, and is located near a business area, which is considered a sensitive area.

Figure 3.1, *Fire Flow Scenario 1 - Fire Event Location*

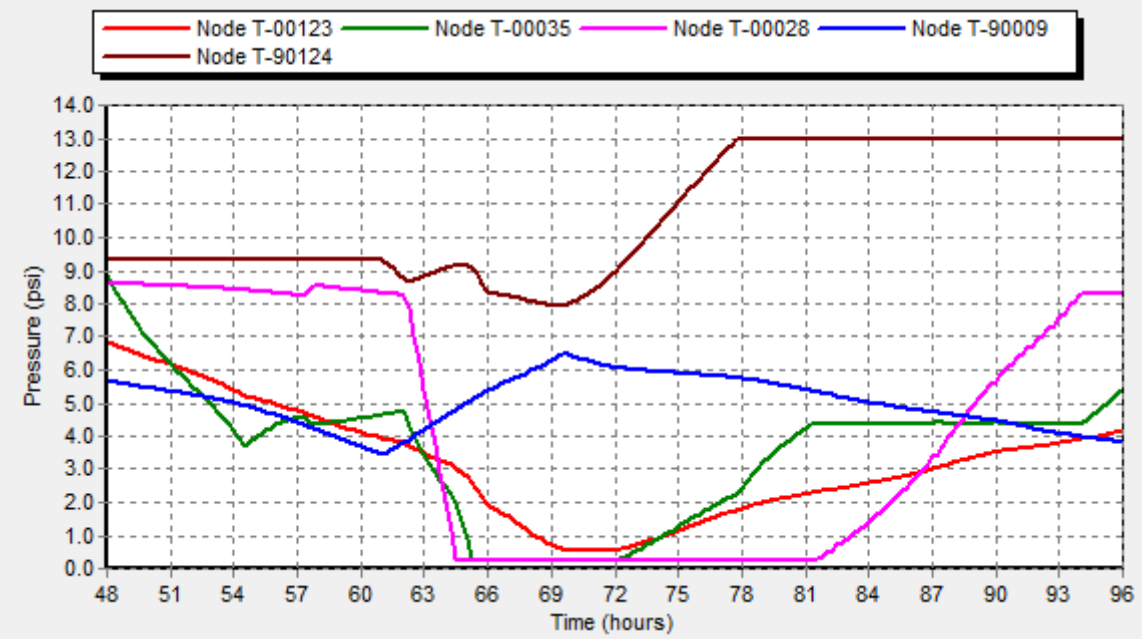


Three scenarios were investigated. In all three cases the fire flow requirements were met. However, the maximum daily demand following the simulated fireflow event, could not be met under the first two scenarios. The fire flow event was scheduled for 4 hours at a rate of 1,000 gpm.

***Scenario 1:* The Existing System without Special Control**

As shown in **Figure 3.2**, the Konocti tank (T-00028) is drawn empty by second hour after the start of the fire flow event and the Shady Lane Tank is drained (T-00035) by hour 2.5. The result is that Zone 3 is without water between hours 2 and 19, because of the lack of storage in the Konocti, Shady Lane, and Pluth Tanks to feed the water demand due to the fire flow event. Under this scenario, reserve storage remains in the Harvey Blvd Tank. However, this reserve is not utilized because the elevation of the tank is too low. Note that booster pumps at the Harvey tank will allow this reserve to be utilized, as shown in the following scenario.

***Figure 3.2**, Fire Flow Scenario 1 – Tank Water Levels*

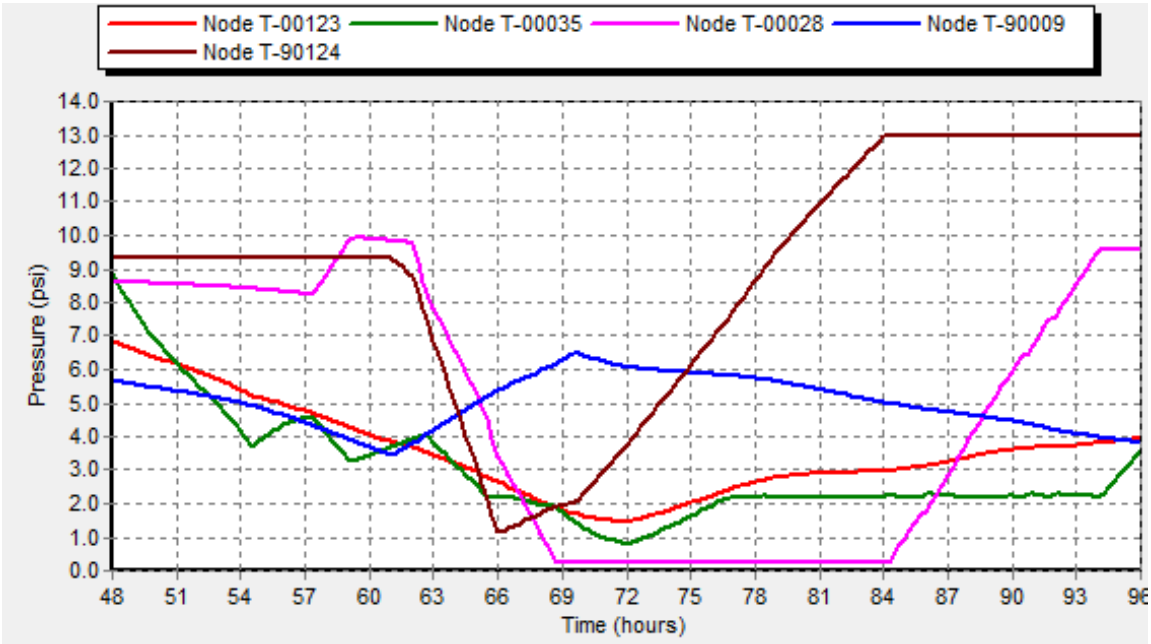


T-00123=Pluth; T-00035=Shady Ln; T-00028=Konocti, T-90009=Paradise Cove; T-90124=Harvey Blvd

***Scenario 2*: Includes Running the Harvey Blvd Tank's Booster Pump during the Fire**

As shown in **Figure 3.3**, the pumped storage from the Harvey tank improves the conditions during the fire period (hours 0-4), but after the fire, the Harvey Tank starts filling and draws the Konocti tank empty, resulting in a lack of water in Zone 3 at hours 6.5 through 22.

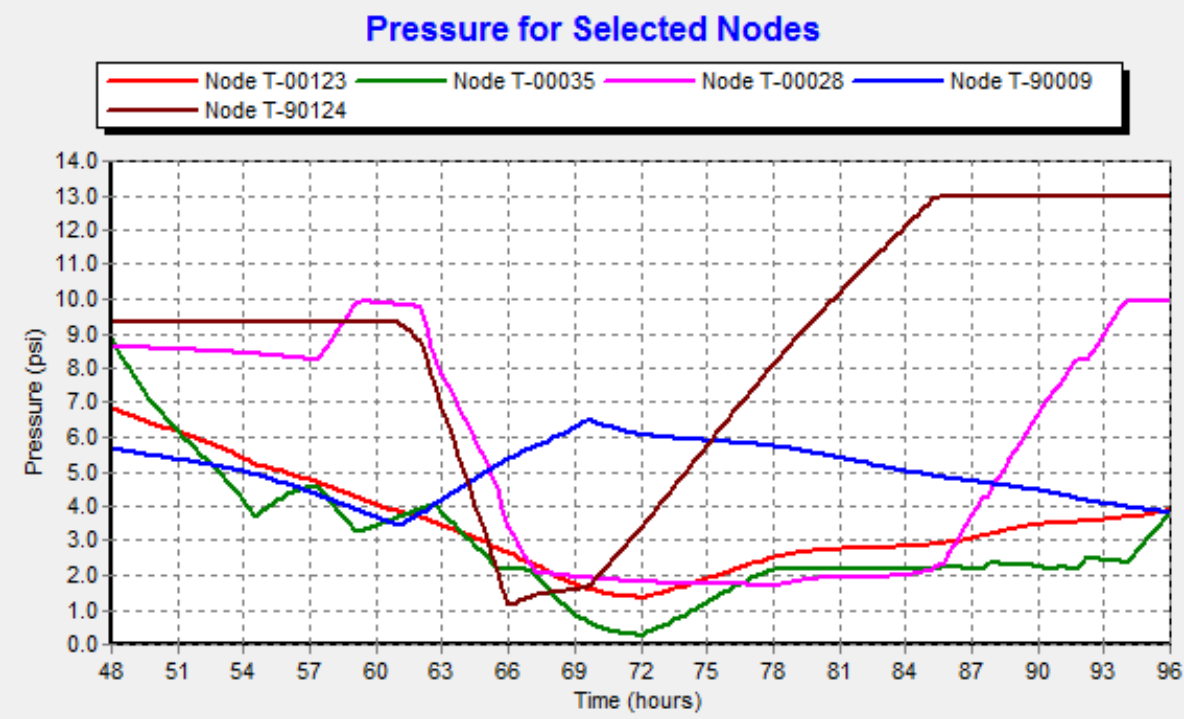
***Figure 3.3,** Fire Flow Scenario 2 – Tank Water Levels*



T-00123=Pluth; T-00035=Shady Ln; T-00028=Konocti, T-90009=Paradise Cove; T-90124=Harvey Blvd

***Scenario 3*: Close the Zone 3-1 PRVs before the Konocti Tank is Empty.**
As illustrated in **Figure 3.4**, this scenario retains sufficient storage in the Konocti tank to provide local Zone 3 demands during the fire flow event. It also provides better distribution of the demand on storage that prevents any areas from running dry. However, the Shady Lane tank does empty out for a short period, which reduces the system pressure in the immediate vicinity of the tank below acceptable levels.

***Figure 3.4**, Fire Flow Scenario 3 – Tank Water Levels*



T-00123=Pluth; T-00035=Shady Ln; T-00028=Konocti, T-90009=Paradise Cove; T-90124=Harvey Blvd

Recommendations
The following items are recommended for the District based on the fire flow modelling results:

- A booster pump station at the Harvey Blvd tank site is highly recommended to allow for use of the water stored at the Harvey tank to supply water demands for fire flow in the current District.
- Consider implementing the Scenario 2 and Scenario 3 control strategies.
- Consider limiting the Harvey Blvd tank's fill rate. This will improve the distribution of available storage during peak demand periods.
- Provide additional storage at the High Valley tank site to increase the Zone 1 storage and make Zone 1 less dependent on the Konocti tank's storage.

If the fire flow requirements could be met at this location (Node J-00061) it will most likely be met at all other locations in the system with the exception of areas with deficient smaller mains. There are a several small diameter mains that are subject to replacement as further described in Chapter 5.

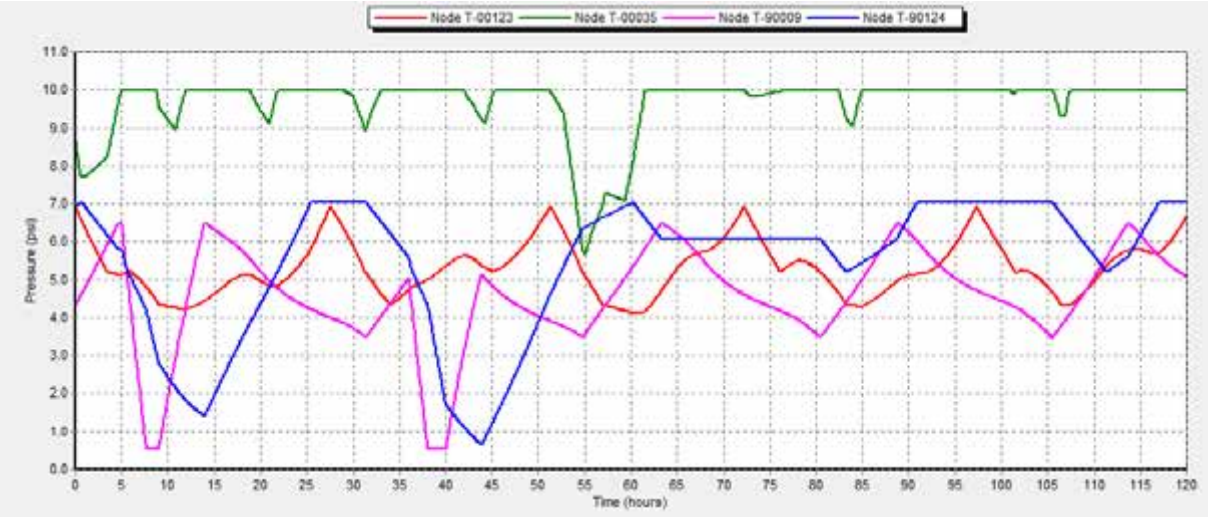
Fire Flow Analysis 2: Paradise Cove (CSA-16)

***Scenario 1*: 1,000 gpm for 4 hours at Paradise Cove**

For this scenario, the target water supply was 1,000 gpm for 4 hours at nodes J-90054 and J-90036. Under these conditions, the distribution system can deliver 1,000 gpm for 3 hours 40 minutes, drawing at a rate of 565 - 600 gpm from Paradise Cove and approximately 440 - 490 gpm form the propsed Harvey Blvd Tank.

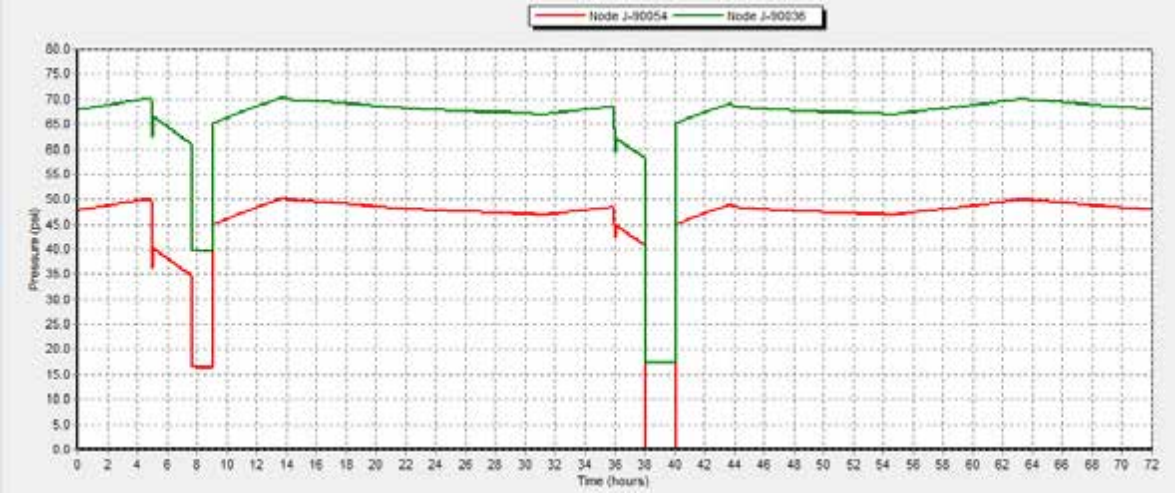
Once the Paradise Cove tank is empty, the Harvey tank delivers water to node J-90054 at 720 gpm, with a fire flow of 665 gpm. The Harvey tank delivers water to node J-90036 at a rate of 890 gpm with a fire flow of 846 gpm. Minimum pressure at hydrants are 15-18 psi when delivering from the Harvey Tank at these rates.

***Figure 3.5**, Fire Flow Scenario 3 – Tank Water Levels*



T-00123=Pluth; T-00035=Shady Ln; T-90009=Paradise Cove; T-90124=Harvey Blvd

***Figure 3.6**, Fire Flow Scenario 3 – Node Pressure*

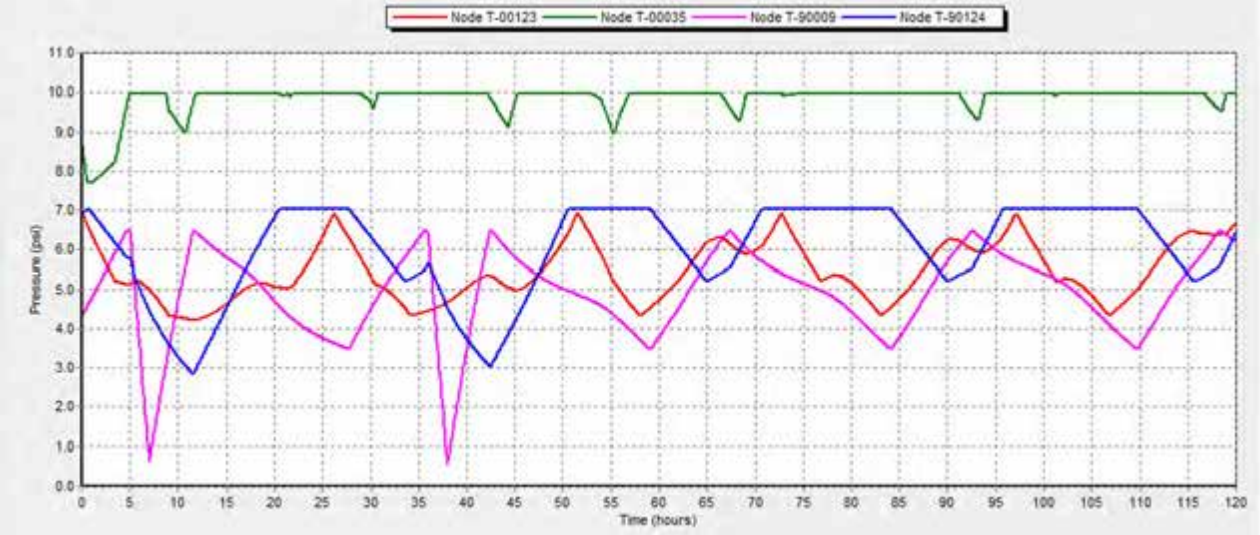


J-90054=Node @ 1380.00 ft; J-90036=Node @1333.0 ft.

***Scenario 2:* 1,200 gpm for 2 hours at Paradise Cove**

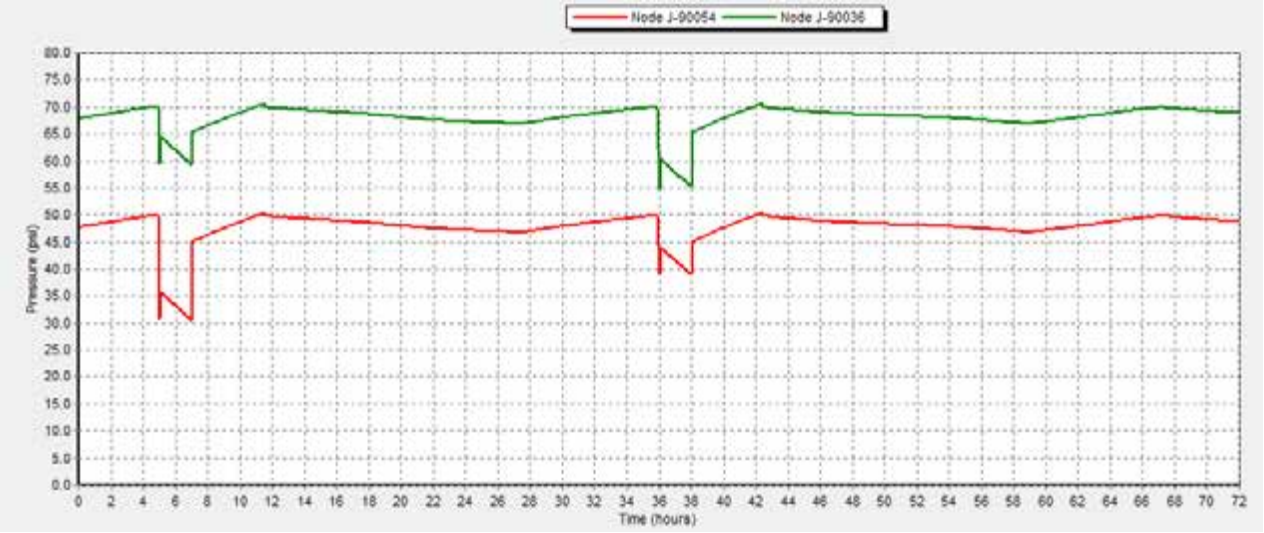
For this scenario, the target flow rate was 1,200 gpm for 2 hours at nodes J-90054 and J-90036. The distribution system can successfully deliver 1,200 gpm for 2 hours, drawing at a rate of 774 gpm from Paradise Cove and approximately 450-510 gpm form Harvey Blvd Tank. Minimum pressure at the hydrant is above 30 psi.

***Figure 3.7**, Fire Flow Scenario 3 – Tank Levels*



T-00123=Pluth; T-00035=Shady Ln; T-90009=Paradise Cove; T-90124=Harvey Blvd

***Figure 3.8**, Fire Flow Scenario 3 – Node Pressure*



J-90054=Node @ 1380.00 ft; J-90036=Node @1333.0 ft.

3.2.4 Hydraulic Model Conclusions

The modeling results for Scenarios 1 through 5 indicate that the District's system will be able to supply the annexation area demands under average day and maximum day conditions. With the modeling criteria discussed in Scenario 3, the CLOCWD system is expected to minimize the pump operation at the water treatment plant to just High Service Pump 3 and restrict flow from Pressure zone 3 to Zone 1. Under Scenario 4 for Maximum Day Demands and existing land use, High Service Pump 2 and the Shady Lane booster pumps are in operation. This results in satisfactory operating criteria for system pressure and velocity at the cost of inefficient pumping operations. It is expected the District would not be able to meet Maximum Day Demands under the Build-out scenario and pumping and storage improvements to the District's system would be required. This condition will likely be mitigated as a result of the proposed water loss reduction program and new main replacement program as described further in **Section 5.**

The final distribution system configuration is largely dependent upon available funding, details regarding cost of construction, and competition with a variety of projects needed throughout the District.
It is recommended that additional modeling runs be made at some point in the future once all proposed lines for replacement are verified and final timing of new storage and booster pumping facilities is determined.

Fire Flow Capacity
Overall, the District's system has a number of existing deficiencies related to meeting fire flow demands throughout the system. The above assessment of the ability to meet fire flow capacity was carried out for the Clearlake Oaks system with an emphasis on identifying locations where additional water storage could alleviate the lack of firefighting capacity, identifying mains that were undersized thus restricting flow, and creating control strategies that maximize efficient use of the water stored throughout the system. A new tank at Harvey Blvd., in addition to replacing the tank at High Valley, was identified in response to a combination of fire flow demands, anticipated water quality impacts complicating the addition of storage at the existing Paradise Cove site, and a need to increase reliability during outages for the westerly portions of the CLOCWD system. Also recommended is an accompanying booster pump station to allow the proposed Harvey tank to supply water for fire flows within the current District service area.

3.2.4.1 Additional Fire Flow Modeling

The original model used existing water demand data using diurnal demand curves based on land use parcel data provided by Lake County as described in **Section 1.2.3**. This water demand data was lumped into aggregated demands at various nodes located strategically within the model. More recently, after installation of four district metered areas, water usage has been quantified more discretely providing more insight as to how the demands are distributed throughout the system. Using data collected in 2023 the original 2016 EPANET model was modified by scaling the demands of specific groups of nodes to better represent the distribution of demands throughout the system.

The previous hydraulic modeling efforts primarily focused on the annexation of the Paradise Cove service area into the CLOCWD distribution system with an emphasis on storage and fire flow requirements. The Paradise Cove has since been annexed and the construction of the 200,000 gallon Harvey tank has been completed.

The intent of recent modeling efforts is to more closely analyze portions of the system which do not meet fire flow requirements, the following areas in particular:

- Konocti tank service area
- Cerrito tank service area
- West Highway 20 service area (from Beryl to Harvey Blvd.)

3.2.4.2 Konocti Fire Flow Analysis

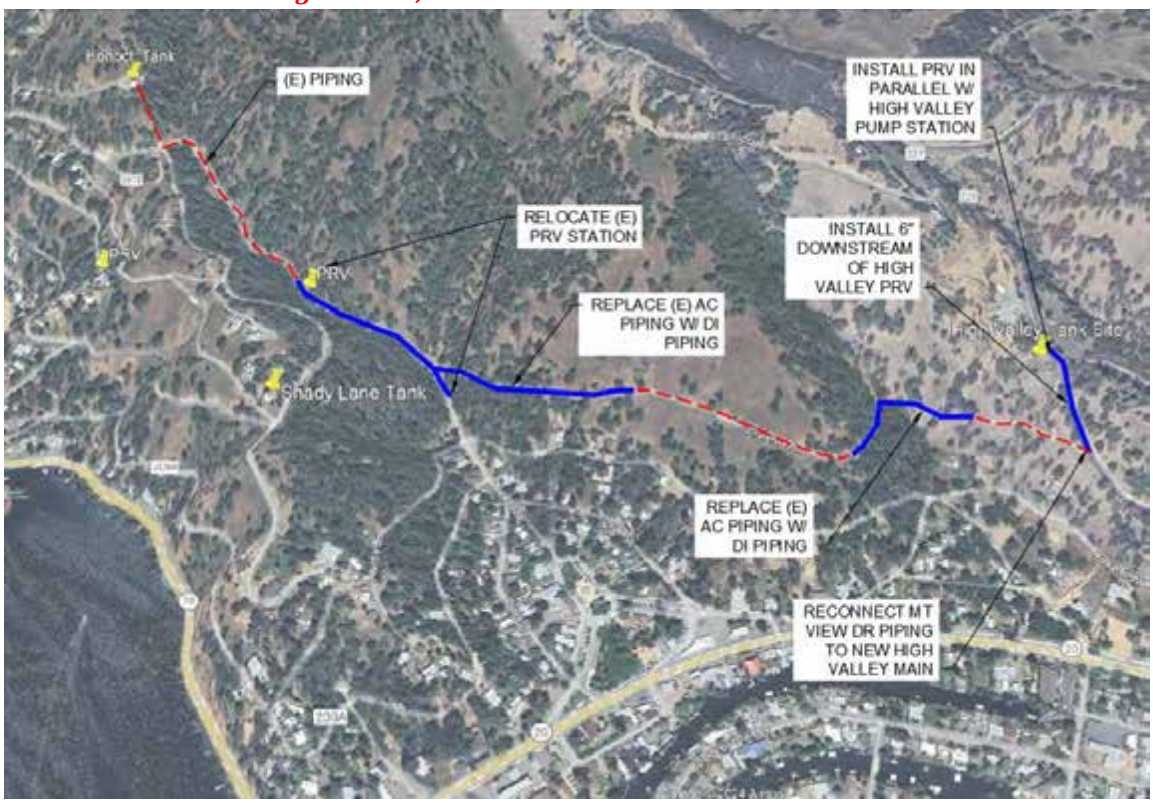
Previous modeling efforts indicated that conveyance of fire flows to the Konocti service area would require upgrading the pumps within the Shady Lane pump station to (2) 20 HP pumps. This recommendation was preliminary and did not consider the hydrant which would require the most head. Also, since then the piping configuration has changed as there are no longer parallel pipelines between the Shady Lane pump station and the Konocti tank due to a landslide on Mesa Drive. The intent of this analysis was to confirm pump sizing and appropriate PG&E service upgrades to accommodate new pumps. Pump improvements were identified assuming the maximum effective storage of the Konocti Tank is 117,000 gallons, and 99,100 gallons for the Shady tank, the maximum conveyance required from the Shady booster pump would equate to nearly 512 gpm when satisfying the flow of 1,000 gpm for a duration of 4 hours. The hydrant requiring most head due to elevation and distance is hydrant no. 48 located on the northeast corner of Mesa Drive and Stubbs Road. Conveyance from the Shady Lane tank to this hydrant would require at least two 25 HP pumps requiring 100 amps dedicated to pumping for 3 phase 240 volt service.

During a recent site visit with CLOCWD staff it was confirmed that the existing PG&E service featured 100amps at 3-phase 240volts. Thus, the maximum allowable load would be no greater than 80 amps for a future pump station design without upgrading the service. However, at least 20 amps would need to be dedicated for single phase demands (lights, receptacles, and other appurtenances) leaving 60 amps for pumping capacity which equates to a single 30 hp pump conveying, at most, which would only supply approximately 360 gpm. Upgrading the pump station to convey flows beyond 360 gpm would require a new PG&E service. A new 200-amp service could provide up to 140 amps dedicated for pumping which could convey up to 700 gpm at most.

An alternative approach considers construction of a pipeline along Mountain View Drive which would allow for the transfer of flows between the Cerrito tank and the Konocti tank. The combined storage of the two tanks (Cerrito and Konocti) equates to nearly 212,000 gallons which is 28,000 gallons short of the 240,000 gallons needed for conveying 1,000 gpm for a 4-hour duration. Thus, the maximum pumping required from the Shady Lane pump station would only equate to about 120 gpm under this alternative. The cross-country pipeline alignment from the Cerrito tank to the Konocti tank is presented in **Figure 3.8.1**. This project would essentially repurpose the existing main located on Mountain View Drive as a

transmission main by conveying flows around the High Valley pump station by use of a PRV back to the Konocti pressure zone. This would require a dedicated line from the High Valley pump station to the intersection of Mountain View Drive and High Valley Road where the existing pipeline on Mountain View Drive would be reconnected to the new pipeline on High Valley Road. Likewise, the existing PRV station on Stubbs would be relocated to allow the reversal of flow on Stubbs with the PRV located on a branch of the mainline to feed the Keys pressure zone by connecting to the mainline on The Plaza. This configuration essentially extends the Konocti pressure zone to Mountain View Drive. Low elevation portions of the pipeline would be subject to pressures near 150 psi which would require installation of DR 14 C900 or ductile iron piping. Another advantage of this configuration is the use of the High Valley pump station to fill the Konocti tank allowing the Shady Lane pump station to be taken out of service when needed.

Figure 3.8.1, *Mountain View Drive Transmission Main*



3.2.4.3 Cerrito Fire Flow Analysis

Previous modeling efforts indicated that conveyance of fire flows to the Cerrito service area would require upgrading the pump at the High Valley pump station to (3) 40 hp pumps. At the time this recommendation was preliminary and did not consider the hydrant which would require the most head or fully evaluate the additional pressure on the existing pipeline as a result of upgrading the pumping capacity. The intent of this analysis was to confirm pump sizing and appropriate PG&E service upgrades to accommodate new pumps.

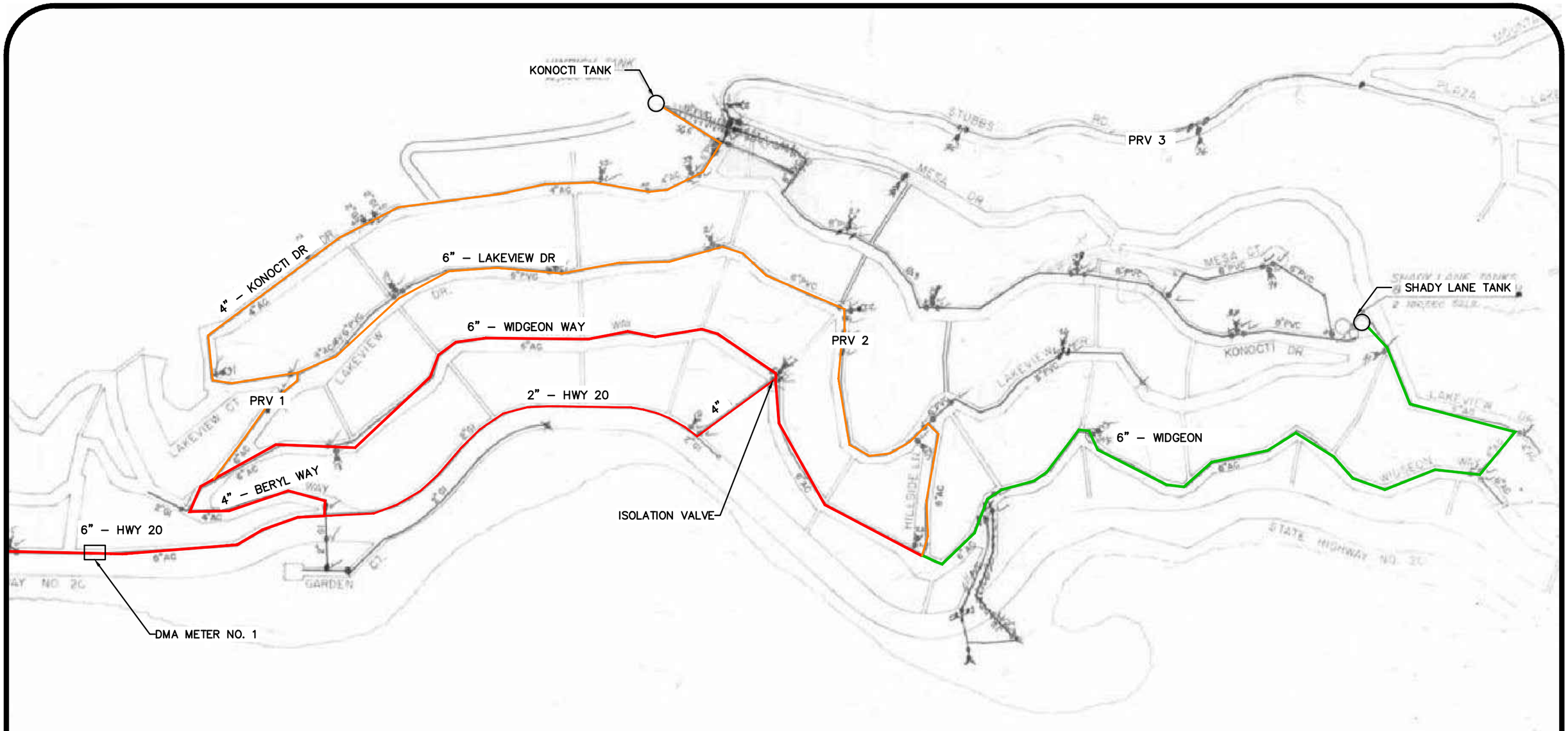
Survey data indicates a base elevation of 1,588 feet for the High Valley site and a high-level elevation of nearly 2,096 feet for the Cerrito Tank resulting in a maximum static head condition of 508 feet. The piping from the High Valley site to the Cerrito site begins with a 6" cast iron piping up High Valley Road to Cerrito Drive and Alta vista where a 6" asbestos cement main branches up Alta Vista and reconnects to Cerrito Drive on the west end. The piping then continues as a single 6" asbestos to the Cerrito tank. The same fire flow criteria described for the Konocti pressure zone also applies to the Cerrito pressure zone. Since both fire flow criteria require volumes beyond the 90,000 gallons, pumping from High Valley is required to meet flow requirements. A 2-hour flow duration at 1,200 gpm would require 750 gpm from the Cerrito tank and 450 gpm from the High Valley pump station. A 4-hour flow duration at 1,000 gpm would require 375 gpm from the Cerrito tank and 625 gpm from the High Valley pump station. Thus, the 4-hour flow duration at 1,000 gpm would control pump sizing. Maximum pump performance is required at the highest hydrant, hydrant no. 68 requiring nearly 600 feet of head at 625 gpm. This would require (3) 50 HP pumps equating to a total of 330 amps for 240 volt 3-phase service. Considering 20 amps for lighting, receptacles, and other appurtenances, as well as a maximum load no greater than 80% of the main breaker, a new service no less than 400 amps would be required. Alternatively, a 200 amp 480 volt 3 phase service could be pursued depending on input by PG&E. In any case all pumps would be controlled by VFDs.

Conveyance of 625 gpm from the High Valley site up to hydrant no. 68 would increase the maximum pressure to nearly 250 psi within the piping immediately downstream of the pumps at the High Valley site and raise the pressure to as high as 130 psi where AC piping begins on Alta Vista Drive. The original wall thickness and existing condition of the cast iron force main between the High Valley site and Alta Vista Drive are unknown and the pipeline has likely begun to reach the end of its life expectancy. Thus, it is recommended that the existing 6-inch cast iron be abandoned and replaced with 6-inch ductile iron piping between the High Valley site and Alta Vista Drive. Upsizing this line to an 8-inch is not recommended since dynamic losses would only be reduced by 10 psi, hardly enough to justify a smaller pump.

3.2.4.4 West Highway 20 Fire Flow Analysis

The intent of this hydraulic model was to evaluate the fire flow capacity of the existing 6" main located on Highway 20 which runs west bound from Beryl Way to Harvey Blvd. Prior to discussing the flow characteristics of this region, the piping to the east, involving the Shady Lane Tank, the Konocti Tank, and PRVs between the two tanks is briefly introduced and presented in **Figure 3.8.2.**

The east side of the Highway 20 main (at Beryl Way and Highway 20) is fed by a 2" line on Highway 20 and a 6" line on Beryl Way. Beryl Way is fed by a 6" main on Lakeview Drive which features a PRV (No. 1) further upstream at Lakeview Drive and Lakeview Court. Flows upstream of this PRV are supplied by the Konocti Tank via Konocti Drive. Following Lakeview Drive east bound, another PRV (No. 2) exists before a 6" interconnect between Widgeon Way and Lakeview Drive. Beryl Way is also fed by the 6" on Widgeon which is pressurized primarily by the Shady Lane tank if not PRV No. 2. Within **Figure 3.8.2** piping which is fed directly from the Konocti Tank is shown in orange, piping which is fed by the Shady Tank is shown in green. Combined flows from both tanks which feed the 6" Highway 20 main are shown in red.



COMBINED SUPPLY

KONOCTI SUPPLY

SHADY TANK SUPPLY

MC Engineering, Inc.
9294 Madison Avenue, Orangevale, CA, 95662
Tel.: 916.223.3828
Fax: 916.860.1863
www.mc-engineers.com

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 3.8.2

SHADY TANK, KONOCTI TANK, AND HIGHWAY 20 DISTRIBUTION

Existing System Characteristics

Flow and pressure data measured at the DMA 1 meter on Highway 20 shows the following characteristics for upstream piping as presented in **Table 3.17.1** below.

Table 3.17.1, *DMA 1 Pressure and Flow Data*

Condition No.	Date	Harvey Tank Fill	2" HWY 20	PRV Active	Pressure, PSI	Flow, gpm
1	1-4-23	No	Open	Yes	115 – 120	28 – 38
2	4-8-23	No	Closed	Yes	100	20
3	1-4-23	Yes	Open	Yes	102 – 103	220
4	4-8-23	Yes	Closed	Yes	91 – 93	133
5	7-27-23	No (Fill Fail)	Closed	No	77 - 81	38

Conditions 1 through 4 show that a substantial loss in pressure occurs when the 2" line on Highway 20 is not in parallel with the 6" main on Widgeon Way, this was achieved by closing the isolation valve at the location indicated in **Figure 3.8.2**. When filling the Harvey tank the flow is reduced from 220 to 130 gpm due to dynamic losses on Widgeon Way. Condition 5 shows that when both PRVs (No. 1 and 2) are taken out of service, in addition to isolating the 2" on Highway 20, the pressure drops from nearly 120 to 80 psi under flows as low as 38 gpm. Under condition 5 flows are supplied to the Highway 20 main exclusively by the Shady Tank, the flow path is denoted by the dashed lines in **Figure 3.8.2**. In round numbers, the flow path distance from the Shady Lane Tank to DMA 1 is nearly 7,200 feet. Conservatively assuming a typical Hazen-Williams coefficient of 120, dynamic losses at 40 gpm can be expected to be no greater than 1 to 2 psi. The measured dynamic losses of nearly 40 psi indicate a flow constriction somewhere within the portion of Widgeon piping in parallel with the 2" on Highway 20. The pressure drop in this location is most likely activating PRV No. 1 on a nearly continuous basis whereby a significant portion of the flows entering the Harvey service area are supplied via the Konocti tank. On the west end of Highway 20 the severe head loss on Widgeon way drops the HGL below the check valves at the Harvey Tank such that the Harvey Tank begins to supply flow back to the Harvey service area and is unable to refill after replenishing the Paradise tank. The performance of the existing system was modeled with the fire flow criteria previous citied in the WMP which consists of the following:

- 1,000 gpm for a minimum duration of 4 hours, and/or
- 1,200 gpm for a minimum duration of 2 hours

Modeling results of select hydrants between DMA 1 and the Harvey Tank are shown below in **Table 1.0 and 2.0** for 1,000 gpm and 1,200 gpm demand criteria, respectively. Hydrants with a residual pressure less than 35 psi have been identified as providing marginal pressure and highlighted in yellow. Hydrants with a residual pressure less than 10 psi have been identified as deficient and are highlighted in orange. Specific minor losses associated with the hydrant type have not been included and in cases where the system pressure was found to be insufficient in meeting fire flow criteria the fire flow demand was decreased until negative residual pressures reached atmospheric. Other assumptions assume that the peak hour demands during max day usage and both the Harvey and Konocti tanks are essentially full.

Table 3.17.2, *1,000 gpm Model*

Hyd No.	Location	Flow, gpm	Residual Pressure, psi	Duration, hrs	Notes
22	HWY 20	1,000	71	4	Good pressure, near Harvey Tank.
23	HWY 20	1,000	65	4	Good pressure, near Harvey Tank.
24	HWY 20	1,000	42	4	
26	Terrace Dr.	1,050	0	4	Insufficient residual pressure downstream and immediately upstream.
27	Terrace Dr.	780	0	4	Insufficient residual pressure downstream and immediately upstream.
28	Terrace Dr.	650	0	4	Insufficient residual pressure downstream and immediately upstream.
29	Chatten Ct.	1,000	32	4	24 PSI at top of cul de sac. As well as Hill Crest Dr. and Terrace Dr.
30	Spring Dr.	1,000	30	4	20 PSI Residual Pressure or less further up Spring Dr., 15 psi at Forest Fire Station.
31	HWY 20	1,000	45	4	Low pressures between 20 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank.
32	Sandalwood Ct	525	0	4	Flow equally split from east and west, low pressure due to high elevation and long 4" connection to Pingree.
33	HWY 20	1,000	48	4	Low pressures between 20 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank.
34	HWY 20	1,000	40	4	Low pressures between 10 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank.
35	HWY 20	1,000	40	4	Low pressures between 10 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank.

Table 3.17.3, *1,200 gpm Model*

Hyd No.	Location	Flow, gpm	Residual Pressure, psi	Duration, hrs	Notes
22	HWY 20	1,200	60	2	Good pressure, near Harvey Tank.
23	HWY 20	1,200	53	2	Good pressure, near Harvey Tank.
24	HWY 20	1,200	20	2	Marginal pressure.
26	Terrace Dr.	1,050	0	2	Insufficient residual pressure downstream and immediately upstream.
27	Terrace Dr.	780	0	2	Insufficient residual pressure downstream and immediately upstream.
28	Terrace Dr.	650	0	2	Insufficient residual pressure downstream and immediately upstream.
29	Chatten Ct.	1,200	0	2	24 PSI at top of cul de sac. As well as Hill Crest Dr. and Terrace Dr.
30	Spring Dr.	1,200	8	2	20 PSI Residual Pressure or less further up Spring Dr., 15 psi at Forest Fire Station.
31	HWY 20	1,200	30	2	Low pressures between 20 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank. Residual pressure of 38 psi with corrections to Widgeon piping.
32	Sandalwood Ct	525	0	2	Flow equally split from east and west, low pressure due to high elevation and long 4" connection to Pingree.
33	HWY 20	1,200	23	2	Low pressures between 20 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank. Residual pressure of 40 psi with corrections to Widgeon piping.
34	HWY 20	1,200	13	2	Low pressures between 10 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank. Residual pressure of 38 psi with corrections to Widgeon piping.
35	HWY 20	1,200	10	2	Low pressures between 10 and 30 psi generated on Konocti Dr. upstream of PRV due to high flow from Konocti Tank. Residual pressure of 45 psi with corrections to Widgeon piping.

3.2.4.5 Additional Fire Flow Hydraulic Model Conclusions

Shady Lane & High Valley

Detailed modeling of the Konocti pressure zone and the Cerrito Pressure zone has determined that both sites will require PG&E service upgrades and booster pump upgrades to satisfy fire flow requirements, and the pump redundancy requirements mandated by the Division of Drinking Water. These improvements are outlined below in **Table 3.17.4.**

***Table 3.17.4**, Proposed Power and Pump Improvements at Shady Lane and High Valley*

Pump Station	Shady Lane	High Valley
PG&E Service Upgrade	3 Phase, 240V, 200 amp	3 Phase, 480V, 200 amp
Booster Pumps	(2) – 25 HP Multi-stage Vertical In-Line Pumps	(3) – 50 HP Multi-stage Vertical In-Line Pumps

More details of general tank site and booster pump station improvements at the Shady Lane and High Valley sites are discussed in Section 5.

West Highway 20

In review of **Tables 3.17.2** and **3.17.3** it is evident that the hydrants located on the hillside, between Henderson Drive and Spring Road, are unable to provide sufficient fire flow or residual pressure due to their location being hydraulically at the midpoint between the Harvey tank and Shady tank. More specifically, hydrants 26, 27, 28, 29, 30, and 32 have been found to be insufficient in providing fire flows gpm and residual pressure. As shown in **Figure 3.8.3** below, these hydrants are located at higher elevations on the hillside relative to those located on Highway 20. Hydrant 28 features the highest elevation and thus dictates flow and pressure requirements of any future improvements. Additional modeling was performed to evaluate the effectiveness of providing additional pipeline capacity to these hydrants as discussed below.

***Figure 3.8.3,** Location of Low-Pressure Hydrants*



Mitchell Road to Terrace Drive Pipeline

Initial analysis to reduce dynamic losses considered installation of an 8-inch diameter pipeline from Mitchell Rd to Terrace Drive. This 1,500 foot alignment would increase the flow from 650 gpm to 1,000 gpm at Hydrant 28 with a residual pressure no higher than 9 PSI. Increasing the diameter to 10 or 12-inches would increase the residual pressure to no more than 11 and 12 psi, respectively. Other challenges include obtaining multiple easements since there is no existing right of way requiring at least three easements. Although this pipeline will not provide adequate pressure to hydrant 28, the alignment should be noted nonetheless as a replacement to the aging AC line on Highway 20.

Figure 3.8.4, *Mitchell Rd. to Terrace Dr. Alignment*



Pingree Alignment

Increasing the residual pressure at Hydrant 28 by reducing the dynamic losses from the east side of Highway 20 was also analyzed by considering construction of an 3,000 LF 8 inch main on Pingree (from Highway 20 to Spring Dr) as shown below in **Figure 3.8.5**.

Figure 3.8.5, *Pingree Alignment*



Construction of this alignment would only increase the residual pressure at hydrant no. 28 from 9 psi to 12 psi at Hydrant 28 and thus its construction is not justifiable beyond replacement of existing parallel section of 6-inch piping on Highway 20. While this alignment would increase the residual pressure and flow at hydrant no. 32, this could also be achieved by an installation of a 6 inch main on Swanson Rd between Highway 20 and Pingree Rd. Since neither the Pingree alignment, or Mitchell Road to Terrace Drive alignment are capable of providing adequate fire flow and pressure to Hydrant 28, these improvements have not been considered further as project alternatives in Section 4. Additional modeling has shown that flow and pressure requirements in this area are only satisfied by construction of an additional storage near Henderson Drive or construction of a booster pump station located on Highway 20 and Spring Drive. These project alternatives and discussed further and evaluated in **Section 4**.

Widgeon 6" AC Pipeline

The model also shows that excessive dynamic losses are generated on the 4" diameter pipeline located on Konocti Drive. This is a result of the apparent obstruction of flow within the 6" piping on Widgeon Way causes PRV no. 1 to open for low pressure conditions along west Highway 20 including fire flow. The model was rerun to analyze hydrant performance assuming no obstruction to flow on the Widgeon 6" piping with results showing a substantial pressure increase to hydrants 35, 34, 33, and 31 as noted within **Table 3.17.3**. The increase of flow from the Shady Lane tank, via Widgeon, also increases the pressure on Konocti Drive since the flow within this 4" mainline has been reduced significantly. It is recommended that staff attempt to flush the 6" line on Widgeon and verify valve operation. If the existing pipeline cannot be rehabilitated, then a new pipeline would need to be installed to restore pressure to the 4" pipeline on Konocti Drive and 6" pipeline on Highway 20.

3.3 Water System Mapping and Analysis

Prior to the completion of this Water Master Plan, the District had no electronic maps of the water distribution system. To facilitate planning and design, and to aid the District in field operations, it was determined that digitizing existing maps and updating them with information received from the District regarding current infrastructure was a high priority. Consequently, initial tasks included gathering and reviewing existing paper maps along with developing GIS shapefiles in order to digitize the existing pipe network into an ESRI Arc GIS file system for subsequent model development. Since a drinking water system is a fully pressurized, precise vertical and horizontal coordinates are not as critical as they are for a sewer model, where pipe slopes affect the resulting model results more significantly.

The existing District pipelines were digitized by approximating the location of various system components and projecting them onto existing Lake County Geographical Information System (GIS) base maps. Existing District water maps were referenced to delineate nodes and pipelines which were overlaid onto the parcel GIS maps in order to apply attributes used by the hydraulic model. Nodes representing pipe junctions, valves, pumps, tanks and other point locations with elevations and other pertinent information were included in the GIS base maps. Lines representing pipelines with attributes for sizes, materials, and other pertinent information were also included in the GIS base map.

Figure 3.9 on the following page depicts the resulting digitized overview water map of the District. An entire map book has been created depicting the entire District service area in similar detail. This map book has been submitted to the District separately from this Water Master Plan. Note that valve locations were geo-located using a Trimble GPS unit but are shown schematically on the map for illustration purposes. A complete series of figures for the digitized water system can be found in **Appendix G**.

Document Path: C:\Projects\CLOCWD\Water Master Plan\GIS\Maps\Water Master Plan_Legend Bottom.mxd

Legend

Water Lines*

- 0.75
- 1.5
- 2
- 2.5
- 4
- 6
- 8
- 12

Objects

- Hydrant
- Valve
- Blow Off Valve
- Air Release Valve
- Pressure Reducing Valve
- Unknown Valve Location
- Pump
- Tank
- Proposed Tank
- Water Treatment Plant

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CLEARLAKE OAKS COUNTY WATER DISTRICT
WATER MASTER PLAN

Sheet Title:

WATER DISTRICT SYSTEM

0 0.25 0.5 1 Miles

N

3.4 AWWA Water Audit

The AWWA free water audit spreadsheet is recognized in the water industry as the most objective means of evaluating water loss and providing a baseline for comparison against industry norms. The methodology involved in completing an AWWA water audit can be found in AWWA Manual M36. The AWWA spreadsheet tool was created to generate objective criteria to compare and evaluate a water system's performance and overall efficiency based on certain universally accepted performance indicators. The water audit estimates the water loss and associated lost revenue within a water system based on the total amount of water supplied to the distribution system (System Input Volume or SIV), and the total amount of water consumed throughout the system (Authorized Consumption).

The following section contains information on the components of the water audit. The AWWA Updated CLOCWD 2014 Water Audit reporting worksheet is contained in **Appendix H**.

The AWWA methodology as described is applicable to the CLOCWD in 2024. An updated 2023 calendar year AWWA water audit using the newly released Version 6 of the software is included in Appendix H1.

3.4.1 System Input Volume

All water entering the system is metered at the District's water treatment plant. Metered water production for 2014 was 177.88 MG. The source meters are calibrated on a regular basis and therefore are considered to be relatively accurate. All systems encounter some degree of error in their master meter data and for the purpose of this study, the error is estimated at 1.0% under-registration. Taking into account a metering error of 1.0%, total water produced and supplied to the distribution system for the year 2014 is calculated to be 179.66 MG.

3.4.1.1 2024 System Input Volume Update

As of 2024, all water entering the system is still metered at the District's water treatment plant by a 10" magnetic flow meter that is in a vault downstream of the water treatment plant clearwell. Metered water production for 2023 was 243.403 MG. The source meter electronic signal is calibrated on a regular basis, however the volumetric measurement of the meter has never been calibrated. A recent call to the meter manufacturer suggested that the meter is too old to be calibrated in the factory, and replacement of the meter was suggested. Furthermore, the meter does not have an adequate length of straight pipe upstream. The industry standard for magmeters is five times the pipe diameter of straight pipe upstream of the meter and two times the diameter downstream of the meter. There is limited space between the clearwell and the meter to provide this straight pipe length.

The CLOCWD distribution system has historically averaged between 35 and 50% non-revenue water over the last 15 years. There are nearly 2,000 customer meters in the system but only one source meter. It is important that the readings from this meter are accurate to determine an accurate estimate of system real loss. Given the importance of the accuracy of this meter, it is recommended that the meter is replaced and moved so that there are five diameters of straight pipe upstream.

3.4.2 Consumption

The District's billing data was analyzed to determine the total consumption for the year 2014. Based on the billing data, it was determined that the billed metered annual consumption was 93.55 MG. The unbilled metered consumption was determined to be 7.47 MG. The unbilled metered consumption was adjusted by the unbilled meter inaccuracy percentage of (-5.50%) as determined during the meter testing program. The unbilled unmetered consumption includes water used by the fire station, District parks, etc. As this number is often difficult for water districts to determine, AWWA recommends an estimated value of 1.25% of the SIV be used. This percentage is based on average unbilled unmetered consumption found in water districts in the US. There is a possibility that this percentage is higher for CLOCWD as it is suspected that there are considerable losses due to water theft by marijuana growers in the surrounding hills and possibly others throughout the community.

3.4.2.1 2024 Consumption Update

Authorized consumption for 2023 was 116.342 MG which included an estimated 0.25% unbilled and unmetered water estimate (based on standard AWWA default value). The Billed Metered consumption was up by 24.4% from the 2014 value in 2023, a surprisingly high increase given the relatively minor growth in customer accounts. No Unbilled Metered water was included in the 2023 updated water audit.

3.4.3 Water Losses

The total water losses for the system are estimated in the AWWA spreadsheet by subtracting the total authorized consumption from the SIV. These total losses are then divided into two categories, Real and Apparent losses.

Apparent losses account for meter inaccuracies and unauthorized consumption (i.e. water theft) as well as data handling errors while Real Losses account for volumes lost as a result of leaks, breaks, and overflows. The **Table 3.17** lists the values found for these components along with the SIV and components of authorized consumption.

***Table 3.17**, AWWA Water Volumes*

Parameter	2014 Value
System Input Volume	179.677 million gallons
Authorized Consumption	
Billed Consumption	93.549 million gallons
Unbilled Consumption	9.715 million gallons
Water Losses	
Apparent Losses	5.627 million gallons
Real Losses	**70.785 million gallons**

The sum of the components of Apparent Loss identified based on meter test results and billing data from the audit period of 2014 is 5.627 MG/year with a total value of approximately $21,289 annually. The components of meter related Apparent Losses for CLOCWD include the under-registration of large, intermediate, and small meters. Mitigating under-registration is discussed in **Section 4.2.**

The value of Apparent Losses is based on the 2015 rate structure while the value for Real Losses was based on the variable production cost of treated water according to the cost of energy, chemicals, labor and maintenance. Results from the 2014 CLOCWD water audit indicate the District is losing approximately $21,289 annually as a result of Apparent Losses and $100,771 as a result of Real Losses.

3.4.3.1 Water Losses Update

The water losses for 2023 were up considerably from 2024 with a considerable increase in suspected Real Losses and a reduction in Apparent Losses due to the recent meter replacement program and assumed increase in overall meter accuracy associated therewith. Real Losses increased by 45.814 MG to 116.599 MG, representing 48% of the total System Input Volume. The variable production cost was estimated at $1,687.82/MG for the 2023 updated water audit. As such, Real Losses are valued at an estimated $196,798 annually. It is very evident that leakage in the system is unacceptably high and efforts should be stepped up to identify and rectify the issue.

***Table 3.17.1**, AWWA Water Volumes*

Parameter	2014 Value	2023 Value
System Input Volume	179.677 million gallons	234.403 million gallons
Authorized Consumption		
Billed Consumption	93.549 million gallons	116.051 million gallons
Unbilled Consumption	9.715 million gallons	0.290 million gallons
Water Losses		
Apparent Losses	5.627 million gallons	1.462 million gallons
Real Losses	**70.785 million gallons**	**116.599 million gallons**

3.4.4 Non-Revenue Water

The un-billed and un-metered totals are added to the total losses in order to determine the amount of Non-Revenue Water (NRW) within the District's system as presented in **Table 3.18**. The percent NRW for 2014 was estimated at 47.9%, District-wide, which is unacceptably high (the California Urban Water Conservation Council identified a 10% benchmark for NRW). This also indicates there is ample opportunity to improve operational efficiency, minimize both Real and Apparent Losses, and recover lost revenues.

***Table 3.18**, Components of Non-Revenue Water*

Parameter	2014 Value
Unbilled Consumption	9.715 million gallons
Apparent Losses	5.627 million gallons
Real Losses	70.785 million gallons
Non-Revenue Water	**86.128 million gallons**

3.4.4.1 2024 Non-Revenue Water Update

***Table 3.18.1**, Components of Non-Revenue Water*

Parameter	2014 Value	2023 Value
Unbilled Consumption	9.715 million gallons	0.29 million gallons
Apparent Losses	5.627 million gallons	1.462 million gallons
Real Losses	70.785 million gallons	116.599 million gallons
Non-Revenue Water	**86.128 million gallons**	**118.352 million gallons**

As described above, the Non-Revenue Water for the CLOCWD is unacceptably high and efforts to reduce Apparent Losses through meter replacements have done little to reduce the percentage of NRW, now estimated at 50.4%. More aggressive efforts are needed to bring the amount of suspected leakage down, thus the emphasis in subsequent sections on pipe replacement, pressure management, and leak detection, among other analytical needs.

As summarized above, leaks (Real Losses) are considered the major component of the Non-Revenue Water. The high water pressures combined with older AC pipe, combined with leaks and repairs on laterals is likely the main cause of the widespread leakage. To aid in identifying the most problematic areas, the Districts repair history was reviewed and plotted to determine the spatial distribution of past repairs. Figure 3.13.1, presented in Section 3.7, shows the location of several years of repairs made to both main and service lines. It is evident that the majority of the failures are, not surprisingly, occurring in the low lying high pressure lines including the Keys and Orchard Shores. A discussion is included in the following sections regarding the feasibility of pressure management as a means of minimizing losses in these areas.

3.4.5 Performance Indicators

The infrastructure leakage index (ILI) is an industry accepted performance indicator of the Real water loss from a water distribution network. The ILI is equal to the current annual real losses (CARL) divided by the unavoidable annual real losses (UARL). The CARL is the measure of water loss in the system in one year. The UARL is a theoretical value representing the low limit of leakage that could be achieved if the system was in optimal working order. The value is based on a system's length of mains, number of service connections, and system pressure.

An ILI of 1 would suggest that the system is operating at an efficiency that meets industry averages. An ILI greater than 1.00 suggests that there is opportunity to reduce Real Losses and recover lost revenue when compared to similar systems from the AWWA based research.

The District-wide water audit yielded an ILI of 3.93. This low ILI value suggests the CARL is well above optimal. The high ILI value suggests there is significant opportunity available for the District to reduce Real Losses and related operating costs while at the same time increasing operational efficiency.

If a considerable portion of this water loss is considered Background Loss, it can be inferred that the District's infrastructure condition factor (ICF - the ratio between the actual level of background leakage in

a zone or an entire distribution system and the Unavoidable Background Leakage level for the zone of the entire distribution system) is relatively high suggesting there is a good case for replacing aging distribution pipes.

The Performance Indicators from the AWWA Water Audit are presented below in **Table 3.19**.

***Table 3.19**, AWWA Summary Results*

AWWA Performance Indicators		
Financial Indicators		
Non-revenue water as percent by volume of Water Supplied:	47.9%	
Non-revenue water as percent by cost of operating system:	11.3%	
Annual cost of Apparent Losses:	$21,289	
Annual cost of Real Losses:	$100,771	
Operational Efficiency Indicators		
Apparent Losses per service connection per day:	7.89	gal/conn/day
Real Losses per service connection per day*:	99.20	gal/conn/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.99	gal/conn/day/psi
Unavoidable Annual Real Losses (UARL):	18.01	MG/year
Real Losses = Current Annual Real Losses (CARL):	**70.78**	**MG/year**
Infrastructure Leakage Index (ILI) [CARL/UARL]:	**3.93**	**Unitless**

3.4.5.1 Performance Indicators Update

Recent updates to the AWWA water audit software prevent and ILI from being generated for small systems such as the Clear Lake Oaks County Water District. Using the older AWWA software and the 2023 losses (with consideration of an additional X X connections), the corresponding ILI would be on the order of 4.X.

3.4.6 District Metered Areas (DMAs)

A DMA is considered a discrete service area within a water distribution network where the System Input Volume (SIV) and total authorized consumption are known. Currently, the only location where the SIV is measured is at the water treatment plant.

Developing zones within the water system for which NRW can be calculated individually would allow the District to identify high leakage zones with greater granularity, facilitate a systematic program aimed at reducing Real Losses, and alert operators as to the approximate location of new leaks when they occur. The DMAs should be hydraulically isolated so that the District can calculate the volume of water lost within the DMA by subtracting the total consumption from the SIV for each DMA. The presence of an AMI system will allow the authorized consumption for each customer within a specific DMA to be determined on an hourly basis and compared to the SIV in real time.

Currently, CLOCWD has three areas that are good candidates to become DMA's. CLOCWD has a few different options for developing new DMAs and while further analysis is required to finalize any locations for Source (Bulk) meters, a preliminary DMA layout map showing existing and proposed DMAs is presented on the following page in **Figure 3.10**.

With the addition of Paradise Cove into the District's water system, a dedicated DMA for that service area could be easily established by relying on the proposed AMI metering system and the new meter proposed at the PRV near Harvey Blvd as discussed in **Section 4.3.1.**

DMA Number	Area	Requirements	Existing/Proposed
1	Elemental Colony	Existing Meter at WWTP	Existing
2	Southeast Area of Keys	New Fire-Rated Meter at Keys Blvd/Konocti	Proposed
3	Western Area of Keys	New Fire-Rated Meter Shutoff Valve at Lake St./Konocti	Proposed
4	Cerritos Tank	Existing Meter at High Valley Tank	Existing
5	Konocti Tank	Existing Meter at Shady Lane Tank	Existing
6	Harvey Area	New Fire Rated Meter at Hwy. 20/Beryl Way	Proposed
7	Paradise Cove	New Fire Rated Meter at Hwy. 20/W. Harvey Blvd.	Proposed
8	Pluth Tank Area	New Fire Rated Meter at on the 8" line located at Hwy 20 and Keys Blvd. headng East	Proposed

Paradise Cove

Paradise Cove Bulk Meter

8-inch Main to Paradise Cove

Highway 20

Proposed Pluth Tank DMA Location

Cerritos Tank

High Valley Tank

Pluth Tank

Konocti Tank

See Above

Shady Lane Tank

Water Treatment Plant

DMA #3 Isolation Valve

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

0 1,250 2,500 5,000 Feet

Legend

- WATER DISTRIBUTION PIPE
- PROPOSED BULK METER LOCATION
- EXISTING BULK METER LOCATION
- DISTRICT WATER TANK
- EXISTING DMA
- PROPOSED DMA
- FIRE HYDRANT
- PARCELS
- WATER VALVE
- PRV

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FIGURE 3.10 DISTRICT METERED AREAS EXISTING AND PROPOSED

-

3.4.6.1 2024 District Metered Areas (DMAs) Update

Four new District Meter Area (DMA) meters were added in 2021 as part of the USDA funded water system improvements. Two of the meters were located on Highway 20, one west of the water treatment plant near Lakeview Drive (11498 Lakeview Drive) and a second east of town on the opposite side of the highway from the motel (13473 State Highway 20). Two additional DMA meters were constructed within the Keys subdivision, one at 596 Keys Blvd and a second at 12806 Shoreview Drive, as depicted in Figure 3.10.1.

After establishing the respective DMA zones as shown in the revised Figure 3.10 below, a spreadsheet model was developed to account for all flows by DMA using the strategically placed meters. In total, eleven distinct DMAs were created through a combination of existing meters and the 4 new DMA meters. The new AMI meters are being used to account for all customer water uses within each DMA while the cellular data from the DMA meters and some existing meters, is being used to calculated the system input volume for each DMA. The process of estimating the water loss for each DMA is complicated by the limitation on driveby reading capability which typically only occurs monthly for the customer meters. This monthly data then needs to be compared with metered data for each DMA that is, in most cases, stored within the SCADA data at the water treatment plant.

Due to the disparate nature of the SCADA and Badger meter database, calculating the loss for each zone is rather cumbersome. The most recent update/DMA modeling effort was performed in July of 2024. The results of this recent water loss evaluation are summarized below for each DMA. This summary indicates that losses have remained at historic highs throughout all of 2023. Overall, system losses are on the order of 50% throughout the most recent period of analysis. In an effort to express losses more appropriately based on the size of the DMA, the losses are presented in terms of gal/day/ft of pipe within the DMA. Using this metric, it is apparent that the Pluth zone is one of the more problematic areas with losses of 65% on average within the DMA that represent 3.08 gpd/ft of loss, over twice the system average loss rate of 1.48 gpd/ft of pipe.

Based on the results of the DMA analysis along with a related tank drawdown investigation, additional measures intended to help pinpoint the losses in the Pluth area DMA were recommended. These measures included closing valves in an effort to isolate the areas on either side of Highway 20 along with extending the tank drawdown analysis window. The relatively high losses in the Keys area, as represented by a range of 17% to 48% for the south-east and west keys DMAs, suggests that the losses are widespread.

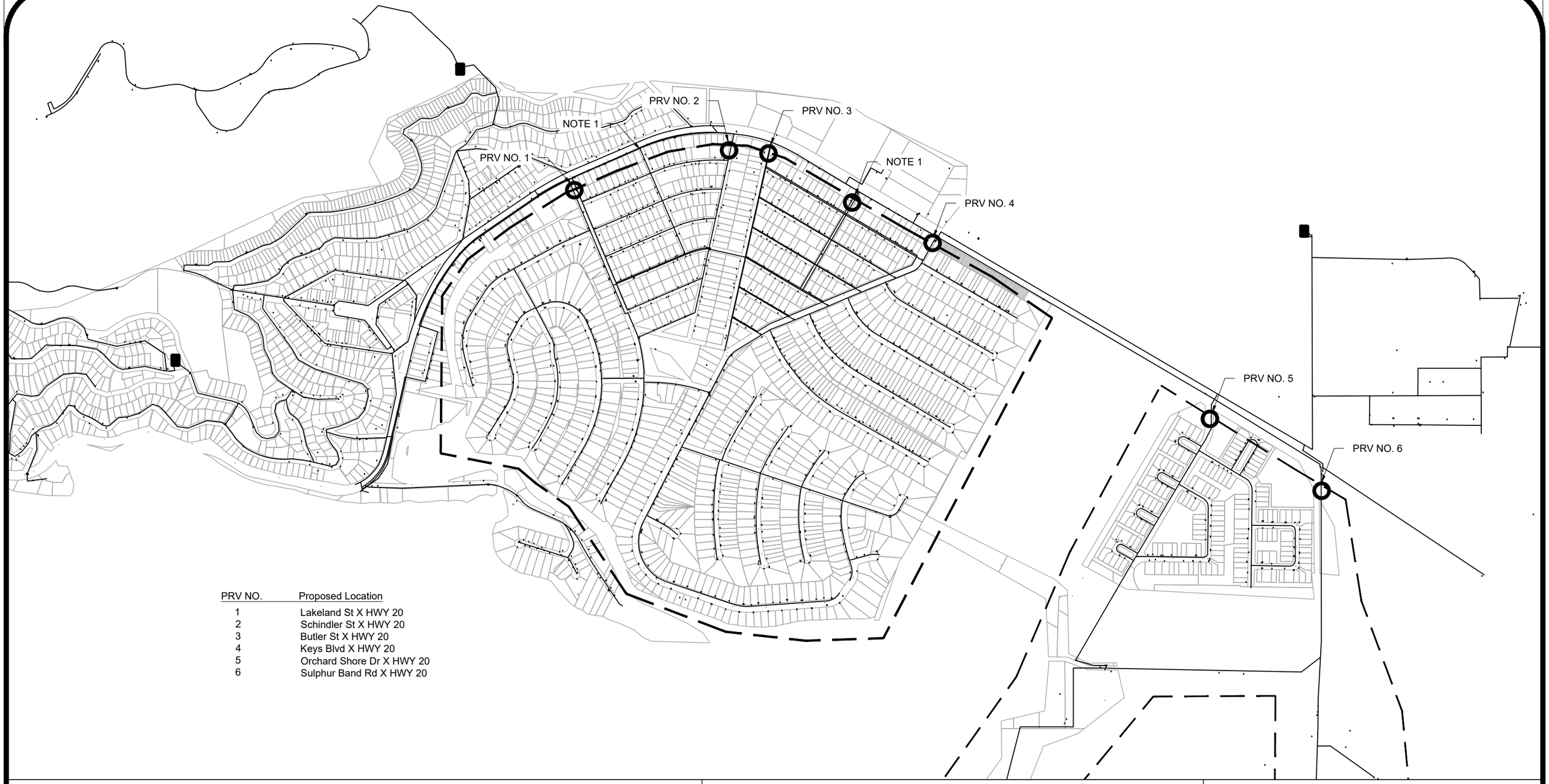
It should be noted that the water pressure in most of the General Zone (Zone 1) including the Keys, is approximately 110 psi. This relatively high pressure is thought to be contributing to the high losses, particularly given the proliferation of AC pipe which is relatively hard to restrain and to couple with for services and various fittings without relying on the adjacent soil for thrust restraint. The soils are likely susceptible to yielding under pressure, particularly given the saturated conditions that can occur near the lake. Pressure management is suggested as an option for reducing losses in the General Zone and it is described further below based on theoretical reductions and projected savings estimates that could be realized through pressure reduction and management.

Water Balance Report Inputs

			Start Dt	01/01/2023		End Dt	01/01/2024	
CLOCWD System Water Balance After December 2022						Total System Losses		324,294 gpd
Model ID	Model Name	Model Status	Average Daily Water Balance for Node					% of Total Losses
			Inflow	Useage	Unaccounted	% Loss	Pipe Length	Loss/Mile	
1	CLOCWD System	Ready	642,243 gpd	317,949 gpd	324,294 gpd	50%	219,615 ft	1.48 gpd/ft	100%
Sub-System Water Balances									
10	General Zone After 12/22	Ready	368,873 gpd	175,088 gpd	193,784 gpd	53%	124,243 ft	1.56 gpd/ft	60%
2	Harvey Zone (with Paradise)	Ready	55,190 gpd	41,171 gpd	14,019 gpd	25%	39,624 ft	0.35 gpd/ft	4%
5	Pluth Zone	Ready	141,967 gpd	49,928 gpd	92,039 gpd	65%	29,884 ft	3.08 gpd/ft	28%
4	Elem Zone	Ready	8,936 gpd	7,304 gpd	1,633 gpd	18%	8,822 ft	0.19 gpd/ft	1%
6	South-East Keys Zone	Ready	32,335 gpd	23,889 gpd	8,446 gpd	26%	10,310 ft	0.82 gpd/ft	3%
7	West Keys Zone	Ready	34,943 gpd	20,569 gpd	14,374 gpd	41%	6,733 ft	2.13 gpd/ft	4%
Sub-System Totals			642,243 gpd	317,949 gpd	324,294 gpd	50%	219,615 ft	1.48 gpd/ft	100%

Pressure Management Considerations

It is likely that pressures in the lower part of the General Zone could be reduced by up to 50%. A reduction in pressures from 110 to 55 psi would theoretically result in an approximately 30% reduction in leakage. Currently the main supply from west to east in the CLOCWD system flows through the Keys area. Aided in part by constructing a new line in Highway 20 (as currently designed) a separate pressure zone could be established in the Keys through the addition of pressure reducing valves (PRVs) at strategic points in the distribution system. Section 4 presents a brief alternative analysis which compares the cost of pipeline replacement to installation of pressure reducing valves. Additional project details, including a map showing the location of the proposed PRVs is presented in Section 5.



PRV NO.	Proposed Location
1	Lakeland St X HWY 20
2	Schindler St X HWY 20
3	Butler St X HWY 20
4	Keys Blvd X HWY 20
5	Orchard Shore Dr X HWY 20
6	Sulphur Band Rd X HWY 20

MC Engineering, Inc.
9294 Madison Avenue, Orangevale, CA, 95662
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Fax: 916.860.1863
www.mc-engineers.com

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 3.10.1

PROPOSED PRV LOCATIONS AND PRESSURE ZONES

3.4.7 Component Analysis Conclusions and Recommendations

A Component Analysis is a method advocated by AWWA, the CUWCC, and others in the water industry for quantifying various components of Real Losses. **Table 3.20** below presents a summary of the key parameters and mitigation measures discussed in this section which are recommended for the District for reducing the various components of Real Losses.

***Table 3.20**, Summary of Key Parameters and Recommendations*

Parameter	Description	Findings	Recommendations
SIV	System Input Volume	Source Meter Accuracy Levels Estimated at 1.0%	On-going verification and testing required to validate source meter accuracy
Apparent Losses	Customer Meter Accuracy Levels	Overall Customer Meter Inaccuracy Estimated at 3.05% and valued at $9,779 annually	Replace meters that are 10 years old and older. Use AMI to improve efficiency in capturing customer consumption data and to identify wasteful usage and leakage. Develop DMAs to isolate target areas
CARL	Current Annual Real Losses	2014 CARL estimated at 71.07 MG/year, valued at $100,771 annually	Repair current leaks based on the 2015 leak survey, employ better record keeping when leaks are repaired, target infrastructure for replacement
CRL	Current Reported Leakage	Not quantified by District at this time.	Improve work order record keeping by adding information on pipe size, pipe type, location of pipe, date and time of leak discovered and repaired, and estimate of leak flow
PRL	Potentially Recoverable Leakage	49 MG/year valued at $69,760 annually	Repair leaks identified in the 2015 leak survey, perform a follow up system leak survey, and implement a program to survey at least 50% of the entire system every year.
TRL	Target Real Loss	18 MG/year	Reduce the CARL and the ILI to meet the Target Real Loss goal by replacing the Cerrito tank and select water mains
ICF	Infrastructure Condition Factor	While it is difficult to quantify the ICF, it is assumed to be high based on background leakage	Replace aging infrastructure and implement AMI to more accurately minimize theft

***Table 3.20**, Summary of Key Parameters and Recommendations*

Parameter	Description	Findings	Recommendations
SIV	System Input Volume	Source Meter Accuracy Levels Estimated at 1.0%	Install new Badger compatible flow meter inside pump room at WTP. Verify accuracy of existing meter by comparison and transmit signal from new meter to cellular endpoint for simplifying DMA analysis.
Apparent Losses	Customer Meter Accuracy Levels	Overall Customer Meter Inaccuracy Estimated at 1%	Continue to leverage existing AMR and cellular meter data for identifying DMAs with high water loss. Add meter at WTP to verify SIV.
CARL	Current Annual Real Losses	2023 CARL estimated at 116.599 MG/year, valued at $196,798 annually	Repair current leaks based on the 2015 leak survey, employ better record keeping when leaks are repaired, target infrastructure for replacement. Conduct new leak survey and focus initially on Pluth area.
CRL	Current Reported Leakage	Not quantified by District at this time.	Improve work order record keeping by adding information on pipe size, pipe type, location of pipe, date and time of leak discovered and repaired, and estimate of leak flow. Utilize recently prepared map to identify areas with many repairs to prioritize pipe replacements.
PRL	Potentially Recoverable Leakage	98.199 MG/year valued at $165,742 annually	Repair leaks identified in the 2015 leak survey, perform a follow up system leak survey, and implement a program to survey at least 50% of the entire system every year. Replace priority pipelines and consider pressure management strategies to reduce leakage rates.
TRL	Target Real Loss	18.4 MG/year	Reduce the CARL and the ILI to meet the Target Real Loss goal by replacing the Cerrito tank and select water mains
ICF	Infrastructure Condition Factor	While it is difficult to quantify the ICF, it is assumed to be high based on background leakage	Replace aging infrastructure and implement AMI to more accurately minimize theft

3.5 Water Loss Management System

A water loss and meter data management system (WLMS) can be supported by using source meter readings at the WTP and meter readings from select locations in the distribution system to monitor water flows. The proposed WLMS would calculate the System Input Value along with authorized consumption from customer meters (via AMI) in order to monitor both production and consumption in order to calculate losses in real time on an hourly or daily basis.

The WLMS will allow District staff to collect readings at will (via two-way communications) through the meter vendor's remote network interface (RNI) database using a password protected website. District staff would have the ability to click on a given meter and drill down into the historical data for monitoring and reporting purposes. The data displayed will typically include hourly, daily, and monthly totals in consumption for each metered location. The web portal should include a report generator allowing historical data for each metered location to be easily downloaded for subsequent analysis and billing related uses.

District staff would have the ability to compare the System Input Value and total consumption from customer and District meters and report the difference as the estimated water lost on an hourly, daily, weekly, and monthly basis in real time. In the event the hourly total water loss target is exceeded, indicating that a new leak has been discovered, an alarm would be generated, and an email sent to the pre-designated District staff alerting them of a leak somewhere in the system. An alarm can be generated by the WLMS software if the target usage is being exceeded based on daily, weekly, and monthly adjustable limits.

3.5.1 2024 Water Loss Management System Update

An Excel-based water loss management system was developed by MC Engineering for the District in 2023. This system was initiated after the District completed a DMA flow meter and drive-by radio read endpoint installation project in 2022. A description of the DMA meters and a related map is presented in Section 3.4.6. The Excel program tabulates monthly or weekly drive-by reads and subtracts this total from the DMA zone flow meter total.

The Excel-based water loss management system utilizes a combination of SCADA flowmeter reads, Badger cellular flowmeter reads, and Badger drive-by reads. The multiple formats of data have resulted in a complex program that can be challenging to run and maintain. For this reason, it is recommended that the District transition to the Badger DMA tool that is built into the Badger Beacon software in the future. The CLOCWD billing staff are already familiar with this software. It is, however, uncommon for water systems to use both drive-by and cellular meters in the Badger DMA tool, and the tool has not yet been proven for the types of endpoints that are maintained by the District. There is a need to work with Badger staff to demonstrate the viability of this tool for the District's unique meter population. It is also recommended that the District upgrade the three flowmeters that are currently read only by SCADA to dual output 4/20 and Badger Cellular format. This upgrade would likely require the replacement of these three flowmeters.

The spreadsheet DMA model has been used to generate a variety of reports in an effort to identify the DMA's with the highest water loss. A summary of the entire 2023 year is presented below in Table 3.20.1.

The analysis is on-going and has revealed various insights to date including:

1) Water loss is widespread throughout the system, varying from 18% in the Elem DMA up to 65% in the Pluth zone.
2) Losses in the Pluth zone represent 28% of the total system loss, despite the relatively small service area. In an effort to express the losses on a relative basis, the amount of loss per foot of distribution line was calculated for each DMA. The gpd/ft of pipe for the Pluth zone was determined to be 3.08 gpd/ft vs. 1.48 gpd/ft for the entire system (roughly twice the system average).
3) Losses in the Keys was found to vary between 18% (most recently) in the West Keys to 41% on average for 2023. This variation may have been due to the valve position on the valve that must be closed to zone off the West Keys.
4) The South-East Keys, a very clean and distinct DMA with a dedicated meter, was found to have a loss of 26% and a relative low loss per ft of pipe at 0.82 gpd/ft.
5) An estimated 60% of the loss is occurring in the General Zone, an area that is calculated by subtracting all the other zones in order to determine its individual DMA system input volume. The overall gpd/mile of the General Zone is reflective of the entire system average at close to 1.5 gpd/ft, thus illustrating that system-wide aspects of the water loss making it very difficult to isolate one particular DMA to significantly affect the overall losses.

***Table 3.20.1**, DMA Analysis and Water Loss Summary Report*

CLOCWD Water Balance Summary Report

Water Balance Report Inputs

				Start Dt	01/01/2023		End Dt	01/01/2024	
CLOCWD System Water Balance After December 2022							Total System Losses		324,294 gpd
Model ID	Model Name	Model Status	Average Daily Water Balance for Node						% of Total Losses
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5	Pluth Zone	Ready	141,967 gpd	49,928 gpd	92,039 gpd	65%	29,884 ft	3.08 gpd/ft	28%
4	Elem Zone	Ready	8,936 gpd	7,304 gpd	1,633 gpd	18%	8,822 ft	0.19 gpd/ft	1%
6	South-East Keys Zone	Ready	32,335 gpd	23,889 gpd	8,446 gpd	26%	10,310 ft	0.82 gpd/ft	3%
7	West Keys Zone	Ready	34,943 gpd	20,569 gpd	14,374 gpd	41%	6,733 ft	2.13 gpd/ft	4%
Sub-System Totals			642,243 gpd	317,949 gpd	324,294 gpd	50%	219,615 ft	1.48 gpd/ft	100%

3.6 Water Treatment Plant Analysis

This section details the findings and recommendations for each process used in treating water at the existing CLOCWD water treatment plant (WTP).

3.6.1 Overview

In general, the CLOCWD WTP appears to be maintained and operated very effectively. Provided flows are maintained below 825 gpm, the plant has historically been able to operate effectively with the limiting factor being the clarifiers when algae is present in the raw water.

3.6.2 Treatment Capacity

The WTP is currently rated at a capacity of approximately 0.9 MGD. Based on input from plant staff it currently has adequate hydraulic capacity to support an estimated 400 additional service connections. At a growth rate of 0.9% as listed in **Section 1.2.1**, the WTP has enough capacity to serve the community of Clearlake Oaks for the foreseeable future (population increase of 21 per year due to 0.9% growth rate, approximate household size from US Census is 2.0, therefore, 10.5 new connections per year. 400 connections/10.5 connections per year equals 40 years). The effectiveness of proposed water loss mitigation programs is expected to have a significant impact on overall demand requirements in the future. The addition of CSA-16 (Paradise Cove) will add approximately 133 connections to the District. These future demands, coupled with the actual impact of proposed water loss mitigation programs should be subject to additional analysis with respect to their impact on overall plant demands once confirmed.

3.6.2.1 2024 Treatment Capacity Update

The capacity referenced above is still accurate except for the extreme algae blooms experienced in recent years due to low lake levels associated with drought conditions. These high turbidity algae blooms curtail the upflow rate of the clarifiers and plant efficiency since the high algae content requires frequent backwashing of the pressure filters beyond normal operations. The frequent backwashing of the pressure filters requires the use of potable water itself, temporarily diverting treated water to the pressure filters which would otherwise be disinfected and stored within the clearwell.

At the request of the Division of Drinking Water, the CLOCWD was required to complete a "Source Capacity Study" in response to concerns that the plant was reaching a point where it would be unable to meet system demands. The following excerpt was provided in the related Executive Summary of the study:

"The maximum daily WTP production capacity is between 0.95 and 1.1 MGD. The available production capacity fluctuates based on Clear Lake water quality. Given that the 2022 MDD was approximately 0.8 MGD, and that this was a historically low-demand year, there is marginal capacity to meet existing system demands. It is recommended that the CLOCWD continues to prioritize reducing real distribution system losses while concurrently increasing WTP production capacity. The CLOCWD WTP is primarily restricted by the treatment capacity of the clarifiers and their impacts downstream on the filters. The

District has requested a grant from the SWRCB DFA for the design of a new upflow clarifier or dissolved air flotation (DAF) system."

The above referenced study recognized that there is marginal capacity to meet system demands during the peak summer season, particularly when there are high algae levels in the lake. The threat to the reliable capacity of the WTP points to the importance of embarking on an aggressive program of pipe repair and replacement coupled with a need to maintain adequate storage which is currently deficient as described elsewhere in this report. Given the extremely high water loss, this two tiered approach involving water loss reduction and improved treatment capabilities is considered critical.

3.6.3 Raw Water Intake

As described in **Section 2.3.2**, raw water is pumped from Clear Lake via two offshore intakes. As both intakes are at the same elevation (approximately 13 feet below the average high water level), the possibility of adding another raw water intake at a lower elevation was examined. As the concentration of algae (cyanobacteria) decreases as depth increases, a deeper raw water intake would allow plant staff the flexibility to draw from a deeper layer of water, thus potentially reducing the amount of *Microcystis* into the plant. An image of the intake jetty is presented on the following page in **Figure 3.11.**

***Figure 3.11**, Raw Water Intake Jetty*



Additionally, the rehabilitation of one of the groundwater wells to supplement lake water during algae blooms would potentially give operators more flexibility in dealing with DBPs in the water treatment process. As discussed further in **Section 4**, a detailed investigation into the historic operating conditions indicated that high iron and manganese levels in the wells at the WTP make this proposition cost prohibitive.

Deficiencies

The threat from cyanobacteria poses a potential threat to water quality, particularly during summer algae blooms. Additional research in this area was on-going at the time this report was prepared. The organic loading associated with the algae, combined with chlorine disinfection, can raise the level of disinfection by-products (DBPs) in treated water.

Recommendations

Potential solutions for reducing algae in the intakes include rehabilitating one of the existing groundwater wells at the WTP, installing a second raw water intake at a greater depth, and/or installing self-cleaning screens on the raw water intake. Mitigation of DBPs associated with algae in the raw water is discussed further, as well as a "no project" option, in **Section 4.**

3.6.3.1 2024 Raw Water Intake Update

In 2022 the CLOCWD installed a new intake pump and pipeline with grant funding by the DWR under the Drought Relief Funding program. Construction of the new intake was in direct response to the low lake levels experienced in 2021 which almost compromised the WTP's ability to provide potable water. During this time the low lake levels subjected the intake pumps to extremely heavy algae which inhibited the upflow capacity of the clarifiers and also required frequent filter backwash operations requiring staff to essentially run the facility nearly 24 hours a day at times.

The new intake pipeline extends nearly 1,300 feet out into the lake where the depth is approximately 26 feet allowing raw water with significantly lower algae content to be pumped to the plant. The intake also features an ISI self-cleaning intake screen which also provides primary filtration and fish protection. The pump consists of a 75 hp trailer mounted centrifugal pump capable of conveying up to 850 gpm. The pump may be mobilized to and from the shoreline as the lake level fluctuates. The pump is controlled by use of a VFD located within a control panel located on the south side of the pressure filter piping building. Since installation of the new intake the raw water turbidity has been significantly reduced during the summer and averages around 5 to 8 NTU while raw water conveyed from the pier averages a turbidity of nearly 20 to 30 NTU. The intake was completed under a permit issued by the California Department of Fish and Wildlife with the understanding that the intake would be used under emergency conditions only and is not considered a permanent facility.

Deficiencies

Recent installation of the new raw water intake pipeline and pump has significantly enhanced treatment process reliability and efficiency however the new intake is still subject to fluctuations within the algae content within the lake and the facility is only permitted as an emergency use facility and is not intended to by used on a year-round basis. In addition, efforts to mitigate water loss within the distribution system have, in general, not reduced water loss significantly and it is likely that production capacity on the plant will need to be optimized rather than counting on a reduction in system demand. With these items in mind, the plant is still at risk of being unable to meet water demands during the summer.

Recommendations

It is recommended that the WTP processes be optimized to maximize the treatment capacity of the facility. Currently the limiting process unit is the capacity of the upflow clarifiers which are limited by the high algae content. The full capacity of the clarifier may be realized by utilizing a pretreatment process to reduce algae content. Or an alternative to a pretreatment process would consist of simply increasing the clarification capacity by construction of a third upflow clarifier.

3.6.4 Pre-treatment

Ozone System

The ozone system provides pre-treatment to mitigate the impact that algae blooms have on water quality. Ozonation is considered a critical component of the overall treatment process for regulatory compliance along with providing safe and reliable drinking water to District customers. O_3 (ozone) is a strong disinfectant and oxidant that provides many benefits with a single application. These benefits include deactivation of bacteria, viruses, and cysts; taste and odor control; and color removal.

Ozonation is used as the primary form pretreatment and is applied immediately after the plant intake facilities. Plant staff typically maximize ozone application when treating algae blooms (cyanobacteria) during the summer. The District utilizes a Pacific Ozone 9M23 ozone gas generator. With the single ozone generator running at full capacity, the plant is capable of producing 21 lbs of ozone per day.

To fully treat the algae blooms during the summer approximately 17 -20 lbs/day is needed to supplement the existing unit. It is recommended that a second unit be installed with an accompanying air compressor. The second ozone generator should be installed in parallel with the existing unit. In addition to aiding in the pretreatment of raw water entering the plant, the second ozone generator would provide critically needed process redundancy and reliability of the treatment process.

Deficiencies

The current ozone production is insufficient to fully pre-treat water during algae blooms. Lack of a second ozone generator and a lack of redundancy in the system poses an unacceptable risk for maintaining treatment during an equipment failure.

Recommendations

A second ozone generator and accompanying air compressor should be installed immediately. The evaluation of this option, as well as a “no project” option, are discussed in **Section 4.1.1.**

3.6.4.1 2024 Pre-treatment Update

The CLOCWD has recently furnished an additional ozone generator and utilizes an Atlas Copco GA18 air compressor with a Hydrovane rotary air compressor as a spare. Currently the north ozone tower is not in use and the staff has indicated their preference for modify the ozone injector to achieve finer diffusion to maximize the disinfection capacity of one tower alone. The potential for other pre-treatment process to enhance clarification capacity are discussed within the Alternatives analysis.

3.6.5 Corrosion Protection

A majority of the unit operations at the water treatment facility are housed above grade within metallic (welded steel) tanks and pressure vessels. In the fall of 2014 the interior and exterior coatings of the upflow clarifiers, clearwell, and pressure filters were inspected to identify corrosion and other coating related deficiencies.

Upflow Clarifiers

The exterior coatings of the both tanks are in fair condition, the average coating thickness is approximately 21 mils. There is serious corrosion damage on the launders of each clarifier as shown in **Figure 3.12** on the following page. The electric potential between the water surface and tank wall was measured to be 373 mV and 382 mV for clarifier 1 and 2 respectively. It should be noted that the welded joints at the launder and sidewall connection is extremely corroded potentially compromising the structural integrity of the lauder.

***Figure 3.12**, External Tank Conditions*



Clearwell

Exterior Coatings: The sidewalls are in relatively good condition as evidenced by an average thickness of 10.5 mils, and no readily visible signs of corrosion. With the exception of the vent, there is little to no corrosion on the roof, however, the vent is seriously corroded. Images of the exterior sidewall and roof vent are presented below in **Figure 3.13.**

***Figure 3.13**, External Tank Conditions*



Interior Coatings: The interior ladder in the clearwell has extreme corrosion and is unusable and unsafe. The supporting beams have also experienced serious corrosion. Condensation formed on the beams drains to the welded joint between the sidewall beam and could pose a serious threat to the structural integrity of the tank if left unchecked. The electric potential between the sidewall and water surface was measured to be 360 mV. Images of the ladder and beams are presented below in **Figure 3.14.**

***Figure 3.14,** Internal Tank Conditions*



The thickness of each exterior wall was measured using a coating thickness gauge.. Samples of exterior wall and interior roof coatings of the clearwell were analyzed for chromium and lead using EPA 6010. The results are presented below in **Table 3.21.**

***Table 3.21**, Clearwell Samples*

Exterior Sidewall				Interior Roof		
Coating	Chromium[1] (mg/kg)	Lead[2] (mg/kg)	Avgerage[3] Thickness (mils)	Coating	Chromium[1] (mg/kg)	Lead[2] (mg/kg)
Styrenated Acrylic	488	ND	10.5	**Styrenated Acrylic**	475	ND

Note:
1 ***Chromium Detection limit of 50 mg/kg***
2 ***Lead Detection limit of 100 mg/kg***
3 ***Average of 4 measurements***

Pressure Filters

Upon visual inspection, the coatings of pressure filters No. 1 and 3 are in relatively good condition and show little to no signs of corrosion. Corrosion is most evident on pressure filter No. 2 as presented below in **Figure 3.15.** The minor corrosion on filter No. 2 may not present an immediate threat to the stability of the structure but it does merit concern.

***Figure 3.15**, External Tank Conditions*



Deficiencies

- The application and maintenance of a high quality paint is the most important part of any corrosion control strategy. The coating of the internal sidewalls and launders for both clarifiers do not provide sufficient corrosion protection and both exhibit serious signs of corrosion. The internal coating of the clearwell is in dire condition at the sidewalls, roof, and beams. If these issues are not addressed, further corrosion could pose a serious threat to the structural integrity of the clarifier launders and clearwell roof. Neither the clarifiers nor the clearwell are equipped with a cathodic protection system. Recently, the need for cathodic protection was confirmed by measurements showing a tank-to-water potential of 360 mV at the clearwell, 373 mV at clarifier 1, and 382 mV at clarifier 2.

Recommendations

- Clearwell renovation of internal components including a thorough tank washout, sandblasting, and application of new high quality prime and finish coatings supplemented by the installation of a cathodic protection system to prevent further corrosion. The ladder is no longer accessible and will need to be removed or replaced.
- The upflow clarifiers need to be washed out, sandblasted, primed, and recoated. The launders should be inspected further to determine if they are salvageable by proper prep work and applying new coatings or if they need to be replaced. The new coatings should be supplemented with the installation of a cathodic protection system.
- The minor corrosion on filter No. 2 does not appear to present an immediate threat to the stability of the structure but does merit concern and should be touched up. The internal condition of the interior still needs to be assessed, and should be scheduled when practical or when changing out filter media.

3.6.5.1 2024 Corrosion Protection Update

The interior of both the clearwell and upflow clarifiers were sand blasted and recoated in 2023 as part of the USDA funded water system improvement project. The clearwell improvements also included replacement of the existing rafters and installation of an impressed current cathodic protection system. The upflow clarifiers improvements also included installation of sacrificial anode cathodic protection system, exterior tank coatings, piping repairs, and repairs to other components which had been severely compromised from corrosion over the years. Recently the District has had all three pressure filters rehabilitated which includes repairs to internal appurtenances and exterior recoating as part of a separate project.

3.6.6 Disinfection Byproducts

The clearwell has a nominal minimum gross volume of 28,000 gallons available for chlorine contact. Based on the regulatory mandated short circuiting factor of 0.2, a net volume of 5,600 gallons is available for chlorine contact, which amounts to approximately 8 minutes at the maximum daily flow of 695 gpm. One log Giardia inactivation is required, which requires a CT of between 20 and 30 under typical summer conditions of temperature and pH. Under worst conditions of pH and temperature, say a temperature of 20C and a pH of 8.5, a CT of over 40 would be required, which would mean a chlorine residual of 4.0 mg/l leaving the plant. This would surely lead to the formation of DBP throughout the distribution system under present conditionsOnce additional storage capacity is added in the distribution system, as is strongly recommended, the problem will likely become more severe.

The situation becomes even more serious if cyanotoxicity becomes a health concern. If the current Health Advisory (HA) of 0.3 ug/l for Microcystin-LR becomes a regulatory requirement, a CT of several times that for Giardia inactivation would be required, mainly because of the relatively high pH in the clearwell.

The installation of VFDs on the high service pumps to make them variable speed will give the operators more flexibility in achieving disinfection at reasonable chlorine residual. However, considerably more needs to be done to mitigate potential DBP formation, therefore further discussion of DBPs is continued in **Section 4**.

Lowering the pH is probably the easiest improvement to implement and will accomplish the most because the required CT for Giardia and Microcystin-LR is highly dependent upon pH. For example, the CT at a pH of 7.0 is a fraction of that for Microcystrin-LR at a pH of over 8.5. There is the same benefit for Giardia inactivation at a lower pH, although not quite so significant. Achieving a lower pH can be accomplished by using alum as a coagulant at a fairly high dose, or injecting an acid as a part of pre-treatment. The efficacy of both can easily be evaluated with jar testing followed by a plant scale test, although the plant scale test would require regulatory approval.

Based on discussions with plant staff regarding previous alum jar tests, the amount of alum required to lower the pH to a level that would result in a beneficial reduction in CT time would create issues in other parts of the treatment process. Megadosing alum in quantities significant enough to reduce pH would also result in an unwanted turbidity increase in the clarifiers and excessive sludge. Due to the poor performance of alum changes in the current polymer process is not proposed as a mitigation measure at this time.

Another option to mitigate DBPs would be to use one of the existing ozone contact tanks for post disinfection after the GAC filters. This would require significant process/piping modifications including; installation of the second ozone generator; construction of a duplex pump station; and additional instrumentation. The CT for disinfection using ozone is much less than that for chlorine, although chlorine would still have to be used to maintain a residual in the distribution system.

Another alternative that could mitigate DBPs is the construction of a one-way supply line from the high service pumps to one of the storage tanks, presumably the tank at Shady Lane or the proposed tank at

High Valley. This, combined with variable speed high service pumps, would considerably increase the operator's flexibility in achieving the required CT at a lower chlorine residual.

Other approaches to minimize the formation of DBP include removing more TOC during clarification by converting to alum and lowering the pH, although it should be noted that TOC removals at the plant far exceed regulatory guidelines at the present time.

The District presently pre-chlorinates, which tends to convert TOCs in the raw water to DBP. The District should try discontinuing this practice, particularly during periods of high TOCs in the raw water. Potential undesirable effects on clarification and filtration would be offset by a reduction in DBPs in the distribution system.

Other potential alternatives for minimizing DBPs include the previously discussed single line from the high service pumps to the first distribution storage tank, which would permit a lower chlorine residual for achieving the required one log inaction for Giardia although DBP would still be an issue at other more distant storage tanks. Using one of the existing ozone contactors for post ozonation would also allow a much lower chlorine residual leaving the clearwell – In fact, a chloramine residual could possibly be all that would be required in that case.

THM sampling performed as recent as August showed a total THM concentration of 34.6 µg/L for finished water entering the distribution system from the clearwell. Considering the mitigation strategies outlined above, it is difficult to determine the net reduction in THMs each improvement would have on finished water leaving the facility. However, what is known is that the general strategy of reducing the formation potential at the source before implementing strategies for removal in the distribution system has been recognized throughout industry as an effective preemptive measure.

Depending of the effectiveness of these mitigation efforts, and the rate by which THMs form within the distribution system, a THM removal system (i.e. an aeration system) may be necessary within the clearwell. Fast reactions will form high concentrations within the clearwell and show a marginal increase within the distribution system while slow reactions develop a majority of the THM concentration within the system itself.

Based on the limited sampling data available, there is evidence that a significant portion of THM formation occurs within the distribution system. The samples collected in August also showed total THM concentrations of 66.6 µg/L at the far west extent of the system off Highway 20 near the proposed location for the Harvey tank site, nearly double the concentration upon entering the system, thus presenting evidence that THM formation is occurring within the distribution system.

Again, depending on the effectiveness of mitigation efforts made at the treatment facility, further THM sampling will be needed to determine whether an aeration system would be needed and at which location.

Deficiencies

There is no pH control at the plant to aid in achieving desirable CT values or optimization of coagulant dosing to mitigate DBP formation. The maximum ozone generation is insufficient during algae blooms during the summer and the plant has no redundant ozone unit. Various factors, including high pH and high levels of cyanobacteria in raw source water, create a serious potential for DBP contamination in the treated water system.

Recommendations

Various strategies for mitigating DBPs in the treated water produced by the WTP exist. Potential mitigating solutions include the following:

- Constructing a one-way fill line from the WTP to one water storage tank in the District
- Installing VFDs on the high service pumps
- Lowering the water pH by adding acid
- Installing aerators in storage tanks for DBP removal
- Modifying WTP site piping to allow an existing ozone contact tower to be used for post ozonation
- Increasing the TOC removed by the clarifiers
- Adding ammonia to water leaving the chlorine contact tank to reduce chlorine residual

The evaluation of these options, as well as a "no project" option, are discussed in **Section 4.1.**

3.6.6.1 2024 Disinfection Byproducts Update

TTHM removal equipment was installed inside the WTP clearwell in 2022 as part of the USDA funded water system improvement project. The installation consisted of two spray aerators, one mixer, and one power vent. With the equipment in service, the typical THM concentration was measured to be 13 µg/L, half the THM concentration (27 µg/L) measured without the equipment in service. While the equipment has reduced concentrations by 50% within the clearwell, significantly improving water quality, additional treatment will be required within the distribution system where THM continues to form in the presence of chlorine residual and organic content.

Reconfiguring one of the two ozone towers for the purpose of post ozonation is no longer recommended since ozone treatment will not prevent or inhibit the growth of THMs within the far reaches of the distribution system. For the same reason, other strategies which involve reducing the production of disinfection byproducts within the clear well will not be prioritized. Instead, the following projects are recommended:

1. Installation of THM removal equipment within the distribution system.
   Currently, only the Paradise Cove tank features THM removal equipment which consists of two spray aerators and a roof blower. Except for the Shady Lane tank, it is expected all of the other tanks within the system will ultimately require THM removal equipment. The prioritization of tank site improvements is based on reducing the THM concentration at the current sample points:

Paradise and Mesa-Stubbs. Further analysis of tank site prioritization, and the development of THMs within the distribution system are discussed within **Section 3.8.4.1**.

2. TOC reduction by additional plant processes or process modifications.
Removal of organic matter (humic compounds) within the process train of the WTP will partially inhibit the production of THMs within the distribution system since the distribution system itself contains organic matter for free chlorine to react with. The extent to which each of these two sources of organic matter contribute to the formation of THMs within the distribution system is unknown but these improvements should be pursued since they would be mutually beneficial to the overall production capacity of the WTP and the mitigation of THMs. Additional plant processes and modifications which would reduce organic matter include installation of a dissolved air floatation unit, rapid ballast clarification (Actiflo), or polymer modifications to the existing clarification processes.

3.6.7 Granular Activated Carbon Filtration

Granular Activated Carbon (GAC) in Filter

The GAC system provides taste and odor treatment and is a critical component of the overall treatment process at the WTP. The GAC also helps maintain regulatory compliance along with providing safe and reliable drinking water to the District customers. The filter media was originally programmed for replacement every five years and was reportedly last replaced in 2014. However, a 5-year replacement timeline may not be sufficient to keep the GAC operating at an efficient level. Data related to TOC removal has suggested that the GAC lifespan is much shorter than anticipated. With a high organic loading, historical operating data indicates that GAC could be effectively spent in one season. As presented in **Figures 3.16** and **3.17** the GAC filter media replacement in the summer of 2014 significantly decreases the TOC in finished water, but quickly rises to pre-replacement levels by the spring of 2015.

***Figure 3.16**, Finished Water TOC (mg/L vs. time)*

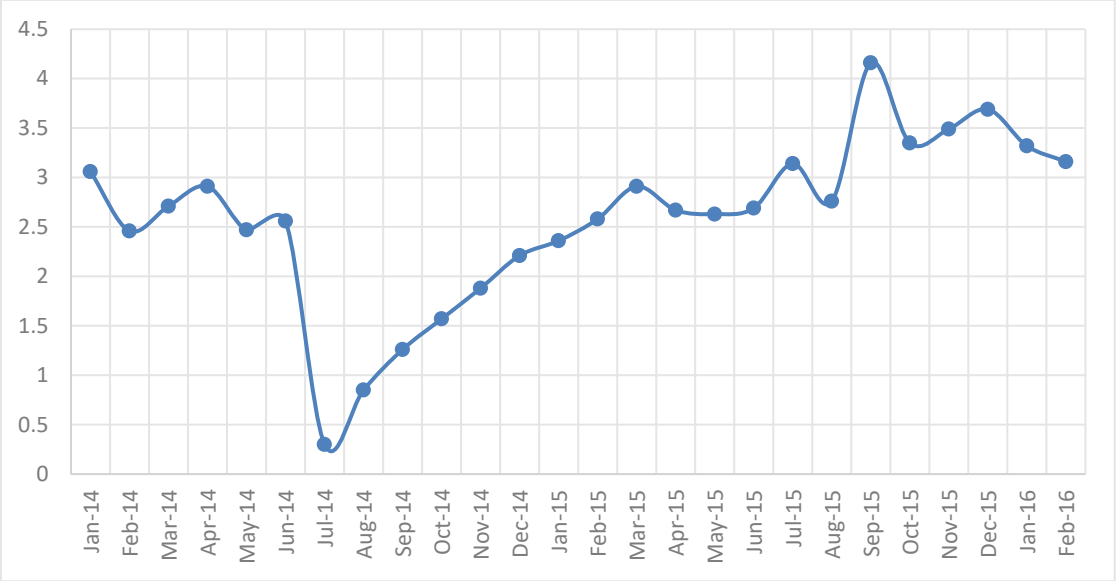
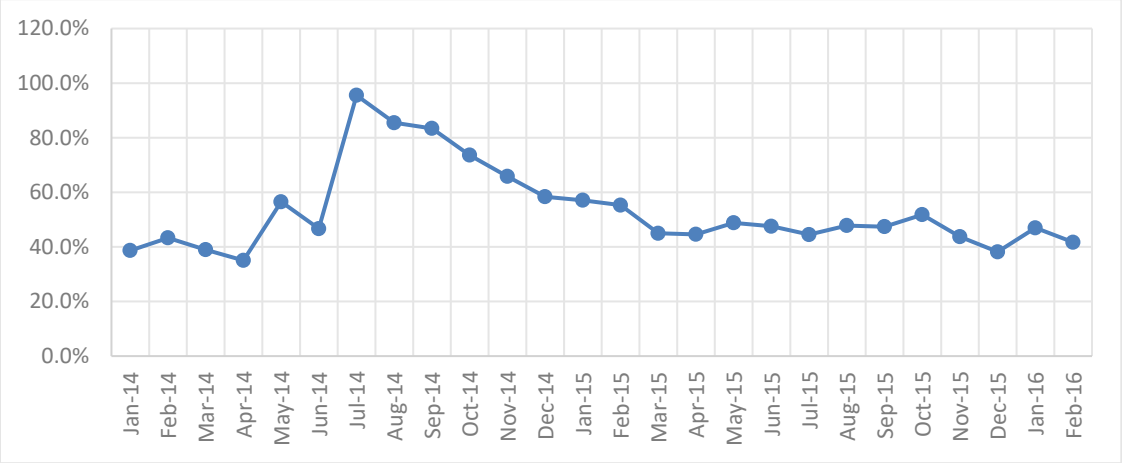


***Figure 3.17**, Percent TOC Removal Finished vs Raw Water*



Deficiencies

The GAC media has reached its useful life and is ready for replacement. Pending additional analysis, the District may need to increase the frequency with which the GAC is replaced.

Recommendations

Replace GAC media and track removal efficiencies. Revise replacement time based on a more detailed analysis of GAC effectiveness over time. The evaluation of this option, as well as a "no project" option, is discussed in **Section 4.1**.

3.6.8 High Service Pumps

There are three high service pumps which pump water from the plant clearwell into the main pressure zone which is controlled by the level in the Pluth tank. The total dynamic head (TDH) is estimated at approximately 125 psi. Currently, Pump No. 3 is capable of pumping approximately 630 gpm. Pump No. 2 can pump at approximately 500 gpm. Pump No. 1 is a high horsepower pump that is old and is reserved as a backup. At a minimum, Pump No. 2 should be replaced with larger pump capable of producing 750 gpm during peak summer demands.

According to plant staff, running more than one pump may cause high pressure surges under existing conditions which would likely result in increased risk for pipe breaks in the distribution system. Because the clearwell is used to maintain contact time (CT) required for achieving the required disinfection levels, plant staff need to limit discharge flows in order to achieve the necessary detention time. Currently they rely on throttling the discharge using a manually operated valve to reduce flows accordingly. This results in a loss of efficiency and higher energy costs for the District.

Variable speed drives are proposed on the high lift pumps that draw water from the clearwell. The variable rates of discharge are necessary in order for plant operators to control contact time in the clearwell without the need to throttle a valve on the discharge side of the pumps which limits control capabilities and wastes energy.

Operating a pump at full speed and throttling the flow using a valve is very inefficient. A more appropriate and efficient method is to control the pump speed using a Variable Frequency Drive (VFD). The VFD replaces the across the line motor starter and allows the pump to vary in speed which allows the flow to be varied accordingly. A two pump system with VFD's would provide the plant staff with the ability to operate the plant with a wide range of efficient flow rates that can be utilized to match various water demands and tank level setpoints in the system.

Deficiencies
Lack of VFDs on High Service Pumps require District staff to throttle pumps to maintain desired flows. High Service Pump 2 undersized and should be replaced with a larger pump.

Recommendations
Install VFDs on High Service Pumps. Replace High Service Pump 2. The evaluation of these options, as well as a "no project" option, are discussed further in **Section 4.1.2.**

3.6.8.1 2024 High Service Pumps Update

The primary split case pump (100 hp motor) has since been equipped with VFD control. The existing 60 hp secondary pump has not been equipped with a VFD. Staff has indicated that VFD controls for the primary and secondary pumps would be adequate and that VFD controls on the 60 hp external pump (tertiary pump) is not necessary in the immediate future. As previously recommended, High Service Pump 2 is still undersized and should be replaced with a larger pump.

Deficiencies
Lack of VFDs on High Service Pumps require District staff to throttle pumps to maintain desired flows to meet high demands while preventing damage to distribution piping due to water hammer.

Recommendations
Remove the existing secondary pump and install a new 75 hp pump with control panel featuring a VFD control.

3.6.9 Washwater Recovery System

Filter and GAC Backwash

Filter backwash water is presently discharged directly into the sewer system. The resulting discharge causes a peak surge at the nearby sewage lift station and at the Waste Water Treatment Plant (WWTP). The installation of an equalization tank would mitigate the surges as well as give the District some flexibility if there were maintenance and capacity issues within the collection system. Removing solids downstream of the equalization tank is feasible with Dissolved Air Flotation (DAF). A DAF unit would have a high initial cost, particularly if the resulting solids were dewatered at the WTP, as opposed to being transported to the WWTP for processing. However, solids removal at the WTP is not considered feasible and the untreated backwash water can simply be released slowly from the equalization tank to the sewer to limit peak flows.

Recycling the clarified water from the DAF unit by sending it back into the treatment process would reduce the amount of raw water presently being purchased, but would add to the concerns regarding cyanotoxicity. Returning backwash water to the process is not recommended until such time that the regulatory issues concerning Microcystin-LR are finalized.

Deficiencies

Lack of equalization tank puts hydraulic load on LS7, LS2, and the WWTP.

Recommendations

The installation of an equalization tank to reduce the hydraulic loading at LS7, LS2, and the WWTP is recommended. Installation of associated flow meter, manual valve, and cleanout on gravity effluent line should also be included. The evaluation of these options, as well as a “no project” option, are discussed further in **Section 4.1.2**.

3.6.10 Backup Generator

The treatment plant has an existing 250 kw diesel generator which at the time this report was prepared was out of commission. The generator was built in 1967 and is at the end of its useful life and should be replaced.

Load calculations prepared by a proposed generator supplier were reviewed and a 250 kw generator was determined to be the correct size by plant staff. The existing generator is connected to the electrical system through an existing automatic transfer switch (ATS). The switch does not meet current requirements for Arc Flash protection. The transfer switch can be replaced at the same time as the generator and can be part of the generator skid. The existing generator and ATS are not connected to the SCADA system.

Recommendations

As of the time of writing this report, the District has purchased and installed a new 250 kW generator out of necessity to provide backup power in case of a power outage. Additional features to provide a more complete system may be required, including SCADA interface, panel modifications, etc.

3.7 Water Distribution System Analysis

3.7.1 Water Main Replacement Program

The original design intent of the existing distribution system appears to have been focused on meeting domestic flows with little attention to accommodating firefighting under emergency conditions. Furthermore, many of the mains and services are old and have had a long history of leaks and breaks. Given the relatively widespread deficiencies, a system of ranking and prioritizing pipe replacements was needed to determine the highest priority projects with consideration of limited funding. A desktop analysis was performed that included reviewing the entire distribution system. All pipes in the system were ranked according to a variety of criteria that included pipe age, leak history, fire flow capacity, and other operational considerations.

A conditional assessment matrix, prepared by MC Engineering, was developed to provide more accurate and updated information regarding the importance and need to replace and upgrade the existing main-line water distribution system pipes, including house services and other various components and appurtenances. The water distribution main-line evaluation and matrix included the evaluation criteria presented below in **Table 3.22** to provide CLOCWD with a method of prioritizing its most important financial, health and safety, and operational needs associated with the distribution system in order to ultimately design and construct new and upgraded facilities. Additional importance was placed on pipe size, leak history and fire flow capacity.

***Table 3.22**, Pipeline Evaluation Criteria*

Pipeline Evaluation Criteria		
Criteria	**Rating 1=Best 5=Worst**	**Weighted Factor (additional importance)**
Pipe size (Q's/pressures/fire flows)	1 to 5	7
Pipe Age (Deterioration/leaks)	1 to 5	3
Leaks/Complaints (Leak pattern/complaints)	1 to 5	7
Mainline Location (Access/dependability)	1 to 5	5
Sys. Pressure (Modeling results)	1 to 5	3
Fire Flow (Spacing/customers affected, flows)	1 to 5	5
The evaluation criteria have been modified to place more importance on the overall pipeline condition, age, and overall reliability.		

All water distribution system pipelines were re-assessed with significant input provided by the operational staff including consideration of more recent changes in the pipe condition and other trends. The result of the distribution system analysis and prioritization is presented in **Table 3.23**. A high ranking indicates a good candidate for replacement, while a comparatively low ranking indicates a pipeline that may be suitable for continued use.

***Table 3.23**, Pipeline Assessment Matrix*

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Ranking System						Rank	Master Plan Priority
								Category and Rank							
								Pipe Size	Pipe Age	Leaks/ Complaints	Mainline Location/ Access	System Pressure[1]	Fire Flow		
								1 - 5 (WF = 7)	1 - 5 (WF = 5)	1 - 5 (WF = 7)	1 - 5 (WF = 5)	1 - 5 (WF = 3)	1 - 5 (WF = 5)		
Harvey	HA 21	Terry Dr & Mudie Ln (Field)	Harvey Blvd	Tie in with 4"	2	GI	268	5	4	0	5	2	5	**103**	Phase I
Harvey	HA 22	Harvey Blvd	Young Dr	Terry Dr	0.75	GI	138	5	4	0	2	2	5	**88**	Phase I
Harvey	HA 30	S. Hwy 20	Swanson	Olson	0.75	Poly	709	5	4	0	3	2	5	**93**	Phase I
Harvey	HA 31	Mitchell Rd	Harvey Blvd	125 ft NE	2	GI	125	5	4	0	5	2	4	**98**	Phase I
Harvey	HA 32	Harvey Blvd	Mitchell Rd & Terry Dr (Field)	Mittchell Rd	2	GI	117	5	4	0	5	2	4	**98**	Phase I
Harvey	HA 17	Mitchell Rd & Terry Dr (Field)	Harvey Blvd	Tie in with 4"	2	GI	369	4	5	0	5	2	5	**99**	Phase I
Harvey	HA 19	Mitchell Rd & Terry Dr (Field)	Tie in with 4"	Mitchell Rd (Field)	4	AC	222	4	4	0	5	2	3	**86**	Phase I
Harvey	HA 41	C. Hwy 20	Swanson	Olson	0.75	GI	42	4	5	2	2	2	5	**98**	Phase I
Harvey	HA 20	Terry Dr (Field)	Young	Mitchell	4	AC	246	3	4	0	5	2	4	**84**	Phase II
Harvey	HA 6	Hillcrest Dr	Terrace	End of LIne (DE)	4	WWS	534	3	4	0	3	2	4	**74**	Phase II
Harvey	HA 29	C. Hwy 20	W of Henderson	North Side of Hwy 20	2.5	GI	46	3	4	0	3	2	5	**79**	Phase II
Harvey	HA 42	C. Hwy 20	Harvey Blvd	Harvey Blvd	2	GI	35	4	5	0	2	2	4	**79**	Phase II

Harvey	HA 12	S. Hwy 20	Harvey Blvd	Hillcrest Dr	2	GI	533	4	5	0	2	2	4	**79**	Phase II
Harvey	HA 11	S. Hwy 20	Henderson Dr	Swanson	2	GI	1422	4	5	0	2	2	4	**79**	Phase II
Harvey	HA 4	Put Dr	W. End of Road	Spring Rd	2	GI	240	4	5	0	1	3	3	**72**	Phase II
Harvey	HA 3	Put Dr	Spring Rd	E. End of Road	2	GI	354	4	5	0	1	3	3	**72**	Phase II
Harvey	HA 5	Pingree Rd	Spring Rd	End of Street	4	AC	434	4	4	0	1	2	3	**66**	Phase II
Harvey	HA 2	Spring Rd	Hwy 20	End of Street	4	AC	634	3	4	0	1	2	3	**59**	Phase II
Harvey	HA 7	Terrace Dr	Hillcrest Dr	End of Street	2	GI	314	4	5	0	1	2	5	**79**	Phase II
High Valley	**HV 22**	Lakeview Dr	High Valley Rd (Field)	High Valley Rd	4	AC	1482	5	4	2	1	1	5	**94**	Phase I
High Valley	**HV 13**	Lakeview Dr	The Plaza	Oak Grove Ave	4	AC	2389	5	4	2	1	1	5	**94**	Phase I
High Valley	**HV 21**	E. Oak Grove Ave	Hwy 20	W. Oak Grove Ave	4	AC	962	3	4	3	1	1	4	**82**	Phase II
High Valley	**HV 1**	Center Way	W. Oak Grove Ave	E. Oak Grove Ave	2	GI	607	5	5	0	1	1	4	**78**	Phase II
High Valley	**HV 3**	High Valley Rd	Hwy 20	Lakeview Dr	4	AC	337	4	4	0	1	2	4	**71**	Phase II
High Valley	**HV 11**	Cerrito Dr	Tie in 6" AC	End of Pipe	4	AC	379	3	4	0	1	3	3	**62**	Phase III
Keys	K 107	Lake St	Hwy 20	6th St	2	GI	1176	5	4	2	1	1	4	**89**	Phase I
Keys	K 113	Schindler St	Hwy 20	6th St	2	GI	1501	5	4	5	1	2	5	**118**	Phase I
Keys	K 105	3rd St	Lake St	Schindler St	2	GI	965	5	4	3	1	1	5	**101**	Phase I

Keys	K 95	5th St	Lake St	Schindler St	2	GI	668	5	4	2	1	1	5	**94**	Phase I
Keys	K 65 & K 67	N. Hwy 20	Lake St	Schindler St	4	AC	1350	5	4	0	3	1	4	**85**	Phase I
Keys	K 25	S. Hwy 20	Lake St	Schindler St	4	AC	1397	5	4	0	3	1	4	**85**	Phase I
Keys	K 89	C. Hwy 20	N. Hwy 20	S. Hwy 20	4	AC	74	5	4	0	3	1	4	**85**	Phase I
Keys	K 103 & K 102	Hwy 20	Butler St	Keys Blvd	4	AC	1574	5	4	0	3	1	4	**85**	Phase I
Keys	K 64	Shoreview Dr	Blue Heron Ct	End of Street	4	AC	1135	3	4	5	1	1	4	**96**	Phase I
Keys	K 88	Island Dr	Oak Knoll Ave	End of Street	1.5	GI	834	5	4	2	1	1	5	**94**	Phase I
Keys	K 69	Hwy 20	N. Short St	Lake St	4	AC	1767	4	4	2	2	1	5	**92**	Phase I
Keys	K 56	1st St	Lake St	Schindler St	2	GI	1244	5	4	0	1	1	5	**80**	Phase II
Keys	K 104	2nd st	Lake St	Schindler St	2	GI	1113	5	4	0	1	1	5	**80**	Phase II
Keys	K 53	4th St	Lake St	Schindler St	2	GI	819	5	4	0	1	1	5	**80**	Phase II
Keys	K 94	6th St	Schindler St	Schindler St	2	GI	363	5	4	0	1	1	5	**80**	Phase II
Keys	K 124	Island Dr	Hwy 20	Oak Knoll Ave	4	AC	1734	5	4	0	1	1	5	**80**	Phase II
Keys	K 86 & K 129	Oak Knoll Ave	Island Dr	End of Street	4	AC	891	3	4	4	1	1	3	**84**	Phase II
Keys	K 68	Short St	Hwy 20	Hwy 20	4	AC	752	4	4	1	1	1	5	**80**	Phase II
Keys	K 72 & K 73	Hwy 20	S. Short St	Island Dr	4	AC	1003	4	4	0	1	1	5	**73**	Phase II

Keys	K 49	Lake St	End of 6" Pipe	End of Street	4	AC	106	1	4	2	1	1	1	**46**	Phase III
Keys	K 51	Shaul St	Hwy 20	6th St	4	AC	941	3	4	0	1	2	3	**59**	Phase III
Keys	K 26	Hoover St	Hwy 20	4th St	4	AC	915	2	4	0	1	1	4	**54**	Phase III
Keys	K 122	Ketch Ct	Surf Ln	End of Street	4	AC	250	2	4	2	1	1	2	**58**	Phase III
Keys	K 20	Pebble Way	Everglade Blvd	S. End of Street	4	AC	321	2	4	2	1	1	2	**58**	Phase III
Keys	K 60	Blue Heron Ct	End of 6" Pipe	End of Street	4	AC	328	3	4	0	1	1	1	**46**	Phase III
Keys	K 61	Island Cir	Blue Heron Ct	W. End of Street	4	AC	1135	3	4	0	1	1	4	**61**	Phase III
Keys	K58	Island Cir	Blue Heron Ct	E. End of Street	4	AC	132	3	4	0	1	1	4	**61**	Phase III
Plaza	P 5	Foothill Blvd	Oak St	Hwy 20	4	AC	594	4	4	2	2	1	5	**92**	Phase I
Plaza	P 8	Oak St	Foothill Blvd	The Plaza	4	AC	1050	5	4	5	1	1	5	**115**	Phase I
Plaza	P 3	Acorn St	Foothill Blvd	Hwy 20	4	AC	326	3	4	0	3	1	5	**76**	Phase II
Plaza	P7	The Plaza	Lakeview Dr	The Plaza (Park)	4	AC	843	4	4	2	2	1	3	**82**	Phase II
Plaza	P9	Pine St	Foothill Blvd	The Plaza	4	AC	1066	5	4	0	1	1	4	**75**	Phase II
Pluth	PL 3 & PL 36	Sulphur Bank Rd	Hwy 20	End of Line (FH)	4	AC	3001	4	4	2	1	3	5	**93**	Phase I
Pluth	PL 10	Sulphur Bank Rd (Field)	680 Sulphur Bank Rd	Fire Hydrant	4	AC	550	4	4	0	5	2	4	**91**	Phase I
Pluth	PL5	Hwy 20	Keys Blvd	Orchard Shores Dr	4	AC	2620	5	3	0	3	2	5	**90**	Phase I

Pluth	PL 20, PL 26, & PL 31	WWTP (Field)	WWTP	Tie into 8"	4	AC	3863	4	4	0	2	4	5	**87**	Phase I
Pluth	PL 66	Hwy 20	Round Mountain Rd	Morine Ranch Rd	2	GI	1908	4	4	0	3	3	5	**89**	Phase I
Pluth	PL 17	Tomalee Ln (Field)	Tomalee Ln	Tie in (Backyard)	4	PVC	226	4	3	0	3	3	5	**86**	Phase I
Pluth	PL 15	Morine Way (Field)	Morine Way	Lee Ct	4	PVC	435	5	3	0	3	3	5	**93**	Phase I
Pluth	PL 4	Hwy 20	Orchard Shores Dr	Sulpher Bank Dr	4	AC	1049	4	4	0	2	2	4	**76**	Phase II
Pluth	PL 21, PL 27, PL 40, & PL 41	Pomo Rd	Elem Rd	Elem Rd (Tie in to 8")	4	AC	2782	4	4	0	1	4	5	**82**	Phase II
Pluth	PL 33	Elem Rd	Pomo Rd	Pomo Rd	4	AC	583	4	4	0	1	4	5	**82**	Phase II
Pluth	PL 19 & PL 34	Jensen Rd	Sulpher Bank Rd	WWTP	4	AC	1844	4	4	0	1	3	5	**79**	Phase II
Pluth	PL 42	McBride Ct (Field)	McBride Ct	Backyard Main	4	PVC	235	4	3	0	2	3	5	**81**	Phase II
Pluth	PL 18	McBride Ct & Tomalee Ln (Backyard)	Round Mountain Rd	Morine Ranch Rd	4	PVC	1385	4	3	0	3	3	4	**81**	Phase II
Pluth	PL 11	Morine Ranch Rd	Tomalee Ln	End of Line (DE)	4	PVC	629	5	3	0	1	3	5	**83**	Phase II
Pluth	PL 16	Morine Way	Morine Ranch Rd	End of Line (DE)	4	PVC	860	5	3	0	1	3	5	**83**	Phase II
Pluth	PL 30	Jensen Rd	WWTP	End of LIne (DE)	2	PVC	966	1	3	0	2	2	4	**52**	Phase III
Pluth	PL 14	Lee Ct	Morine Ranch Rd	End of Line (DE)	4	PVC	314	3	3	0	1	3	3	**59**	Phase III
Pluth	PL 78	Sanns Ct	Tie in with 6"	Morine Ranch Rd	4	PVC	65	2	3	0	1	3	2	**47**	Phase III
Pluth	PL 37	Morine Ranch Rd	Sanns Ct	End of Line (DE)	4	PVC	171	2	3	0	1	3	2	**47**	Phase III

Shady Lane	SL 2	Widgeon Way	Shady Lane	The Plaza	4	AC	1790	4	4	0	1	1	5	**73**	Phase II
Shady Lane	SL 5	Manzanita Ct	Lakeview Dr	End of Line (DE)	2	GI	397	4	5	0	1	1	4	**71**	Phase II
Shady Lane	SL 8	Laura Way	Widgeon	Lakeview	2	GI	584	3	5	0	2	1	4	**69**	Phase II
Shady Lane	SL 36	Hwy 20	Beryl	Widgeon Way (Field)	2	GI	1353	2	4	0	5	1	4	**74**	Phase II
Shady Lane	SL 29	Widgeon Way (Field)	Highway 20	Widgeon Way	4	AC	306	2	4	0	5	1	4	**74**	Phase II
Shady Lane	SL 4, SL 7, SL 6 & SL 11	Lakeview Dr	The Plaza	Lakeview Dr (Field)	4	AC	1959	3	4	0	1	1	3	**56**	Phase III
Shady Lane	SL 34	Lakeview Dr	Beryl	End of Line (West)	2	GI	163	3	4	0	1	1	2	**51**	Phase III
Shady Lane	SL 32	Garden Ct (Field)	Garden Ct	Hwy 20	2	GI	147	2	5	0	1	1	3	**52**	Phase III
Shady Lane	SL 33	Beryl Way	Lakeview Dr	Hwy 20	4	AC	522	3	4	0	1	1	4	**61**	Phase III
Shady Lane	SL 35, SL 36, & SL 57	Garden Ct	Highway 20	End of Line (DE)	2	GI	1017	3	4	0	1	1	2	**51**	Phase III

In addition to the deficiencies identified in specific pipeline runs as outlined above in **Table 3.23**, additional deficiencies were noted as follows:

***Deficiency* - Inadequate fire flow capacity in the Harvey (Zone 5) and Pluth tank (Zone 1) pressure zones**
Previously conducted hydrant testing by the CLOCWD in 2005-2006, along with more recent hydraulic model analysis, identified poor system pressure resulting in Limited fire flow capacity in Zone 1 and the proposed Zone 5 systems.

***Deficiency* – Backyard Mains in Zone 1 near Harvey Blvd**
Zone 5 near the proposed Harvey tank has approximately 1227 LF of existing mains located in backyards making operation and maintenance very difficult. Most of these back-of-lot mains are undersized, with a diameters of 4-inches or less.

2024 Update
Regarding the deficiencies identified above, completion of the Harvey tank and pipelines has significantly enhanced fire flow protection within Zone 5 and no pipeline projects are recommended to increase fire protection within Paradise Cove service area. Low system pressures and low storage capacity of Zone 1 during fire flow demands can be remedied with the improvements recommended in **Section 3.2.3.2**. The backyard mains bound by Harvey Boulevard have since been abandoned following the installation of new 6” mains on Mitchell Road, Terry Drive, Harvey Boulevard, and Young Drive.

3.7.1.1 2024 Water Main Replacement Program

An updated pipeline priority assessment matrix is presented in **Table 3.23.1** on the following page. Notable changes to the table included removal of completed projects and reassessing the priority of select pipelines. Pipelines promoted to Phase 1 priority include:

- Blue Heron Court
- Center Way
- Island Drive
- Oak Knoll
- Island Circle (West side)
- Short Street
- Garden Court

Many of these streets were prioritized since they feature either a small diameter galvanized iron or asbestos cement pipe prone to failure under the high pressure associated with the low elevation in the Keys. The location of historic leak repairs is presented in **Figures 3.12**, **3.13**, and **3.13.1**. In all cases each line is severely undersized. Other pipelines promoted to the priority assessment matrix include 80 feet of 6-inch PVC piping located on Mesa Drive which was completely lost to a landslide. This line provided fire flow capacity to the Konocti pressure zone and served as a redundant fill line between the Shady Lane

pump station and the Konocti Tank; this pipeline has been assigned to Phase II priority replacement. As previously mentioned in this section the 6 inch AC pipeline between Lakeview Drive and Hillside Lane located on Widgeon Way is currently restricting flows to a fraction of its true capacity, since this line serves as a transmission line between the Shady Lane tank and the Harvey tank its replacement should be considered high priority if it can not be rehabilitated to its original capacity, this pipeline has been added to Phase II priority. A map showing the location of the pipeline priority replacements is presented in **Figure 5.4.1** of Section 5.

Table 3.23.1, 2024 Updated Pipeline Assessment Matrix

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Pipe Size, 7	Pipe Age, 3	Leaks/ Complaints, 7	Mainline Location/ Access, 5	System Pressure, 3	Fire Flow, 5	Rank	Master Plan Priority
Keys	K 113	Schindler St	Hwy 20	6th St	2	GI	1501	5	4	5	1	2	5	**118**	Phase I
Keys	K 107	Lake St	Hwy 20	6th St	2	GI	1176	5	4	5	1	1	4	**110**	Phase I
Keys	K 61	Island Cir	Blue Heron Ct	W. End of Street	4	AC	1135	5	5	3	2	1	4	**104**	Phase I
Keys	K 103 & K 102	Hwy 20	Butler St	Keys Blvd	4	AC	1574	5	5	0	3	4	5	**102**	Phase I
Keys	K 64	Shoreview Dr	Blue Heron Ct	End of Street	4	AC	1135	3	4	5	1	1	5	**101**	Phase I
Keys	K 124	Island Dr	Hwy 20	Oak Knoll Ave	4	AC	1734	5	4	3	1	1	5	**101**	Phase I
Keys	K 68	Short St	Hwy 20	Hwy 20	4	AC	752	4	4	4	1	1	5	**101**	Phase I
Keys	K 105	3rd St	Lake St	Schindler St	2	GI	965	5	4	3	1	1	5	**101**	Phase I
Keys	K 69	Hwy 20	N. Short St	Lake St	4	AC	1767	4	4	2	2	4	5	**101**	Phase I
Plaza	P 5	Foothill Blvd	Oak St	Hwy 20	4	AC	594	4	4	2	2	4	5	**101**	Phase I
Keys	K 89	C. Hwy 20	N. Hwy 20	S. Hwy 20	4	AC	74	5	5	0	3	5	4	**100**	Phase I
Keys	K 65 & K 67	N. Hwy 20	Lake St	Schindler St	4	AC	1350	5	4	1	3	3	4	**98**	Phase I
Keys	K 56	1st St	Lake St	Schindler St	2	GI	1244	5	5	2	1	1	5	**97**	Phase I
Keys	K 104	2nd st	Lake St	Schindler St	2	GI	1113	5	5	2	1	1	5	**97**	Phase I
Keys	K 53	4th St	Lake St	Schindler St	2	GI	819	5	5	2	1	1	5	**97**	Phase I
Keys	K 94	6th St	Lake St	Schindler St	2	GI	363	5	5	2	1	1	5	**97**	Phase I
Pluth	PL 3 & PL 36	Sulphur Bank Rd	Hwy 20	End of Line (FH)	4	AC	3001	4	4	2	1	4	5	**96**	Phase I
Keys	K 86 & K 129	Oak Knoll Ave	Island Dr	End of Street	4	AC	891	3	4	4	1	3	4	**95**	Phase I
Keys	K 60	Blue Heron Ct	End of 6" Pipe	End of Street	4	AC	328	5	4	4	1	3	1	**94**	Phase I
Keys	K 95	5th St	Lake St	Schindler St	2	GI	668	5	4	2	1	1	5	**94**	Phase I
Keys	K 88	Island Dr	Oak Knoll Ave	End of Street	1.5	GI	834	5	4	2	1	1	5	**94**	Phase I

Table 3.23.1, 2024 Updated Pipeline Assessment Matrix

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Pipe Size, 7	Pipe Age, 3	Leaks/ Complaints, 7	Mainline Location/ Access, 5	System Pressure, 3	Fire Flow, 5	Rank	Master Plan Priority
High Valley	HV 1	Center Way	W. Oak Grove Ave	E. Oak Grove Ave	2	GI	607	5	5	0	3	3	4	**94**	Phase I
Shady Lane	SL 32	Garden Ct (Field)	Garden Ct	Hwy 20	2	GI	147	4	5	0	3	3	5	**92**	Phase I
Keys		Ebbtide Village	1000' from end of street	end of street	6	AC	1000	4	5	2	0	3	5	**91**	Phase II
Keys		Venus Village	1000' from end of street	end of street	6	AC	1000	4	5	2	0	3	5	**91**	Phase II
Keys		Marina Village	200' from end of street	end of street	6	AC	200	4	5	2	0	3	5	**91**	Phase II
Keys		Anchor Village	400' from end of street	end of street	6	AC	400	4	5	2	0	3	5	**91**	Phase II
Keys		Driftwood Village	500' from end of street	end of street	6	AC	500	4	5	2	0	3	5	**91**	Phase II
Pluth	PL 10	Sulphur Bank Rd (Field)	680 Sulphur Bank Rd	Fire Hydrant	4	AC	550	4	4	0	5	2	4	**91**	Phase II
Konocti		Widgeon Way	Lakeview Drive	Hillside Lane	6	AC	2680	3	4	1	3	3	5	89	Phase II
Keys	K58	Island Cir	Blue Heron Ct	E. End of Street	4 & 6	AC	300	5	4	2	1	1	4	**89**	Phase II
		Lakeview Dr	Konocti Drive	Hillside Lane	6	AC	1560	4	4	0	3	3	5	**89**	Phase II
Pluth	PL 19 & PL 34	Jensen Rd	Sulpher Bank Rd	WWTP	4	AC	1844	4	4	2	1	3	4	**88**	Phase II
Harvey	HA 11	S. Hwy 20	Henderson Dr	Swanson	2	GI	1422	4	5	0	2	3	5	**87**	Phase II
Keys		Keys Blvd	Konocti View Drive	Everglade	6	AC	500	5	5	0	0	4	5	**87**	Phase II
Pluth	PL 20, PL 26, & PL 31	WWTP (Field)	WWTP	Tie into 8"	4	AC	3863	4	4	0	2	4	5	**87**	Phase II
Pluth	PL 21, PL 27, PL 40, & PL 41	Pomo Rd	Elem Rd	Elem Rd (Tie in to 8")	4	AC	2782	4	5	0	1	4	5	**85**	Phase II
Plaza	P7	The Plaza	Lakeview Dr	The Plaza (Park)	4	AC	843	4	5	2	2	1	3	**85**	Phase II
Keys	K 49	Lake St	End of 6" Pipe	End of Street	4	AC	300	4	4	2	1	2	4	**85**	Phase II
Konocti		Mesa Drive	Stubbs Road	Lakeview Drive	6	PVC	80	5	3	1	1	1	5	84	Phase II
Harvey	HA 4	Put Dr	W. End of Road	Spring Rd	2	GI	562	5	5	0	1	3	4	**84**	Phase II
Pluth	PL 16	Morine Way	Morine Ranch Rd	End of Line (DE)	4	PVC	860	5	3	0	1	3	5	**83**	Phase III

Table 3.23.1, 2024 Updated Pipeline Assessment Matrix

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Pipe Size, 7	Pipe Age, 3	Leaks/ Complaints, 7	Mainline Location/ Access, 5	System Pressure, 3	Fire Flow, 5	Rank	Master Plan Priority
Pluth	PL 11	Morine Ranch Rd	Tomalee Ln	End of Line (DE)	4	PVC	629	5	3	0	1	3	5	**83**	Phase III
High Valley	HV 21	E. Oak Grove Ave	Hwy 20	W. Oak Grove Ave	4	AC	962	3	4	3	1	1	4	**82**	Phase III
Pluth	PL 33	Elem Rd	Pomo Rd	Pomo Rd	4	AC	583	4	4	0	1	4	5	**82**	Phase III
Pluth	PL 42	McBride Ct (Field)	McBride Ct	Backyard Main	4	PVC	235	4	3	0	2	3	5	**81**	Phase III
Pluth	PL 18	McBride Ct & Tomalee Ln (Backyard)	Round Mountain Rd	Tee North of Mcbride	4	PVC	865	4	3	0	3	3	4	**81**	Phase III
Harvey	HA 42	C. Hwy 20	Harvey Blvd	Harvey Blvd	2	GI	35	4	5	0	2	2	4	**79**	Phase III
Harvey	HA 12	S. Hwy 20	Harvey Blvd	Hillcrest Dr	2	GI	533	4	5	0	2	2	4	**79**	Phase III
Harvey	HA 7	Terrace Dr	Hillcrest Dr	End of Street	2	GI	314	4	5	0	1	2	5	**79**	Phase III
Harvey	HA 29	C. Hwy 20	W of Henderson	North Side of Hwy 20	2.5	GI	46	3	4	0	3	2	5	**79**	Phase III
Pluth	PL 15	Morine Way (Field)	Morine Way	Lee Ct	4	PVC	435	5	3	0	2	3	3	**78**	Phase III
Harvey	HA 30	S. Hwy 20	Swanson	Olson	0.75	Poly	709	5	4	0	2	2	3	**78**	Phase III
Plaza	P 8	Oak St	Foothill Blvd	The Plaza	4	AC	1050	3	3	2	1	1	5	**77**	Phase III
Plaza	P 3	Acorn St	Foothill Blvd	Hwy 20	4	AC	326	3	4	0	3	1	5	**76**	Phase III
Pluth	PL 4	Hwy 20	Orchard Shores Dr	Sulpher Bank Dr	4	AC	1049	4	4	0	2	2	4	**76**	Phase III
Plaza	P9	Pine St	Foothill Blvd	The Plaza	4	AC	1066	5	4	0	1	1	4	**75**	Phase III
Harvey	HA 41	C. Hwy 20	Swanson	Olson	0.75	GI	42	3	3	2	2	2	3	**75**	Phase III
Shady Lane	SL 36	Hwy 20	Beryl	Widgeon Way (Field)	2	GI	1353	2	4	0	5	1	4	**74**	Phase III
Shady Lane	SL 29	Widgeon Way (Field)	Highway 20	Widgeon Way	4	AC	306	2	4	0	5	1	4	**74**	Phase III
Harvey	HA 6	Hillcrest Dr	Terrace	End of LIne (DE)	4	WWS	534	3	4	0	3	2	4	**74**	Phase III
		Hillside Lane	Lakeview Drive	Widgeon	6	AC	456	4	4	0	2	3	3	**74**	Phase III
Keys	K 26	Hoover St	Hwy 20	4th St	4	AC	915	4	4	0	2	1	4	**73**	Phase III

Table 3.23.1, 2024 Updated Pipeline Assessment Matrix

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Pipe Size, 7	Pipe Age, 3	Leaks/ Complaints, 7	Mainline Location/ Access, 5	System Pressure, 3	Fire Flow, 5	Rank	Master Plan Priority
Pluth	PL 30	Jensen Rd	WWTP	End of LIne (DE)	2	PVC	966	4	3	0	2	2	4	**73**	Phase III
High Valley	HV 3	High Valley Rd	Hwy 20	Lakeview Dr	4	AC	337	4	4	0	1	2	4	**71**	Phase III
Keys	K 72 & K 73	Hwy 20	S. Short St	Island Dr	4	AC	1003	4	4	0	1	2	4	**71**	Phase III
Harvey	HA 5	Pingree Rd	Spring Rd	End of Street	4	AC	434	4	4	0	2	2	3	**71**	Phase III
Keys	K 51	Shaul St	Hwy 20	6th St	4	AC	941	4	4	0	1	2	4	**71**	Phase III
Pluth	PL 14	Lee Ct	Morine Ranch Rd	End of Line (DE)	4	PVC	314	4	3	0	1	3	4	**71**	Phase III
Harvey	HA 3	Put Dr	Spring Rd	E. End of Road	2	GI	354	3	5	0	2	3	3	**70**	Phase III
High Valley	HV 13	Lakeview Dr	The Plaza	Oak Grove Ave	4	AC	2389	4	3	0	2	1	4	**70**	Phase III
High Valley	HV 11	Cerrito Dr	Tie in 6" AC	End of Pipe	4	AC	379	4	4	0	1	3	3	**69**	Phase III
Pluth	PL 37	Morine Ranch Rd	Sanns Ct	End of Line (DE)	4	PVC	171	3	3	0	2	3	4	**69**	Phase III
Pluth	PL 78	Sanns Ct	Tie in with 6"	Morine Ranch Rd	4	PVC	65	3	3	0	2	3	4	**69**	Phase III
Pluth	PL 17	Tomalee Ln (Field)	Tomalee Ln	Tie in (Backyard)	4	PVC	226	3	2	0	2	2	5	**68**	Phase III
Shady Lane	SL 34	Lakeview Dr	Beryl	End of Line (West)	2	GI	163	3	4	0	2	1	4	**66**	Phase III
High Valley	HV 22	Lakeview Dr	High Valley Rd (Field)	Oak Grove Ave	4	AC	1874	3	3	1	1	1	4	**65**	Phase IV
Shady Lane	SL 8	Laura Way	Widgeon	Lakeview	2	GI	584	3	5	0	2	1	3	**64**	Phase IV
Shady Lane	SL 2	Widgeon Way	Shady Lane	The Plaza	4	AC	1790	3	4	0	1	1	4	**61**	Phase IV
Shady Lane	SL 33	Beryl Way	Lakeview Dr	Hwy 20	4	AC	522	3	4	0	1	1	4	**61**	Phase IV
Shady Lane	SL 5	Manzanita Ct	Lakeview Dr	End of Line (DE)	2	GI	397	3	5	0	1	1	3	**59**	Phase IV
Keys	K 20	Pebble Way	Everglade Blvd	S. End of Street	4	AC	321	2	4	2	1	1	2	**58**	Phase IV
Keys	K 122	Ketch Ct	Surf Ln	End of Street	4	AC	250	2	4	2	1	1	2	**58**	Phase IV
Shady Lane	SL 4, SL 7, SL 6 & SL 11	Lakeview Dr	The Plaza	Lakeview Dr (Field)	4	AC	1959	3	4	0	1	1	3	**56**	Phase IV

Table 3.23.1, 2024 Updated Pipeline Assessment Matrix

MP Project Area	MCID	Road	From	To	Existing Pipe Size (inch)	Pipe Type	Existing Pipe Length (feet)	Pipe Size, 7	Pipe Age, 3	Leaks/ Complaints, 7	Mainline Location/ Access, 5	System Pressure, 3	Fire Flow, 5	Rank	Master Plan Priority
Shady Lane	SL 35, SL 36, & SL 57	Garden Ct	Highway 20	End of Line (DE)	2	GI	1017	3	4	0	1	1	2	**51**	Phase IV
Pluth	PL5	Hwy 20	Keys Blvd	Orchard Shores Dr	4	AC	2620	5	3	0	3	2	5	**0**	Eliminated
Keys	K 25	S. Hwy 20	Lake St	Schindler St	4	AC	1397	0	5	0	0	0	0	**0**	Eliminated
Pluth	PL 66	Hwy 20	Round Mountain Rd	Morine Ranch Rd	2	GI	1908	4	4	0	3	3	5	**0**	Eliminated
Harvey	HA 31	Mitchell Rd	Harvey Blvd	125 ft NE	2	GI	125							**0**	Project Complete
Harvey	HA 17	Mitchell Rd & Terry Dr (Field)	Harvey Blvd	Tie in with 4"	2	GI	369							**0**	Project Complete
Harvey	HA 21	Terry Dr & Mudie Ln (Field)	Harvey Blvd	Tie in with 4"	2	GI	268							**0**	Project Complete
Harvey	HA 2	Spring Rd	Hwy 20	End of Street	4	AC	634							**0**	Project Complete
Harvey	HA 32	Harvey Blvd	Mitchell Rd & Terry Dr (Field)	Mitchell Rd	2	GI	117							**0**	Project Complete
Harvey	HA 19	Mitchell Rd & Terry Dr (Field)	Tie in with 4"	Mitchell Rd (Field)	4	AC	222							**0**	Project Complete
Harvey	HA 20	Terry Dr (Field)	Young	Mitchell	4	AC	246							**0**	Project Complete
Harvey	HA 22	Harvey Blvd	Young Dr	Terry Dr	0.75	GI	138							**0**	Project Complete

3.7.2 Proposed Paradise Cove Service Area Annexation

An 8" pipeline was installed in 2015 to connect the Paradise Cove Service Area (CSA-16) to the western edge of the District's water system near Harvey Blvd. This pipeline will provide water service to the communities of Paradise Cove and the proposed future Paradise Valley Ranch development. A PRV installation at Harvey Blvd will allow the pipeline to be put into service while a new tank is being planned near Harvey Blvd. to provide additional fire flow and emergency storage capacity to serve the Paradise Cove system and the western portions of the CLOCWD system. See **Section 4.3.1** for more details.

Potable water for CSA-16 is currently supplied by three wells and a greensand pressure filter treatment facility. A secondary water supply and distribution system using surface water from the lake will reportedly continue to provide water for most irrigation needs in the Cove.

2024 Update
The Paradise Cove Service Area has since been incorporated as part of the CLOCWD service area. The three wells and greensand pressure filters have been abandoned and water is supplied by the 8-inch pipeline described above. The Paradise tank pressurizes this service area and additional capacity for fire protection is provided by the Harvey tank.

3.7.3 Acoustic Leak Survey

As part of the water system analysis for the District's Water Master Plan, MC Engineering and USA Associates performed a system-wide acoustic leak detection survey. The survey took place between June 2015 and December 2015 and covered approximately 37 miles of pipeline. The survey focused on the pipelines owned by the District, and, in some cases, customer-owned laterals.

The approach involved a preliminary survey phase which involved using water leak detection equipment to determine the locations of suspected leaks for follow-up pinpointing. The preliminary survey phase also involved deploying noise logging devices in areas that were suspect based on the noises detected or high traffic areas that prevented the use of a contact microphone. The noise loggers were placed on top of operating nuts on valve boxes for both fire hydrant and mainline valves or within a meter box on the shutoff valve. The loggers were programmed to listen for leaks between the hours of 2 am and 4 am. In most instances they were left in place a minimum of three nights. If a leak or suspected leak related noise was detected, the area was targeted for correlating and pinpointing.

Deficiencies

The acoustic leak detection survey resulted in identification of 26 leaks that were pinpointed by the leak survey crew. The total water loss from the 26 leaks was estimated to be approximately 75-95 gpm (108,000 gallons to 136,800 gallons per day). The 75-95 gpm equates to 39.4 MG to 49.9 MG of water loss per year. The estimated cost of these leaks, based on the current water audit and variable production cost, is approximately $56,091 to $71,039 a year.

Further potholing and final pinpointing is required to verify these leak quantities. Some of the pinpointed leaks might be less than the estimated value and some may be due to customer side leakage or other anomalies.

The Cerrito Drive Water Tank leakage was originally estimated at 35 gpm by USA. The 35 gpm would equate to 18.4 MG/year. Based on an analysis of tank level trajectories from the WTP SCADA system, the estimate of 35 gpm was determined to be high since the water level drop in the tank equated to approximately 3 gpm in May of 2016. As a result, the amount of leakage was estimated at only 2 gpm. It should be noted that approximately 1-2 gpm over a 24 hour period equates to approximately 1,450 to 2,900 gallons/day which would be considered normal usage for the customers in that zone based on 2015 billing history.

Following the 2015 leak survey, the District fixed 13 leaks identified in the acoustic leak survey report. The approximate flow of the 13 leaks was 59 gpm. It is critical that the District fix the remaining identified leaks and follow-up with an additional system-wide acoustic leak survey program.

The District provided leak repair data to MC Engineering for the years 2014 and 2015. The data did not provide exact locations of the leaks, but did provide the road where the leaks were and the type of leaks fixed. The data was placed on ArcGIS to map the leak history and develop a pattern and is presented on the following page in **Figure 3.12**. The Keys project zone was determined to be the most problematic area resulting in 65% of the leaks in 2014 and 56% during 2015.

3.7.3.1 Acoustic Leak Survey 2024 Update

The Cerrito tank has since been replaced and is no longer an issue. Likewise, the 4-in AC mainline located on Spring Drive has been replaced with a 6-inch PVC main and significant water loss on Spring Drive is no longer present. Although these two improvements have undoubtedly reduced water loss, the District still struggles to locate similarly large leaks within the system. To date no additional acoustic leak surveys have been performed. Similar to **Figure 3.12, Figure 3.13.1** on the following page show the approximate location of leaks repaired by the District between 2016 and 2024.

Given the results of the DMA analysis described in Section 3.5.1, it is evident that losses are widespread throughout the system. One outlier identified to date is the Pluth Zone where the relative loss is roughly twice that which is occurring on average throughout the system. A first step is suggested that involves effort to isolate areas of the Pluth zone north and south of Highway 20 via a tank drawdown analysis. This should be followed immediately by a focused acoustic leak survey, initially in the Pluth area, then beyond based on priorities identified to date in the DMA analysis and review of leak history.

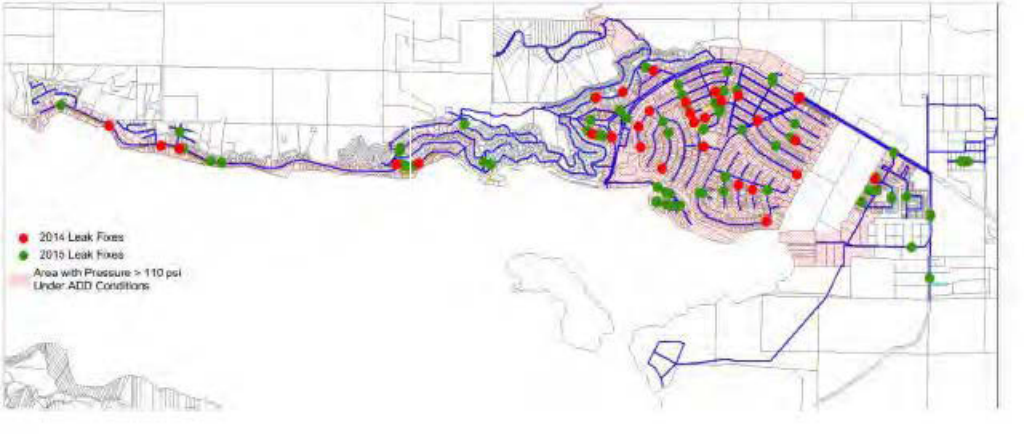

2014 Leak Fixes
2015 Leak Fixes
Area with Pressure > 110 psi
Under ADD Conditions

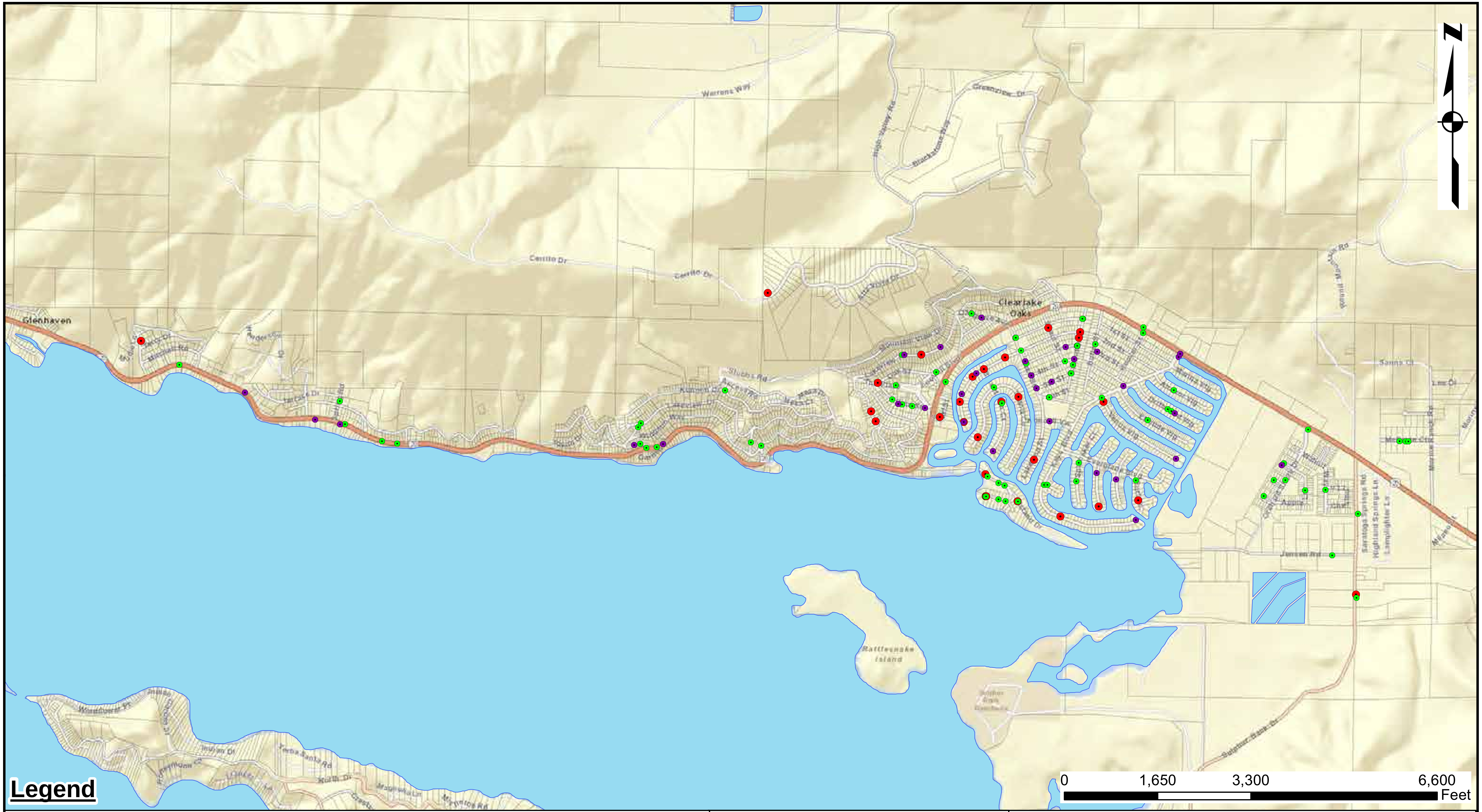
Figure 3.12 shows that the majority of leaks fixed during the 2014-2015 period were in areas with operating pressure in access of 110 psi. This indicates that the majority of leaks are occurring in areas where the piping system has deteriorated enough for high water pressures to cause line breaks.

Recommendations

It is recommended that further investigations into the amount of water loss from the Cerrito tank be conducted, including verification and calibration of the tank level transducer. There is visible leakage flowing out of the tank but the actual amount is difficult to quantify. The Cerrito tank is recommended for replacement as part of this study.

It is further recommended that each year, at least 50% of the entire system be surveyed and any leaks that are identified be repaired and recorded in a timely manner. This can greatly reduce the amount of Real Losses within the system while providing the critical data needed for an on-going assessment of the relative effectiveness of proposed water loss mitigation programs.

Figure 3.13 on the following page presents the leaks pinpointed during the 2015 acoustic leak survey and the District-repaired leaks between 2014 and 2015. It is important to point out that the leaks that were repaired by the District in 2014 were, for the most part, not present during the 2015 acoustic leak survey. This figure further shows that by implementing an ongoing leak detection program, leaks can be identified and fixed while they are small which likely can save the District thousands of dollars per year in Real Losses.



Legend

● 34 Repairs Completed by CLOCWD in 2014

● 75 Repairs Completed by CLOCWD in 2015

● 26 Suspected Leaks During 2015 System-Wide Leak Survey

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Figure 3.13 - Acoustic Leak Survey and Repairs

Document Path: C:\projects\CLOCWD\GIS\Water\Master_Plan_Meter_TM_Suspected_Leaks.mxd

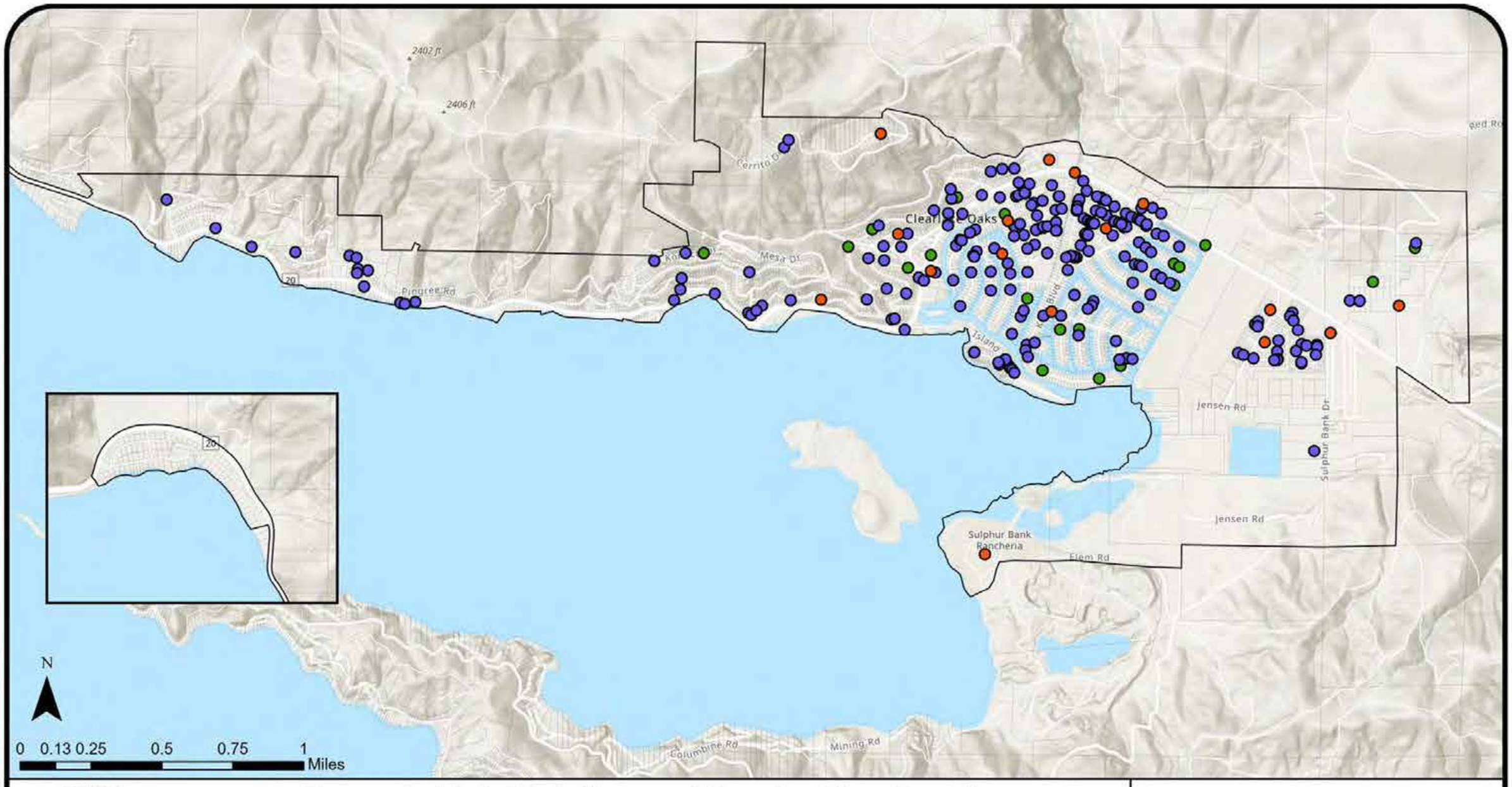


Figure 3.13.1 Mainline and Service Line Repairs

- Mainline Repairs
- Service Line Repairs
- Boil Water Notices
- CLOCWD Service Area
- parcels

MC Engineering
9294 Madison Ave
Orangevale, CA 95662
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8/23/2024

3.7.4 Backflow Prevention (Project Complete)

In May of 2011, the District conducted a survey that logged 204 addresses where pumps and pipes were observed running from Clear Lake to residences. A cross-connection control inspection report was subsequently submitted to the District General Manager recommending that all properties with direct access to Clear Lake be required to install an approved backflow device. This would prevent raw lake water from entering the distribution system via an unauthorized connection between the lake and a customer's household plumbing or irrigation system.

Title 17 of the California Code of Regulations (CCR) requires that water suppliers protect the water supply by implementation of a cross connection control program. A backflow survey completed in May of 2011 identified a total of 100 backflow devices in the District at that time. Testing data was provided with the most recent results presented from April 2015. The District issued Ordinance 76 in October of 2013 to comply with the current regulations. Ordinance 76 is included in **Appendix J**.

The provisions of the District's Ordinance 76 included:

- Evaluation criteria and conditions requiring the installation of a backflow prevention device
- Installation requirements to be met prior to the to the installation of an auxillary water source
- Installation, Testing, and Reporting Standards for backflow devices
- Requirements for periodic surveys and customer notifications
- Conditions potentially resulting in a disruption of service by the District for non-compliance

Installing backflow devices is costly and creates a financial burden for the District's customers, many of which are living on very limited fixed incomes. The number of residences with direct access to Clear Lake is estimated to be 771.

With the annexation of the Paradise Cove service area the District is facing additional challenges for preventing cross connections and backflows into the distribution system as there are currently an estimated 74 residences served by a dual system involving irrigation from lake water. The water drawn from Clear Lake in Paradise Cove is screened with a drum type filter prior to conveyance into a separate system owned and operated by the Paradise Cove Homeowner's Association (HOA). All homes in the Paradise Cove service area reportedly have a backflow device, however this could not be confirmed at the time this report was prepared since the annexation was still pending. It is recommended that the District inspect and verify each private backflow device in addition to implementing a recurring cross connection testing program throughout the service area.

Due to the topography in the CLOCWD system, services in higher elevations are susceptible to introducing backflows from swimming pools, hot tubs, etc. in the event of a line break or pressure loss. These residences should be required to install backflow devices on hose-bibs and services where deemed necessary by the CLOCWD.

Deficiencies
Lack of backflow devices on select residences and businesses considered at-risk for introducing untreated water into the distribution system.

Recommendations
Installing backflow devices on at-risk connections is the most viable solution for addressing this deficiency. The evaluation of this option, as well as a "no project" option, are discussed in **Section 4.1.2.**

3.7.4.1 2024 Update

By 2023 the District had installed backflow prevention devices on mostly all of the services for properties featuring access to Clear Lake as part of the USDA funded water system improvement project.

3.7.5 Flow Meters

To better understand the volume of Apparent Loss within the District's water system—and therefore better quantify Real Losses—a meter testing program was developed aimed at targeting meters for testing and analysis. The meter study was designed to identify meter accuracy issues due to age, condition and wear, and inappropriate meter sizing or typing for various intermediate meters. Meters not meeting minimum requirements were targeted for replacement.

Due to staff limitations, the District does not currently have a regular recurring meter testing program in place. As part of this study, 113 small (5/8" to 1") residential and commercial meters were bench tested and 13 intermediate (1.5" and 2") and large (> 3") meters were tested in place.

Small Meter Analysis
Small customer meters include all meters that are 1-inch and less. These meters typically measure usage in single family residential dwellings and on small or light commercial accounts. The District provided MC Engineering with four years of billing and consumption data from which it was determined that 111 small meters (5/8" to 1") would be pulled and tested. Meter accuracy was determined by testing each meter at 3 different flows and developing a weighted average based on AWWA meter standards contained in AWWA manual M6.

MC Engineering retained the services of RTS, an experienced meter testing firm, to pull and test the meters for the study. The locations of the residential meters selected for replacement and testing are shown below in **Figure 3.18**.

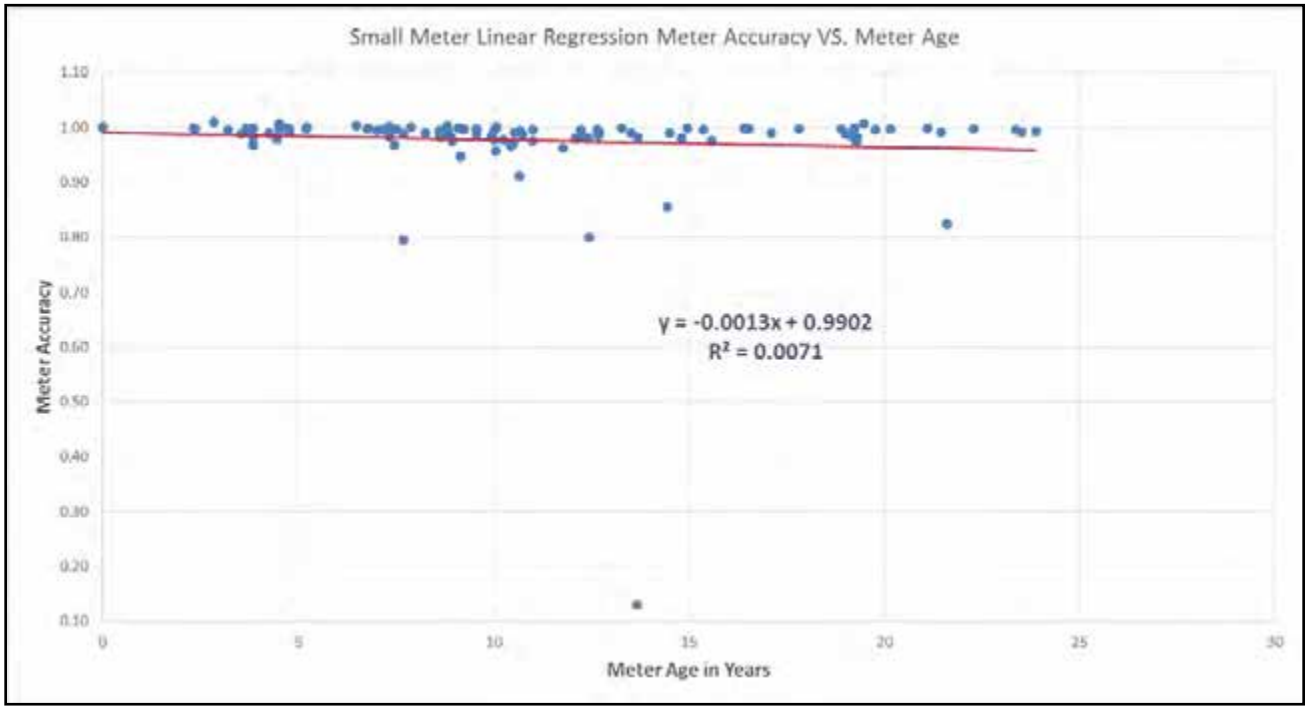
***Figure 3.18**, Small Meter Locations*



Test results from the study, along with the test parameters used by RTS and MCE for the analysis, can be found in **Appendix K**.

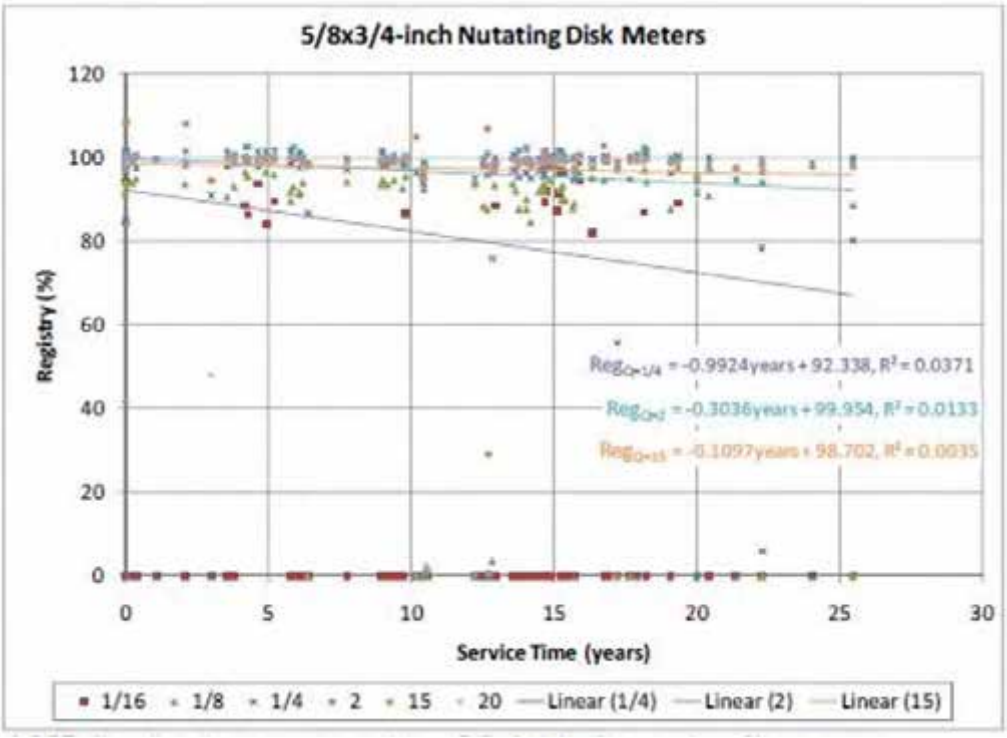
The average meter under-registration value was calculated for the 111 tested meters and the overall weighted accuracy was estimated at 97.57%, or 2.43% under registration for the entire sample set. A linear regression analysis was performed on the small meter test sample set to determine a relationship between meter age and tested meter accuracy. The resulting regression line showed a 0.125% per year accuracy loss in the overall tested small meter population. The regression analysis is shown below.

***Figure 3.19**, Regression Analysis of Tested Small Meters*



To provide an additional reference for determining an overall percent accuracy loss on the District's entire water system, further analysis was performed. The AWWA Research Foundation (AWWARF) conducted a comprehensive study on small meters which included testing over 500 disc type meters that were obtained from a variety of water utilities. The resulting test results are presented below in **Figure 3.20** and they include a regression equation for estimating meter accuracy degradation based on the age of the meter.

Figure 3.20, Service Time vs. Accuracy for Nutating Disc Meters



The average annual percent accuracy loss for the 500 meters tested in the AWWARF study was 0.41% per year. Because the AWWARF study relied on a larger sample set, it was determined that for the purpose of this study an average percent reduction between the small meter sample set that was tested and the meters tested in the AWWARF study would be used to develop estimates for replacing meters.

The average accuracy loss used for this study was calculated to be 0.2675% per year using this approach.

Intermediate to Large Meter Analysis

Based on the customer meter data received, CLOCWD has 23 intermediate to large metered accounts, which includes 15 currently active billing accounts. There were 6 unbilled intermediate to large metered accounts and 2 inactive accounts at the time of this study.

The majority of the District's intermediate meters (1.5" and 2") are Badger type meters. Large meters are predominately Badger Turbo meters, including two compound meters, which are also Badger.

A field survey was completed prior to testing intermediate and large meters to determine the best candidates for testing in an effort to identify the amount of non-revenue water (NRW) associated with the intermediate and large meters. During the field survey, photos were taken of the existing surrounding conditions, the meter pit, and the meter setting. Other information was recorded such as box type, type of meter, verification of serial number compared to billing data, and other pertinent information. The commercial meter survey results for select meters can be found in **Appendix L**. Another purpose of the field survey was to determine which of the intermediate and large meters have a test port that could facilitate testing without removing the meter

Based on the results of the survey, 13 intermediate or large meters were targeted for testing. This testing took place concurrently with the small meter change-out and testing work. Two of the intermediate to large meters that did not have test ports were changed out during the testing program. These meters were changed out and bench tested based on an analysis of the historic billing data and a determination that the meters were not properly typed. Only two of the intermediate to large meters are not billed (i.e. unbilled water). Both of these tested within the AWWA accuracy limits. These two meters are not included in the intermediate to large testing analysis as they do not affect Apparent Losses or NRW. Only five of the intermediate to large meters that were tested were found to be under-registering during the testing exercise. The results of all the inaccurate intermediate to large meters, along with corresponding recommendations, are included in **Table 3.24** below.

***Table 3.24**, Intermediate to Large Meter Analysis and Recommendations*

Billed Metered Accounts							
Meter Number	Meter Size (inch)	Meter Age (years)	Address	Business Name/Type	Percent Under-Registration	Apparent Loss (MG/year)	Recommendation
26565894	1.5	10-15	14275 E Hwy 20	Flagship Marine	27.99%	0.0366	Meter was changed out during meter testing project
97222409	2	15-20	140 Spring Rd.	Forestry Service	1.93%	0.0075	Meter is working adequately. Recommend testing meter yearly or every other year
8744272	2 (Turbo)	15-20	13470 E Hwy 20	Hotel	85.11%	0.0762	Meter was changed out during meter testing project
8169321	3 (Turbo)	5-10	12505 Foothill	Parks	7.23%	0.1797	Retest Yearly and consider repair
6101671	6 (Comound)	5-10	400 Sulphur Springs	Mobile Home	2.46%	0.2923	Fix customer side valve and retest

The amount of Apparent Loss contributed by the tested intermediate to large meters was estimated at approximately 0.60 MG/year.

The meter at 400 Sulphur Springs Road, the largest billed user in the system, was tested but the meter should be retested due to the fact that the customer side valve could not be completely closed. It is recommended that the customer side valve be repaired and the test repeated. This meter is critical in terms of both consumption and revenue.

There were three large meters that were not tested as a part of this Meter Study. These meters are unbilled accounts and should be tested in the future to verify their contribution to the District's NRW if they are put back into service.

Based on the recent test results, and the fact that the two intermediate to large meters with the worst registration have already been replaced, there are no recommendations for intermediate to large meter change outs on any of the tested meters. For the cost estimate, it is assumed that three additional intermediate residential meters that were not tested would be replaced based on age and consumption. The need to replace these three meters should be verified in the future.

3.7.5.1 Flow Meters 2024 Update

In 2021 the CLOCWD initiated a system-wide meter change-out program. The quantity and types of meters that were replaced are described in Section 2.5.3.1. The apparent loss is assumed to be much lower in 2024 than ten years ago, however the water audit and DMA analysis described in previous sections suggests that Real Losses are continuing to increase and are alarmingly high. This prevalent and persistent problem points to the importance of leveraging all available analytical tools and related mitigation efforts.

Previous sections, including Section 3.5, of this report describe the current DMA modeling needs and suggested improvements. Three new meters are recommended including replacing meters at the Harvey PRV vault, the Shady Lane Booster Station, and the main source meter at the WTP. It should be noted that the accuracy of the meter at the WTP has been in question and it is not in an ideal setting with a gave valve immediately in-line with the meter. Investigations into applicable meter types, with the capability of both 4-20 mA output and a protocol consistent with the Badger cellular endpoint described in more detail in Section 4.3.2. Photos of the existing meters slated for replacement are depicted below.



Main WTP System Input 10” McCrommeter Magnetic Flowmeter with valve immediately in-line (to remain)



4-inch meter at Shady Lane tank site that pumps to Konocti (to be replaced with Badger compatible magmeter)



Existing 6-inch Sparling Magmeter inside Harvey Blvd PRV vault (to be replaced with Badger compatible magmeter)

3.7.6 Pressure Reducing Valve Analysis

A field survey conducted by MC Engineering, Inc., Cla-Val representatives, and the District staff investigated the operational condition of three PRVs located between zones 1 and 3. The existing Cla-Vals in use (model 90-01) are designed to reduce pressure on the downstream side by using a self-actuating diaphragm to control the release of flow through the valve. The action of the diaphragm is entirely dependent on the pressure on the downstream side of the valve. Each 6" PRV is supplemented with a 2" PRV in parallel. The 2" bypasses are self-actuating as well, and respond to downstream pressure only. If the flow from the 2" bypass valve is unable to sustain the downstream pressure setpoint the larger valve is designed to open up to pass more flow. **Table 3.25** below summarizes observations made during the field investigation and photos of valves during the field visit are presented in below in **Figure 3.21** through **3.23**.

***Table 3.25**, Valve Survey Results*

Valve Location	Field Observations
Lakeview Dr (West Valve)	Incorrect restriction fittings on 2" Valve.
Lakeview Dr (East Valve)	Incorrect restriction fittings on 2" Valve. 6" valve installed opposing flow direction (backwards).
Stubbs Rd	Incorrect restriction fittings on 2" Valve

***Figure 3.21**, Lakeview Drive (West)*



***Figure 3.22**, Lakeview Drive (East)*



***Figure 3.23**, Stubbs Road*



With insufficent restriction fittings on all three 2" valves, they are rendered inoperable. Additionally, it was discovered that the 6" valve at Lakeview Dr (East) was installed backwards allowing unrestricted flow from Zone 3 to Zone 1.

Deficiencies
Incorrectly plumbed PRVs that are not operating correctly due to incorrect fittings and/or improper installation.

Recommendations
Install correct fittings, refurbish and re-install PRVs that were improperly installed. Note that as of the time of writing this report, the District has corrected the PRV installations at these locations. It is recommended that staff verify the settings on these PRVs are consistent with proposed operating strategies discussed above.

3.8 Pump Stations and Water Storage Analysis

3.8.1 Pump Stations

As described in **Section 2.5.1**, the District operates three pump stations, separate from the High Lift Pumps at the WTP, to supply the water distribution system and upper storage reservoirs in Zones 2, 3, and 4. These pumps are located at the Shady Lane, Cerrito, and High Valley sites.

For information on pumps located at the water treatment plant, see **Section 3.4**.

Deficiencies
The existing pump stations have no backup pumps and no backup power. SCADA control is limited and the pumps are undersized for fire flow, buildings are non-conventional wood structures, and most appurtenances and fittings are old. Pump houses are deteriorated or non-existent, and valves are leaky and needing replacement. Piping is placed above ground at the High Valley site and there is no effective way of back-feeding water through the pump discharge line from upper zones back to Zone 1 in emergencies.

Recommendations
Install new pumps, buildings, backup power, SCADA and associated site work at each of the pump stations.

The evaluation of this option, as well as a "no project" option, are discussed in **Section 4.4.2.**

3.8.2 Water Storage Tanks

Water demand criteria is listed in **Section 3.0.1** for both the existing District service area and for the Paradise Cove annexation area.

The CLOCWD plans to extend their water supply service to the Paradise Cove area. The existing Paradise Cove water system includes a 100,000-gallon storage tank. **Table 3.26** below summarizes the current water storage in the District.

***Table 3.26**, Summary of Existing Storage Tanks*

	Dimensions					Water Levels (ft)			
Tank	**Dia (ft)**	**Height (ft)**	**Area (ft^2)**	**Storage (gal)**	**Base Elevation (ft)[2]**	**Min[3]**	**Max**	**Alarm**	**Active Storage (gal)**
Pluth Steel	55.00	20.25	2,376	359,890	1588.00	1.25	16.00[4]	19.25	288,800
Pluth Redwood	31.00	18.00	755	101,630	1588.00	1.25	16.00	16.50	91,700
Pluth Combined[1]	63.13	18.00	3,131	421,470	1588.00	1.25	16.00	16.50	380,500
Shady Lane	32.00	24.00	804	144,390	1588.00	0.50	23.00[5]	23.50	97,800
Konocti	30.00	24.00	707	126,900	1791.00	0.50	23.00	23.50	121,600
Cerrito	29.19	20.00	669	100,120	2081.00	0.50	15.50	19.50	77,600
Total CLOCWD				**832,930**					**677,500**
Paradise Cove	34.00	16.00	908	**108,670**	1480.25	1.25	15.00	15.50	**101,900**

Note:

1. ***Calculated for modeling purposes.***
2. ***Based on survey by Geo Legal (2016).***
3. ***Estimated for modeling purposes.***
4. ***Currently, the Pluth Tanks' elevation is controlled from the redwood tank, which limits the max. water elevation in the steel tank.***
5. ***Typically, no more than 17 feet based on the Pluth tank level control elevation***

Deficiencies

The lack of storage in the vicinity of Harvey Blvd. combined with the previous elimination of two water storage tanks at High Valley limits the performance of the distribution system and fire flow capacity of the system as a whole. The addition of a storage tank at the High Valley site would greatly relieve system constraints when the PRV's separating Pressure zone 3 open to meet demands. Additionally, a new tank site located near Harvey Blvd would reduce the relatively high pressure loss in the pipeline serving the annexation area and increase the redundancy and emergency capabilities of the District's water system. With the appropriate flow control and valve features in place at the point of connection near Harvey Blvd, the tank at Paradise Cove could help offset emergency storage capacity in the District's water system. Visible leakage is shown in **Figure 3.24** on the following page.

***Figure 3.24**, Visible Leakage at Cerrito Site*



Recommendations

Install new tanks at Harvey Blvd and High Valley. Replace deteriorating redwood tanks at the Cerrito tank site. Decommission the redwood tank at the Pluth site. These recommendations are evaluated in **Section 4.3.1,** as well as a "no project" option.

3.8.2.1 2024 Water Storage Tanks Update

As previously recommended, the Cerrito tank was demolished and replaced with a bolted steel tank in 2022 as part of the USDA funded water system improvement project. These improvements also included construction of the Harvey tank and booster pump station. During this time the District had also decommissioned the Pluth redwood tank. These changes are reflected in Table 3.26 below. Note that the active storage values are representative of typical high levels as seasonally adjusted by staff, the active storage capacity of each tank is presented in **Table 3.26.1**.

***Table 3.26.1**, 2024 Summary of Existing Storage Tanks*

	Dimensions					Water Levels (ft)			
Tank	**Dia (ft)**	**Height (ft)**	**Area (ft^2)**	**Storage (gal)**	**Base Elevation (ft)[2]**	**Min[3]**	**Max**	**Alarm**	**Active Storage (gal)[4]**
Pluth Steel	55.00	20.25	2,376	359,890	1588.00	1.25	16.00[4]	19.25	262,125
Harvey (New)	34.16	32.00	916	219,380	1515.00	0.50	30.00	30.50	205,700
Shady Lane	32.00	24.00	804	144,390	1588.00	0.50	23.00[5]	23.50	111,292
Konocti	30.00	24.00	707	126,900	1791.00	0.50	23.00	23.50	121,600
Cerrito (New)	34.16	20.00	669	100,120	2081.00	0.50	15.50	19.50	77,600
Paradise Cove	34.00	16.00	908	108,670	1480.25	1.25	15.00	15.50	100,000
Total CLOCWD				**941,600**					**777,500**

Note:

1 ***Calculated for modeling purposes.***
2 ***Based on survey by Geo Legal (2016).***
3 ***Estimated for modeling purposes.***
4 ***The active storage volume shows what maximum volumes are present under current operations. The maximum working capacity for each tank is presented in Tables 2.6.2.1.***

3.8.3 Water Storage Corrosion Protection

In the fall of 2014 the interior and exterior coating of each steel tank was inspected to identify corrosion and other coating related deficiencies. Using a coating thickness a gauge, the thickness of the coating on each exterior wall, at each existing steel tank, was measured. Samples of exterior wall and interior roof coatings were analyzed for chromium and lead using EPA 6010. The test results are presented below in **Table 3.27**

***Table 3.27**, Tank Paint Coat Testing Results*

Tank	Exterior Sidewall				Interior Roof		
	Coating	Chromium[1] (mg/kg)	Lead[2] (mg/kg)	Avgerage[3] Thickness (mils)	Coating	Chromium[1] (mg/kg)	Lead[2] (mg/kg)
Shady Lane	Alkyd	ND	ND	10.5	Epoxy	81.2	ND
Pluth	Alkyd	ND	ND	9.4	Modified Epoxy	381	ND
Konocti	Acrylic	6880	ND	4.1	Epoxy	78.9	ND

Note:
1. ***Chromium Detection limit of 50 mg/kg***
2. ***Lead Detection limit of 100 mg/kg***
3. ***Average of 4 measurements***

Shady Lane

External coatings: The sidewall coating is in good condition, and minor signs of corrosion exist on the roof, however, the roof vent and manway are showing signs of extreme corrosion.
Internal Condition: The internal sidewall coating is in fair condition. The moderate corrosion on the roof is likely a result of the condensation associated with insufficient ventilation. Condensation formed on the beams drains to the welded joints between the sidewall and beam posing a serious threat to the structural integrity of the tank as shown below in **Figure 3.25**.

***Figure 3.25**, Shady Lane Tank Vent and Interior*

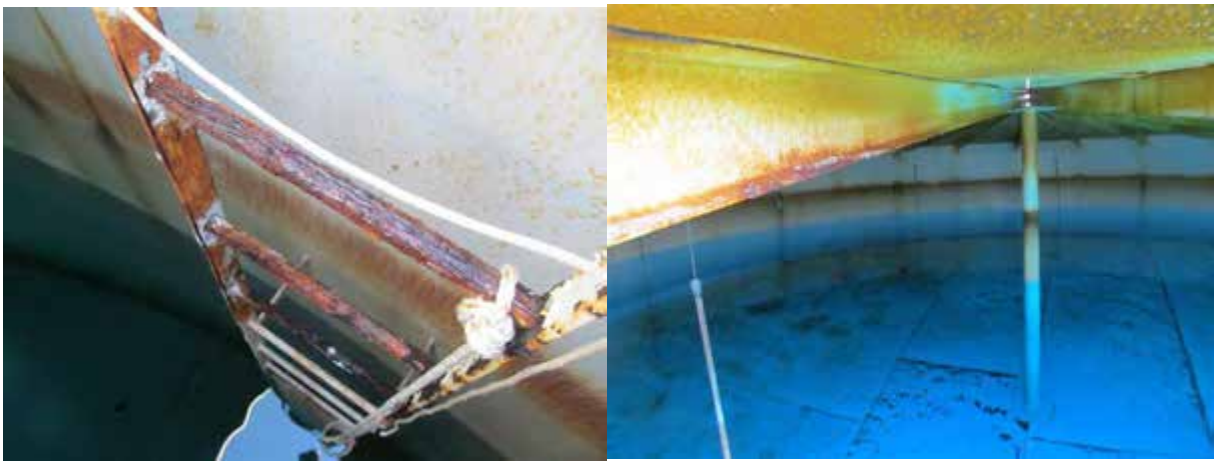


Pluth

External coatings: The sidewall of the tank appear to be in fair condition, however, coating did fail under the scratch test indicating a weak adhesion of the coating. The roof appears to be in fair condition as there are only minor signs of corrosion, including considerable corrosion at the vent.

Internal Coatings: Similar to Shady Lane, there is excessive condensation forming on the roof as well as the beams which, if left unchecked, could compromise the structural integrity of the tank. The ladder has suffered from extreme corrosion and is no longer useable. It should be removed or replaced. Images of the interior ladder and roof is presented in **Figure 3.26** below.

***Figure 3.26**, Pluth Tank Ladder and Interior*



Konocti

External Coatings: The sidewall of the tank is included an average coating thickness of 4.14 mils and is likely limited to primarily the prime coat in many locations. With the exception of the moderate corrosion of the vent, the roof shows no signs of corrosion and appears to be in fair condition.

Internal Coatings: Similar to the other tanks within the system, the extensive condensation formed on the roof has corroded a considerable portion of the structural members within this tank. The resulting corrosion from condensation collected at the welded joints between the beams and wall pose a serious threat to the structural integrity of the tank if left unchecked. Images of the vent and interior roof are presented in **Figure 3.27** below.

Figure 3.27, Konocti Tank Vent and Interior



Cathodic Protection

A cathodic protection survey was completed in May of 2016. Each tank site was visited and assessed, as well as both clarifiers and the clearwell at the WTP. The results of the survey are presented below in **Table 3.28**.

Table 3.28, Tank Cathodic Protection

Tank	Cathodic Protection In-Place	Tank-to-Water Potential	System Condition
Pluth Steel	Magnesium Anodes	1.39 V	Fair Condition
Shady Lane	Magnesium Anodes	977 mV	Fair Condition
Konocti Steel	Magnesium Anodes	340 mV	Anodes Depleted

***ANSI and AWWA specifies cathodic protection for steel water storage tanks in AWWA standard D106.**

Deficiencies

The coating of the internal sidewalls and roof at both Pluth and Konocti show signs of extensive corrosion. The corrosion is also evident among the beams and welded joints. If these issues are not addressed, further corrosion could pose a serious threat to the structural integrity of these tanks. Relative to the other tanks, Pluth is in fair condition. The magnesium anodes at Pluth and Shady Lane are in fair condition, however the anodes at Konocti have been depleted.

Recommendations

The application and maintenance of a high quality coating paint is the most important part of any corrosion control strategy. Tanks should be internally and externally painted with long-life coatings every 15-20 years. It is not known if any of the tanks operated by the District are coated with lead-based paint however no lead was detected within the external sidewalls or internal roof as presented in **Table 3.27**. It is recommended that the presence of lead, if any, be verified before conducting pre-painting activities such as sandblasting.

The District should continue with routine maintenance on cathodic protection systems at Pluth and Shady Lane and replace anodes at Konocti. All of the tanks should be renovated including new internal and external coats with repair/replacement of ladders, vents, and other appurtenances. Considering all the tanks, Konocti is on the verge of corroding into a dire state and should be prioritized as an immediate maintenance project.

3.8.3.1 2024 Water Storage Corrosion Protection Update

To date no improvements have been made to the storage tanks within the distribution system. Recently, professional divers were retained to assess the interior condition of the Shady, Konocti, and Pluth tank. The report documenting the internal tank conditions is presented in **Appendix N**. In general, the report recommends rehabilitating each of the tanks. Specific improvements recommended for each tank, including preliminary project costs, are outlined in Section 5. The existing condition for each tank is summarized below.

The overall existing condition of the Konocti Tank is as follows:

Exterior:

- The exterior of the tank appears to be in good condition, with recent recoating and no immediate concerns.
- Minor pooling on the roof should be monitored to prevent potential coating wear.
- Isolated areas of physical damage on the shell are minimal and do not compromise the overall integrity.
- The roof hatch is corroded and needs replacement due to safety hazards.
- The exterior ladder is structurally sound but requires a self-closing gate at the top.
- The roof railing lacks compliant toe boards.
- The center vent is undersized and should be replaced with a larger compliant vent.

Interior:

- The interior is in poor condition and requires renovation to prevent further degradation.
- Significant blistering and rust nodules are present, especially in the submersed zone, leading to metal loss.
- The center column, overflow, and rafters show advanced coating failure.
- Approximately ¼ inch of sediment was found on the tank floor.
- The cathodic protection system is present but failed and needs replacement.
- The roof hatch is corroded and poses a hazard.
- Safety upgrades are required, including tie-offs on the roof and confined space signs on the manway.

Pluth Tank Condition:

Interior:

- Coatings: Significant deterioration with rust, corrosion, blistering, and coating failure, especially in the atmospheric zone.
- Structural Components: Some rafters and the interior ladder are compromised. The interior ladder has significant metal loss and is falling into the tank.
- Sediment: Approximately ¼ inch of sediment on the tank floor.
- Corrosion: Present in key areas such as the overflow, rafters, roof connections, and beam-to-shell contact points. A large rust nodule is on the center column around the fluctuating water line.
- Cathodic Protection: Present but failed, leaving the submersed zone unprotected.
- Overall Condition: The tank remains structurally sound but requires renovation to prevent further deterioration.

Exterior:

- Coatings: Deteriorating with pronounced delamination and flaking, particularly near the foundation. UV degradation is present on the top roof.
- Structural Components: The exterior ladder is a caged design with a fall arrest system but needs a self-closing gate at the top.
- Corrosion: Initial stages of metal loss are occurring near the foundation. Piping connected to the tank is also exhibiting coating flaking.
- Safety and Security: Some safety upgrades are required to meet compliance, including installing tie-off points, a new center vent, and an overflow airgap.
- Overall Condition: The exterior is due to be recoated to prevent further degradation and metal loss.

Shady Lane Tank:

Interior:

- Steel floor in good condition.
- Coating system has begun to show substantial wear within the atmospheric zone with areas of rust, coating cracking, and moderate corrosion notably on the rafters and connection points between the rafters and shell.
- The center column is in poor condition with complete coating failure exposing the underlying steel.
- Coating system is has been compromised within the submersed zone with widespread blistering across most of the tank's interior surfaces.

Exterior:

- Exterior coating shows substantial signs of UV induced degradation.
- Coating degradation contributing to rust formation that has spread across the upper shell.
- In general, the tank exterior is in good condition

3.8.4 Storage Disinfection Byproducts

As discussed above, the formation of THMs within the distribution system is currently an issue and will be exacerbated with the annexation of Paradise Cove and additional storage tanks. Currently there are no facilities within the distribution system to monitor or remove THMs. At certain times of the year, THM concentrations within the distribution system are going to be a significant issue. It is likely that several of the future distribution storage tanks will require facilities to remove THMs that have developed as a result of high residence times in the distribution system.

Deficiencies

Cerrito Tank Site

The Cerrito serves pressure zones 2 and 4 from the High Valley tank site. These pressure zones branch off of Zone 1 and thus experience much longer residence times. The storage at Cerrito is also subject to low turnover as well but must maintain enough volume to meet fire flow requirements. For these reasons it is recommended that a mixing system and air ventilation system be installed at this tank.

Pluth Tank Site

The Pluth tank is located on the far east side of the distribution system serving pressure zone 1, the tank uses a common inlet-outlet and is susceptible to stratification. Considering these conditions it is recommended that, at a minimum, a mixing system and air ventilation system be installed at this tank.

Konocti Tank Site

The Konocti tank serves pressure zone 3 and is fed from the Shady Lane tank. The tank uses a common inlet-outlet and is susceptible to stratification. Considering these conditions it is recommended that, at a minimum, a mixing system and air ventilation system be installed at this tank.

Shady Lane Tank

The Shady Lane tank site supplies water to the Konocti tank (zone 3) as well as storage and pressure to zone 1. Considering the tank is in close proximity to the water treatment plant and likely experiences more frequent turnover due to separate inlets and outlets, this tank is likely less susceptible to producing THMs.

Harvey Tank

Because the proposed Harvey tank site will serve the far west end of the distribution system and annexed Paradise Cove area, the formation of THMs are expected to be an issue at this location. It is expected that, at a minimum, a mixing system and air ventilation system would need to be installed at this tank.

Proposed High Valley Tank

At a minimum, a mixer and power vent will be required at the proposed High Valley tank to maintain a high tank level at a near continuous basis.

Recommendations

Following the immediate improvements made at the treatment facility to mitigate THM formation, and the addition of storage facilities, THM sampling will be necessary to determine the percent removal from each tank to ensure compliance with MCL of 80 µg/L. Funding should be secured to install, at a minimum, a mixer and ventilation system at each site with the exception of Shady Lane. It is also possible that a full THM removal system would be necessary at the Harvey tank site as previously discussed in **Section 3.6.6.**

Modeling of water quality within the CLOCWD distribution system was used to better understand the characteristics of THM formation and better identify improvements which may reduce the concentration of THMs as measured at the two sample points within the distribution system. Modeling parameters, assumptions, and results are discussed below in **Section 3.8.4.1**. Where multiple project alternatives exist, ultimate recommendations are made in Section 4.

3.8.4.1 2024 Storage Disinfection Byproducts

As discussed in Section 2, there are now two sample locations which must satisfy the MCL of 80 µg/L for TTHMs and 60 µg/L for haloacetic acids. Historically haloacetic acids have been well below the MCL and have not been a compliance issue and will not be discussed further. Measured TTHMs have been measured near the MCL several times or exceeded at the Paradise sample point located at the far west end of the system. Since the recent construction of the Harvey tank has also increased the water age prior to reaching the Paradise service area, TTHM levels have become even more difficult for operations staff to maintain. For this reason, the high-liquid level within the Harvey tank has been kept at about one-third capacity to reduce the detention time prior to entering the Paradise service area. Under these conditions TTHM concentrations have been measured in the range of 52 to 64 µg/L within the Harvey tank. Water within the Paradise cove tank has measured TTHMs within the range of 2.24 to 3.62 µg/L as there is an active aeration equipment within this tank which effectively volatilizes TTHMs.

However, due to the configuration of the piping between the Paradise Tank and Harvey Tank not all of the water transferred from the Harvey tank is circulated through the Paradise Tank prior to reaching the Paradise sample point. Upstream of the Harvey tank water is stored within the Konocti tank. To date TTHM samples direct from the Konocti tank have not been collected however the Mesa-Stubbs sample point is representative of the tank since its pressurized by the tank and located approximately 400 feet away with TTHM concentrations ranging from 51 to 78 µg/L. Upstream of the Konocti tank, TTHM data is limited to one sample at the Shady Lane tank which indicated a concentration of 48.7 µg/L. Upstream of the Shady tank sampling shows that the TTHM concentration within the WTP clearwell effluent is nearly 12 to 14 µg/L with the THM removal equipment in service, approximately half the concentration without the equipment in service.

TTHM concentrations within the Cerrito and Pluth tank have not been collected since these tanks are located within the northwest and northeast corners of the system, respectively, and do not influence either the Paradise or Mesa-Stubbs sample points.

Water Quality Modeling

A preliminary model was prepared using EPANET to better prioritize the location of future THM removal equipment to reduce concentrations at both the Paradise and Mesa-Stubbs sample locations. The analysis was conducted by first developing a model of the existing system followed by analyzing system performance with the equipment located at different locations or other system modifications such as pipeline improvements. Modeling of THM removal equipment assumes that the equipment can reduce the concentration by 50% at the site of application. A 50% removal rate is consistent with the performance guaranteed by manufacturers and is also consistent with the performance of the existing equipment within the WTP clearwell.

Scenario 1 – Existing System

Model Settings & Assumption:

- 480-Hour extended time analysis
- Limiting concentration 110 µg/L
- Global Bulk Coefficient: 0.3
- Clearwell effluent TTHM concentration of 14 µg/L
- Shady Lane Tank
    - HL 23’ LL 13’
    - 2 Compartment Mixing Model (45% active)
    - Initial TTHM concentration of 0 µg/L
- Konocti Tank
    - HL 20’ LL 18’
    - 2 Compartment Mixing Model (10% active)
    - Initial TTHM concentration of 0 µg/L
- Harvey Tank
    - HL 9.5’ LL 11.5’
    - 2 Compartment Mixing Model (10% active)
    - Initial TTHM concentration of 0 µg/L
- Paradise Tank
    - HL 9’ LL 8’
    - Fully Mixed
    - Average TTHM concentration of 3.5 µg/L (regardless of turnover rate)
    - Paradise Service Area Demand 25,000 gpd
    - Harvey Service Area Demand 62,000 gpd

***Figure 3.27.1**, Scenario 1 TTHM Concentrations*

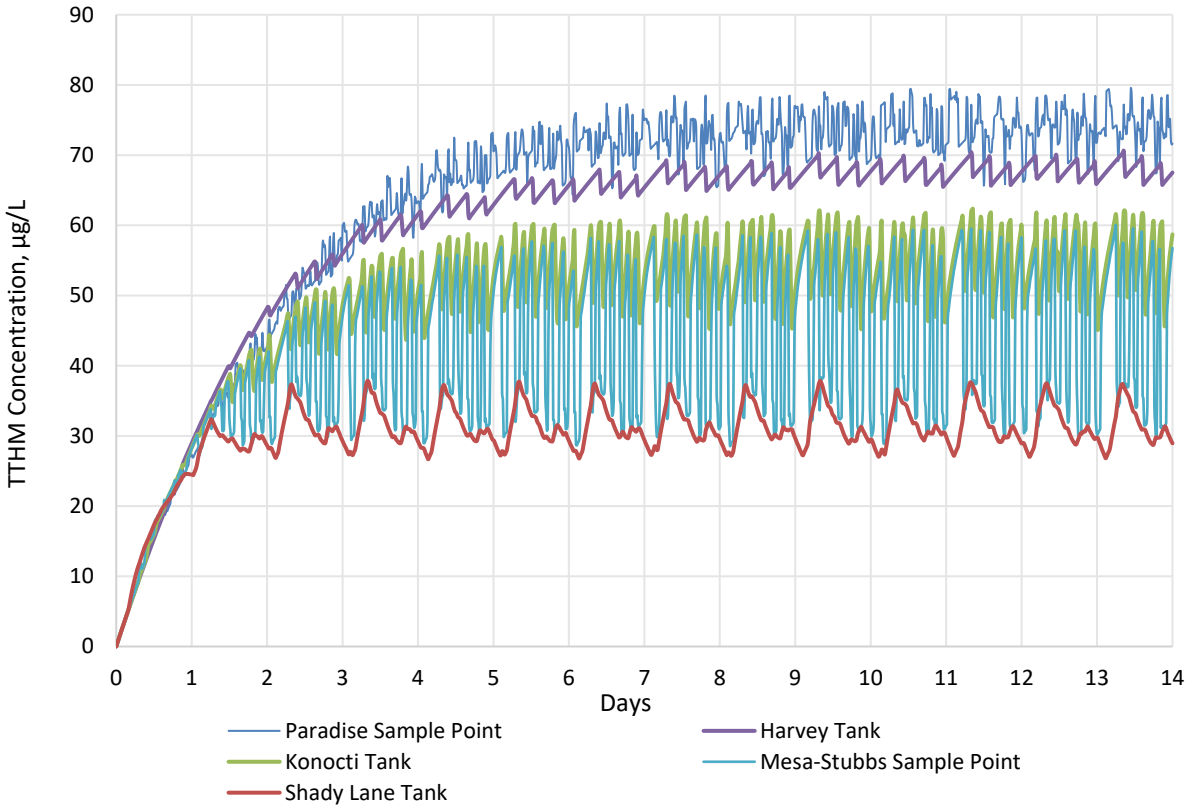


***Table 3.28.1**, Scenario 1 - Modeled Range of TTHM Concentrations*

	Shady Lane Tank	Konocti Tank	Mesa-Stubbs Sample Point	Harvey Tank	Paradise Tank	Paradise Sample Point
Average, µg/L	31.3	55.1	44.7	68.1	3.1	74.3
Maximum, µg/L	37.6	62.1	59.4	70.7	5.2	81.1
Minimum, µg/L	26.8	45.1	29.2	65.7	2.8	66.6

The modeling results for Scenario 1 are presented in both **Figure 3.27.1** and **Table 3.28.1**. It should be noted that the Mesa Stubbs sample point is subject to variations bound between the THM concentrations within Shady tank and the Konocti tank since the water quality at this point is influenced by the Shady Lane tank when the pumps are in service. In general, the TTHM concentration ranges are representative of the sampling data which was previously presented in **Table 2.1.1.**

Scenario 2 – Existing System High Level Harvey Tank

Scenario 2 is essentially the same as Scenario 1 except the Harvey high level was set to 30 feet to simulate a full tank. The model results in **Figure 3.27.2** and **Table 3.28.2** show that the MCL of 80 µg/L would be exceeded within the Harvey tank while also increasing concentrations at the Paradise sample point beyond the MCL.

***Figure 3.27.2**, Scenario 2 TTHM Concentrations*

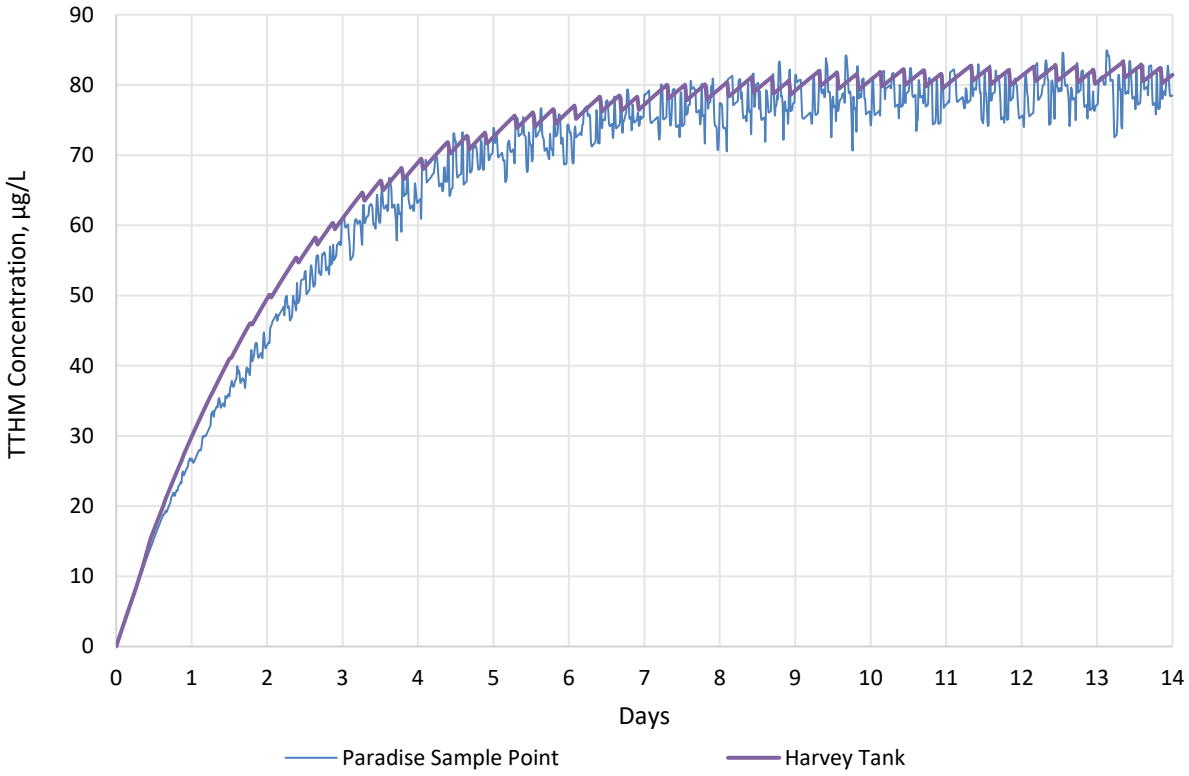


***Table 3.28.2**, Scenario 2 - Modeled Range of TTHM Concentrations*

	Shady Lane Tank	Konocti Tank	Mesa-Stubbs Sample Point	Harvey Tank	Paradise Tank	Paradise Sample Point
Average, µg/L	31.3	55.1	44.7	81.9	3.1	79.3
Maximum, µg/L	37.6	62.1	59.4	83.6	5.2	85.8
Minimum, µg/L	26.8	45.1	29.2	80.4	2.8	72.2

Scenario 3 – Konocti Tank THM Removal

Scenario 3 is the same as scenario 2 except that the model assumes the use of THM removal equipment within the Konocti tank capable of reducing the TTHM concentration within the tank by 50%. The results for scenario 3 are presented in **Figure 3.27.3** and **Table 3.28.3**.

***Figure 3.27.3**, Scenario 3 TTHM Concentrations*

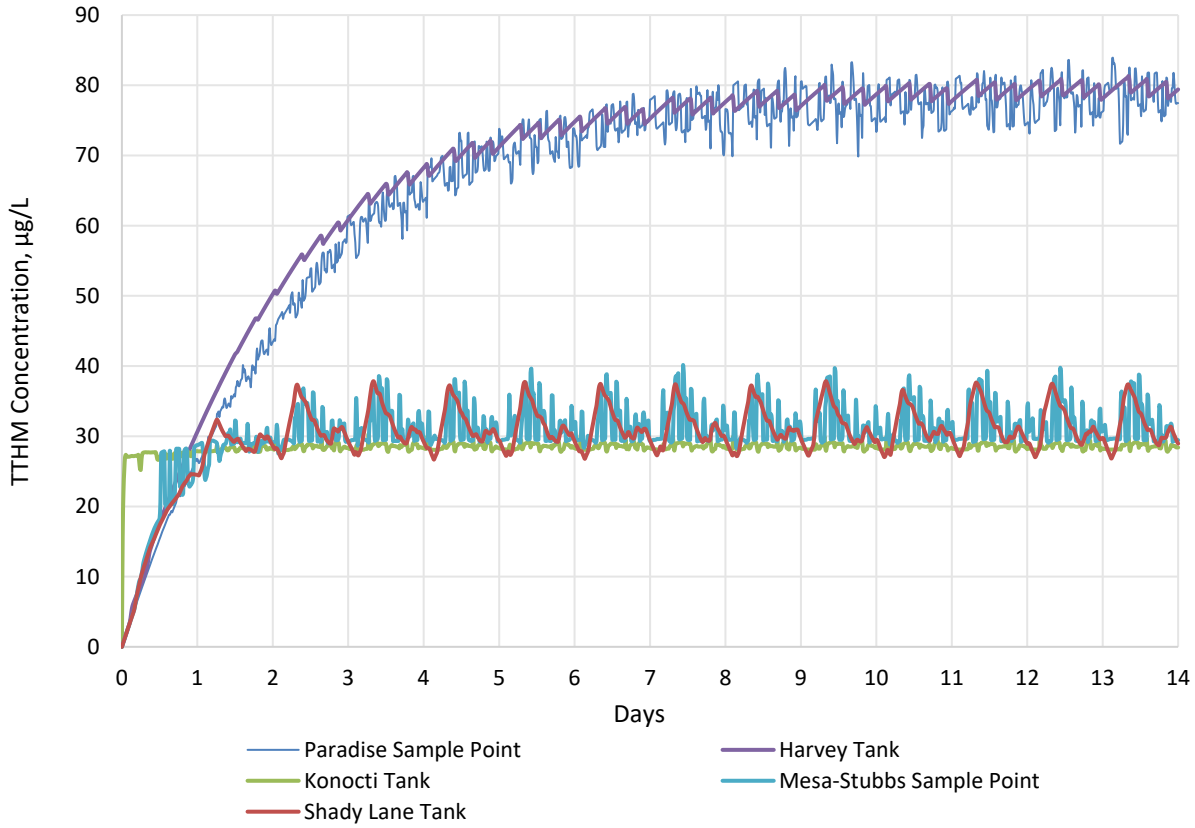


***Table 3.28.3**, Scenario 3 - Modeled Range of TTHM Concentrations*

	Shady Lane Tank	Konocti Tank	Mesa-Stubbs Sample Point	Harvey Tank	Paradise Tank	Paradise Sample Point
Average, µg/L	31.3	28.6	31.4	79.9	3.1	78.4
Maximum, µg/L	37.6	30.1	39.3	81.6	5.2	84.8
Minimum, µg/L	26.8	27.8	29.1	78.1	2.8	71.3

Scenario 4 – Harvey Tank THM Removal

Scenario 4 is the same as scenario 3 except the model also considers installation of THM removal equipment within the Harvey tank capable of reducing the TTHM nearly in half within the tank.

***Figure 3.27.4**, Scenario 4 TTHM Concentrations*

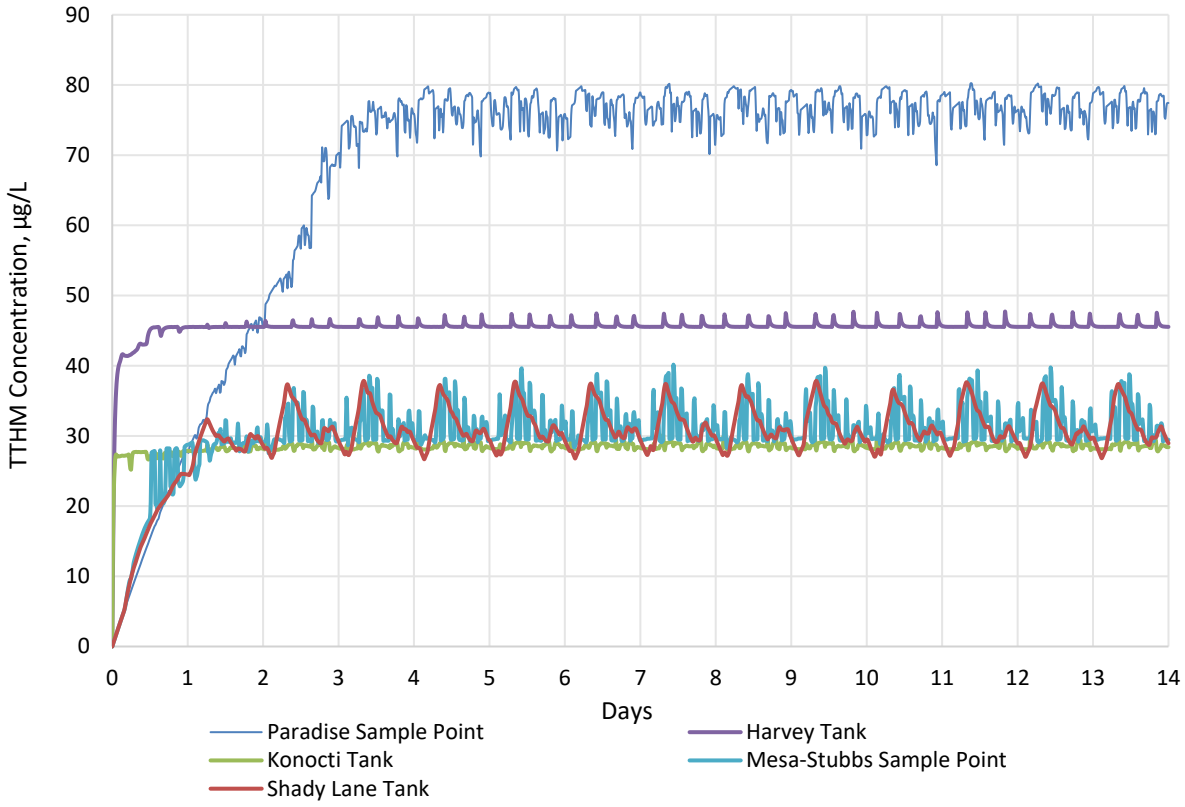


***Table 3.28.4**, Scenario 4 - Modeled Range of TTHM Concentrations*

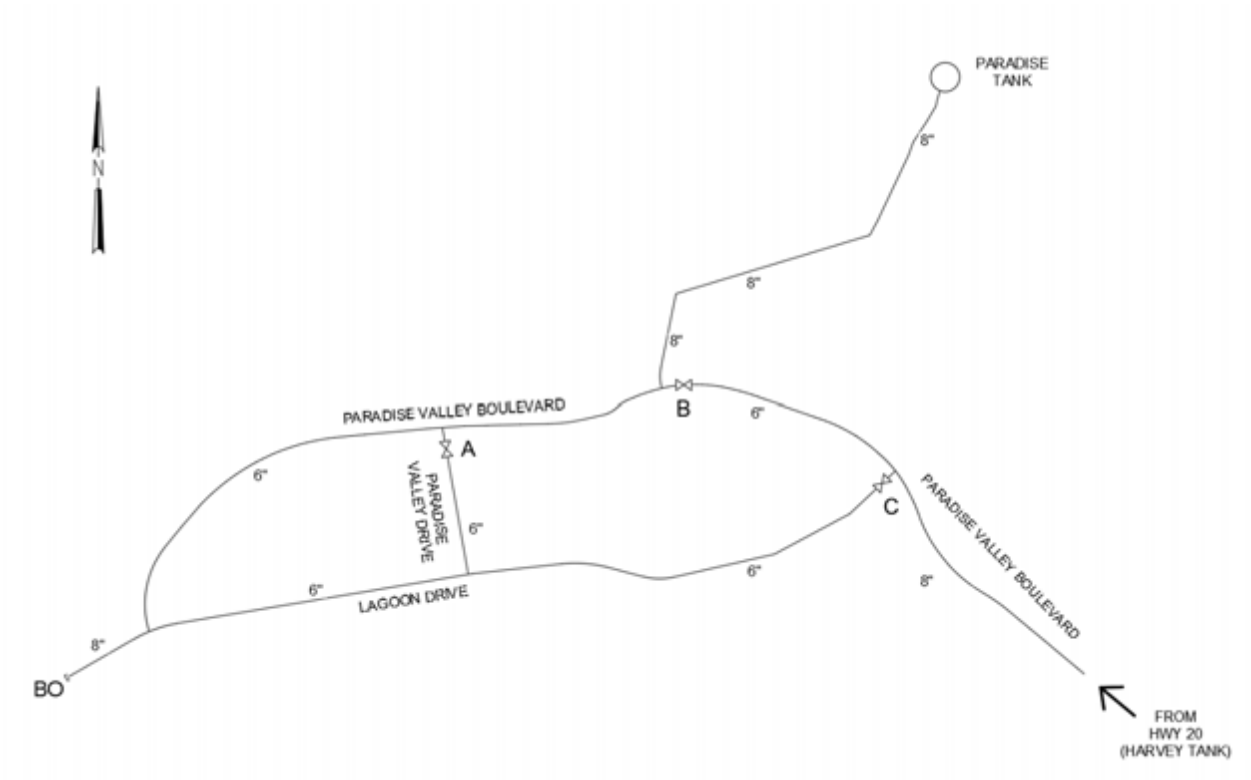
	Shady Lane Tank	Konocti Tank	Mesa-Stubbs Sample Point	Harvey Tank	Paradise Tank	Paradise Sample Point
Average, µg/L	31.3	28.6	31.4	45.7	3.1	77.0
Maximum, µg/L	37.6	30.1	39.3	47.8	5.2	80.2
Minimum, µg/L	26.8	27.8	29.1	45.5	2.8	69.7

Scenarios 1 – 4 Discussion

Scenario 2 confirms that the Harvey tank would exceed the TTHM MCL of 80 µg/L if operated at full capacity. Scenario 3 indicates that installation of THM removal equipment in the Konocti tank would significantly reduce TTHM levels at the Mesa Stubbs sample point but with minimal influence on the concentrations within the Harvey tank when full. Scenario 4 shows that installation of THM removal equipment within the Harvey tank would generally only serve the Harvey tank itself with little influence on the Paradise Sample point. This is partially due to the long length of pipe between the Harvey tank and the High Valley tank which volumetrically totals to approximately 32,000 gallons, providing over a day of additional retention time prior to reaching the Paradise service area allowing THM concentrations to regenerate. A schematic of the Paradise cove piping is presented in **Figure 3.27.5** showing that flows are routed through Paradise Valley Boulevard, Lagoon Drive, and Paradise Valley Drive prior to entering the Paradise Tank where THMs are removed. Note, the sample point is immediately upstream of the blowoff located on the west end of Lagoon Drive. The absence of a dedicated outlet pipe between the

tank and the piping on Lagoon Drive and Paradise Boulevard results in aged water within the 8" inlet piping travelling back to the Paradise Valley Boulevard prior to the arrival of treated water from the Paradise tank. CLOCWD staff has indicated that valve "B" has been left partially closed with the intent of improving water quality by routing more flow through Lagoon Drive and the west side of Paradise Valley Boulevard prior to filling the Paradise Tank. This valving arrangement, in addition to other valving arrangements were also modeled under scenario 5.

***Figure 3.27.5**, Paradise Cove Distribution Schematic*



Scenario 5 – Paradise Valving Analysis

This scenario is the same as Scenario 1 except the TTHM concentration at the Paradise sample point is evaluated under different conditions which consider alternate flow routing throughout Lagoon Drive, Paradise Valley Drive, and Paradise Valley Boulevard by the closure of specific valves.

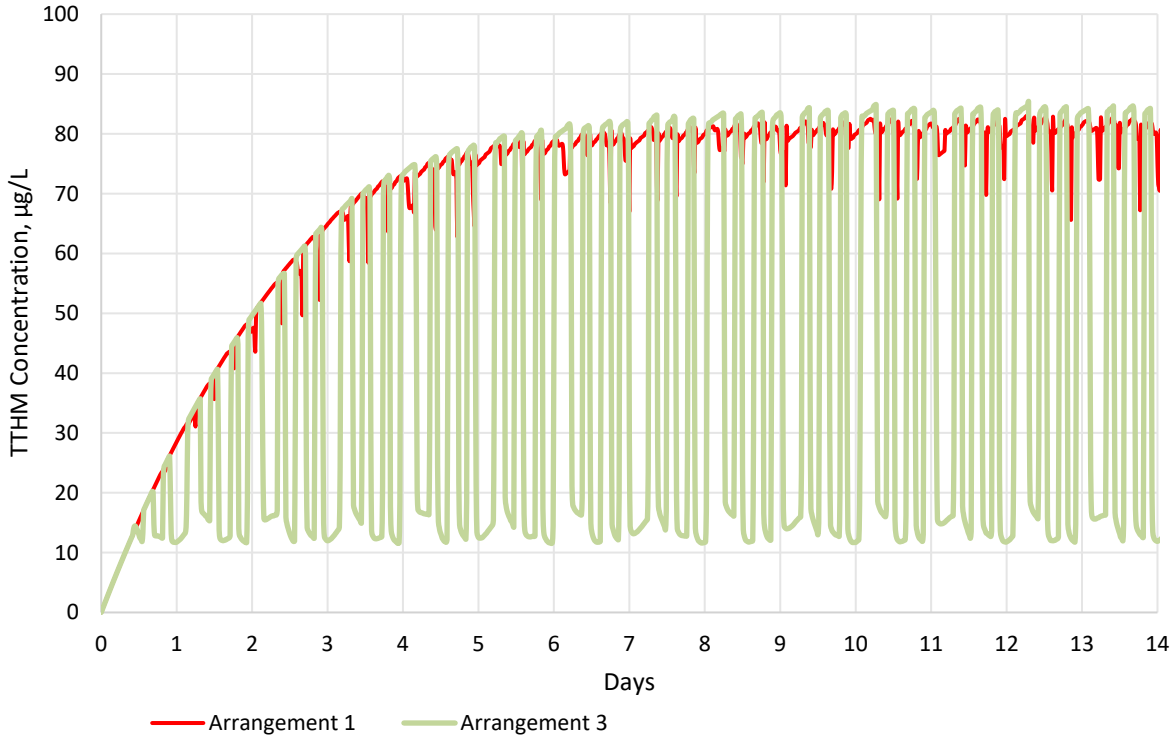
***Table 3.28.5**, Scenario 5 - Modeled Range of TTHM Concentrations*

Valving Arrangement	Valve Status			**Paradise Sample Point** TTHM, µg/L
	A	**B**	**C**	
0	Open	Open	Open	71.1
1	Closed	Closed	Open	70.8
2	Open	Closed	Open	73.2
3	Closed	Open	Closed	45.1

Table 3.28.5, arrangements no. 0 - 2, shows that routing flow through Lagoon Drive to the Paradise Tank with Paradise Valley Drive either open or closed does not noticeably improve TTHM concentrations relative to leaving all isolation valves open. Valving arrangement no. 3 indicates that routing flows directly to the Paradise Tank will reduce TTHM concentrations to approximately 45 µg/L on average. This decrease in concentration is a result of Harvey water only entering Lagoon Drive after the Paradise tank has filled when the flow reverses within the piping between the tank and Highway 20. Other valving arrangements, which route flows through Lagoon Drive prior to entering the tank, completely fill the mains on Lagoon Drive and Paradise Valley Boulevard with high concentration THM water from Harvey prior to filling the paradise tank. **Figure 3.27.5** below shows the estimated THM concentration on the west end of Lagoon Drive for valving arrangements 1 and 3. Valving arrangement no. 3, presented in green, shows alternating flow of low THM concentration from the Paradise tank followed by high concentration THM flow from the Harvey tank. The THM concentrations under valving arrangement no. 1 is presented in red which show that high concentration THM water from the Harvey tank occupies the piping on the west end of Lagoon Drive a majority of the time due to the fact that by the time that the low THM concentration water from the Paradise tank begins to reach the west end of Lagoon Drive the low level in the tank is reached and the Harvey valve is called to refill the Paradise tank which reverses flow and introduces high THM concentration water back into Lagoon Drive and Paradise Valley Boulevard.

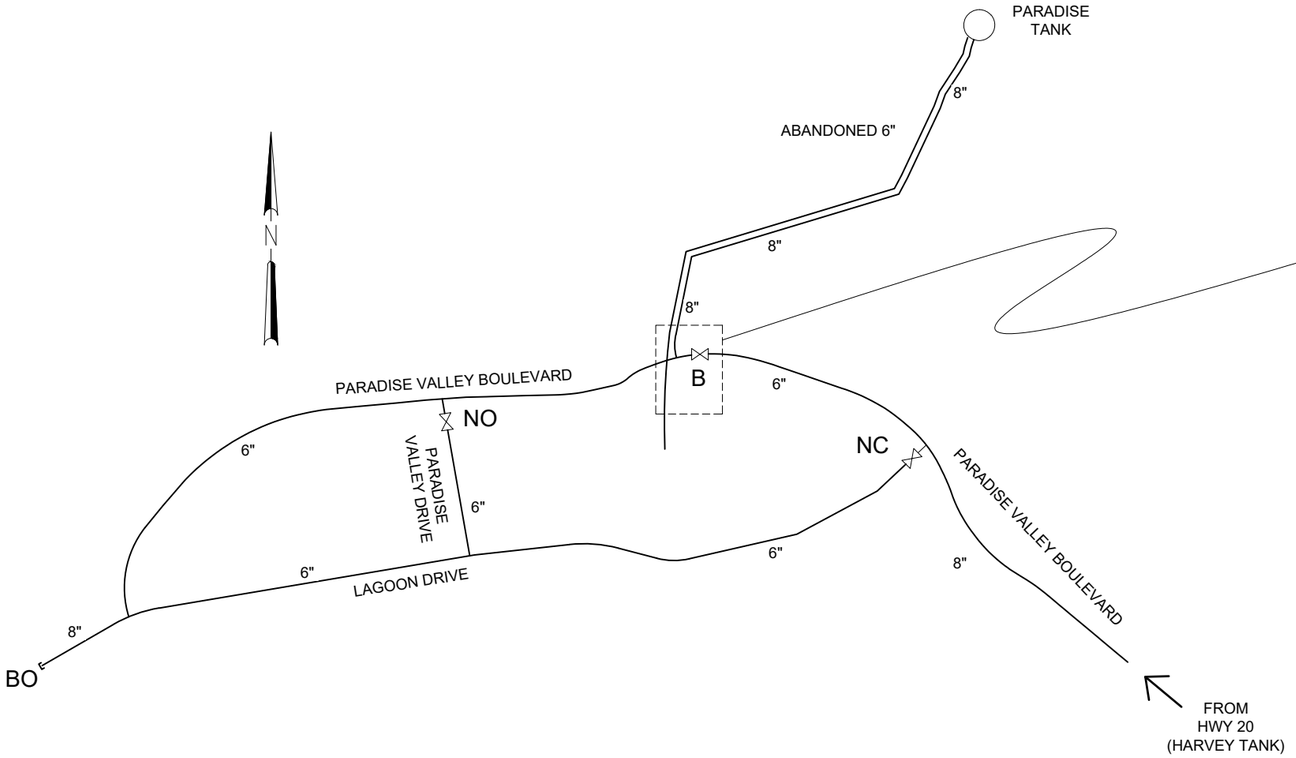
Under all the valving arrangements the underlying mechanism, responsible for high THM concentrations is the same: the 8-inch diameter pipeline between Paradise Valley Boulevard and the Paradise tank introduces a slug of high THM water into Lagoon Drive every time the Paradise tank is filled. Thus, water quality is improved when the frequency of fill cycles is reduced by lowering the tank's low level set point. The strategies identified above, closure of the valve on Paradise Valley Drive, and lowering the Paradise tank's low-level are only remedies and are not recommended since both actions would jeopardize the fire protection capacity within this area.

***Figure 3.27.6**, Scenario 5 Model Results*



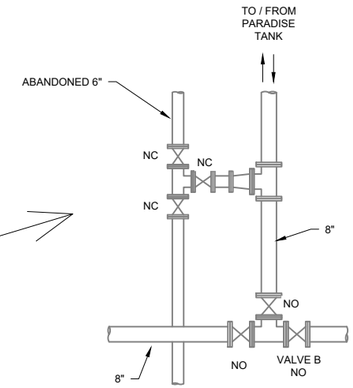
Scenario 6 – Paradise Cove Piping Modifications

Since the single 8-inch diameter pipeline between the Paradise tank and Paradise Valley Boulevard causes up to 3,000 gallons of water from the Harvey tank to bypass treatment within the Paradise tank the most effective improvement is to provide separate inlet and outlet piping from the Paradise tank to Paradise Valley Boulevard. Two proposed piping improvements are presented in **Figure 3.27.7** on the following page. Both improvements assume rehabilitation of the abandoned 6" pipeline which parallels the existing 8" such that the 6" line is used to fill the Paradise tank and the 8" line is used as an outlet. The intertie alternative improvement allows flows to be routed directly to the Paradise tank without bypassing treatment, it should be noted that the fill line would also serve as the outlet for demands east of valve "B" while demands from west of valve "B" are served via the 8" pipeline. The check valve alternative will also prevent Harvey tank effluent from flowing back down the fill line; however, this valving arrangement would not prevent Harvey flows from bypassing treatment when downstream demands from the west side occur while filling the tank. A model was run for each piping alternative with the results shown in **Figure 3.27.8** with THM concentrations resulting in the intertie improvement shown in red and THM concentrations resulting in the check valve improvement shown in blue**.** As expected, the model shows spikes as high as 50 µg/L under the check valve improvements when flows from Harvey bypass the Paradise tank when demands occur during filling of Paradise tank. For the intertie improvements THM concentrations are estimated to average around 15 µg/L with a maximum of 20 µg/L. Both of these improvements assume the closure of valve "C" necessitating installation of a blowoff at the east of Lagoon Drive.

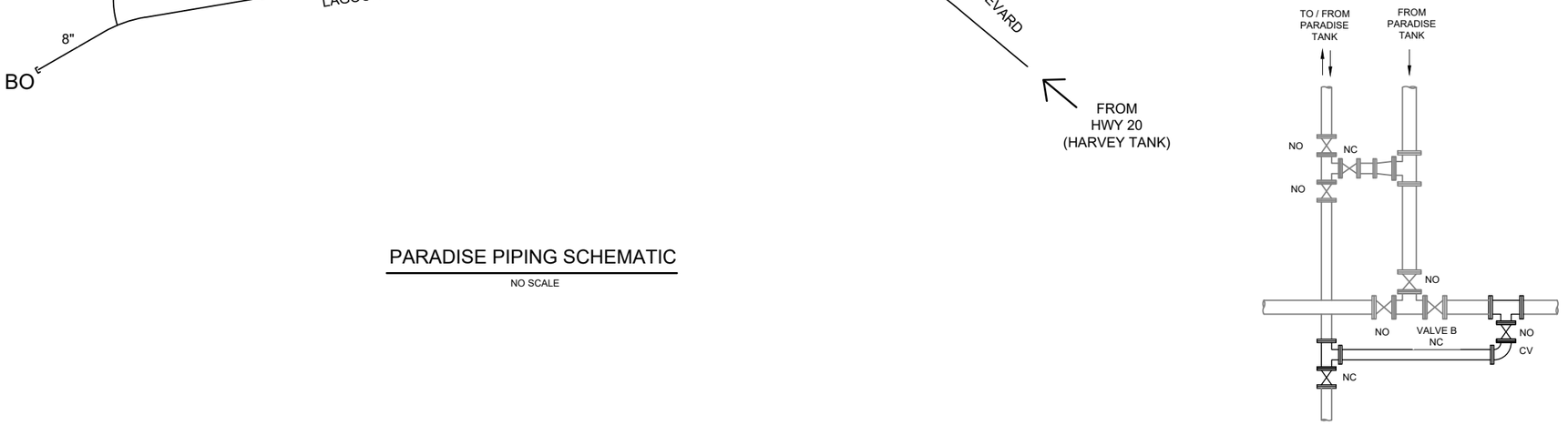


PARADISE PIPING SCHEMATIC

NO SCALE



EXISTING PIPING



INTERTIE ALTERNATIVE IMPROVEMENTS

CHECK VALVE ALTERNATIVE IMPROVEMENTS

NO = NORMALLY OPEN VALVE

NC = NORMALLY CLOSED VALVE

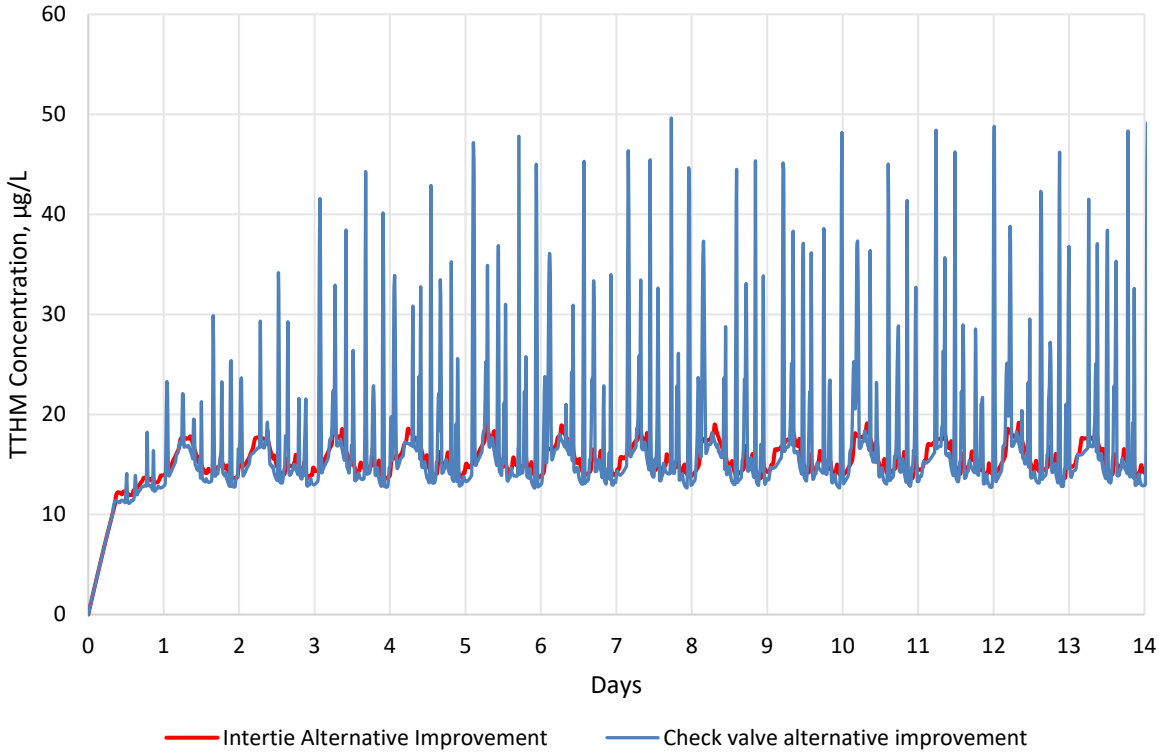
MC Engineering, Inc.
9294 Madison Avenue, Orangevale, CA, 95662
Tel.: 916.223.3828
Fax: 916.860.1863
www.mc-engineers.com

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 3.27.7

PARADISE BOULEVARD PIPING IMPROVEMENTS

***Figure 3.27.8**, Scenario 6 Model Results*



3.9 Operation and Management Systems Analysis

3.9.1 Advanced Meter Reading/Advanced Meter Infrastructure (completed, see update below)

Approximately 80% of the CLOCWD meters are made by Badger Meter and with the implementation of the recommended small meter replacement program as outlined in **Section 4.2.3,** the number would increase to 100%. All existing District Badger meters are fitted with older pulse-type Badger Recordall Transmitter Registers (RTR).

These registers were installed primarily for use with Badger Meter Orion drive-by AMR systems. The RTR register operating principle involves the register sending a pulsed signal for each 1/10 of a rotation of the register. The ability for these registers to perform well in a fixed base system is limited. As such, the cost estimate for all AMI system alternatives assumes that all registers would be replaced with Badger's newer solid state High Resolution Encoder (HRE) registers. The District's meter population includes approximately 2,002, active accounts. This may vary but for the purpose of this analysis, it will be assumed that there will be 2,002 meters/registers that are part of the system.

Deficiencies

The District currently collects meter reads via a combination of drive-by and manual reads. While drive-by is helpful to District staff by making it relatively convenient to obtain meter reads, old and failing endpoints make the system unreliable and in need of an upgrade. Additionally, the large number of manual read meters requires District staff to spend an inordinate amount of time each month to collect meter reads. It also exposes District staff to hazards including traffic, inclement weather, and in some cases rugged terrain and wildlife. The lack of a system-wide drive-by or AMI system limits the staff's ability to maintain an accurate record of water usage throughout the system further complicating their ability to track and monitor the high water losses and the success of related mitigation programs.

High Resolution LCD Encoders from Badger Meter are fully electronic, solid-state, field programmable and use industry standard ASCII communication protocols to provide high resolution encoded output. Status indicators/alarms can also be sent as part of the encoded output to endpoints capable of receiving extended messages. In addition, the HR-E® LCD offers tamper-resistant features such as register removal and magnetic tamper indicators to provide utilities with increased security.

Figure 3.28, *Badger RTR Register*



Figure 3.29, *Badger HRE Register*



Endpoint Installations and Meter Box Lid Retrofit Needs

Although it is possible to receive radio signals from underneath a meter lid, it is highly recommended that any AMI solution include the use of a thru-pit radio transmitter. By its very nature, the ability to receive a radio signal from a water meter below the ground is a challenging proposition. Obstructions including topography, trees, buildings, parked cars, etc. all contribute to the challenge of receiving a viable signal. The meters will require a 1-7/8" diameter hole in the lid to accommodate the endpoint radio. In most cases, this will be accomplished for CLOCWD using a new FRP plastic lid with a pre-drilled hole. For this study, it is estimated that lids will be required in all existing meter locations. For estimating purposes, it is assumed that approximately 1,955 lids will need replacing. A typical thru-pit endpoint from Sensus meter and a completed installation in a concrete lid in a non-traffic area for a Sensus 520M radio transmitter are presented below in **Figure 3.30**.

Figure 3.30, Meter Endpoint and Thru-pit Transmitter Installation



3.9.1.1 Advanced Meter Reading/Advanced Meter Infrastructure 2024 Update

The small meters were recently replaced or upgraded to AMR as described previously, using Badger Orion endpoints with driveby reading capability. The dedicated DMA meters essentially operate using AMI in that they are attached to Badger cellular endpoints that allow the collection of hourly data. The lack of AMI on all the smaller meters does limit the ability to track leaks using the DMA analytics. These analytics will be enhanced once the 3 existing source meters are replaced with Badger compatible magmeters (WTP, Harvey vault, Shady booster pump station meter).

3.9.2 Miscellaneous Equipment

Staff at the District water treatment plant informed MC Engineering of lab equipment that would be beneficial to plant operations. These include a streaming current monitor and a microscope. Equipment details follow:

Benchtop Charge Analyzer

Currently, coagulant dosing at the WTP is determined by performing jar tests. The jar test consists of applying varying dosages of coagulant to a series of glass or plastic jars that are mixed with a gang stirrer to match the mixing and flocculation field conditions as closely as possible. After mixing and settling, the jars are observed to determine which dosage produces floc suitable for water treatment based on criteria that include size, strength, settlement, rate of formation, volume of floc, and clarity of the water.

The overall test may take over an hour to perform and for this reason it is not practical to conduct the test frequently. Because of this, typical practice is to apply dosage rates slightly higher those determined by the jar test to ensure coagulation for varying water quality. This additional dosing of coagulant, over the course of a year can prove costly for the District. As a means of remedying this issue, a streaming current monitor should be considered as a cost-effective strategy for reducing chemical costs by optimizing dosing. The benchtop instrument uses a simple titration procedure to correlate “best jar” with a quantified charge values. Coagulation is added using a pipette or syringe until the dosage is optimized. The process can be completed within a few minutes.

Microscope

A microscope would be beneficial to plant staff by allowing microscopic visual inspection of raw and treated water, allowing for the visual identification of microorganisms, biofilms, and other harmful physical contaminants. The presence of contaminates, or lack thereof, can allow staff to draw conclusions regarding other parameters of water quality and treatment processes such as water pH and coagulant effectiveness. A microscope will also allow for the visual inspection of floc structures and help identify cyanobacteria. A digital camera configured for use with a microscope will allow high resolution images to be captured, stored, and archived.

SECTION 4 – Project Alternatives Evaluations

This section examines various project alternatives that are intended to address and correct the deficiencies discussed in **Section 3**. Projects that solve or mitigate each deficiency are considered along with the costs, benefits, and drawbacks associated with taking no action (the "No Project" option). Operational efficiency, design and constructability, and financial viability are also considered for the projects evaluated. A life cycle cost analysis comparison was prepared for select projects and is included for deficiencies with more than one project alternative (aside from a no project option).

Preliminary design information for the projects that are recommended as a result of the project alternatives evaluation is found are developed further in **Section 5**. A project alternatives matrix summarizing the results of the various alternative evaluations is shown in **Section 4.5**.

4.1 Raw Water Supply

Deficiency – High Concentrations of Cyanobacteria in Clear Lake Source Water During Algae Blooms

As discussed in **Section 3.4.1**, periodic high levels of cyanobacteria in the Clear Lake raw water complicates treatment processes and raises the level of DBPs in the treated water and distribution system, particularly during summer months.

Project Alternative 1 – Rehabilitate One Groundwater Well
As part of a prior investigation, MC Engineering conducted a preliminary analysis to determine the anticipated costs and feasibility of installing a packaged treatment plant at the site of two existing groundwater wells in order to supplement the raw water supply. Based on conversations with previous District staff, there are two wells located on the fill area adjacent to the District's surface water plant on Clear Lake next to Highway 20. The existing groundwater wells were used at one time as the main water source for the plant. Treated water from the wells could be used as part of a conjunctive use strategy that would involve relying on both surface water and groundwater to diversify the District's supply and to augment the current surface water capacity. This additional supply could potentially serve the Paradise Cove Special District annexation area, or other new developments, in order to meet both current and projected demands, particularly during summer months when algae blooms tend to limit clarifier capacity.

The proposed wells were previously used by the District but were reportedly abandoned due to taste and odor problems associated primarily with high iron and manganese levels in the 1990s. The east well was recommended as the best candidate for rehabilitation and treatment. Initial samples were taken in February of 2013, however, the water quality results may have been somewhat inconclusive due to the fact that the well has not been producing and the stagnant water may not be representative of the long-term water quality that would be expected once the well is re-developed and brought into production after sustained pumping. According to retired District staff, the iron levels varied between 8 to 12 mg/L and the manganese was in the range of 0.75 to 1.25 mg/L prior to the well being taken out of service. By comparison raw water samples taken on 2/7/13 were 6 mg/L for iron and 0.8 mg/L for manganese. Results of the February testing can be found in Attachment 4.

The east well is reportedly approximately 50' deep and contains one to three screened sections that are interceded with a blue clay/aquitard. If well water is treated in the future, the use of both chlorine and potassium permanganate for re-charging the greensand would be recommended due to the relatively aggressive raw water quality in the wells. It has not been determined what the condition of the west well is in. The treatment of iron and manganese for this well was reportedly documented in Volume 2 of the Water Treatment Manual published by the Office of Water Programs in Sacramento, California.

Design Criteria

The proposed rehabilitated well would presumably be designed to pump a peak flow of 500 gpm, a flowrate that was confirmed by prior District staff involved in operating the well in the 1990s. Additional preliminary design criteria for the well alternative are presented below in **Table 4.1**.

***Table 4.1**, Preliminary Wellhead Treatment Design Criteria*

Design Criteria	Units
Design Flow Rate	500 gpm
Raw Water Iron Concentration	6-12 mg/L
Raw Water Manganese Concentration	0.75 – 1.5 mg/L
Filter Area	170 sq. ft.
Filter Diameters	Six 6'-0" Dia.
Surface Loading Rate	3 gpm/sf
Backwash Flow Rate	12-15 gpm/sf
Potable Water Iron Secondary MCL	0.3 mg/L
Potable Water Manganese Secondary MCL	0.05 mg/L
Estimated TDH on Well Pump	91 feet
Estimated Well Pump Motor HP	25 HP

Preliminary Design

Two alternative packaged units were considered for the project, one included six filters in a combined package manufactured by Trident Systems and a second alternative consisted of two eight foot diameter filters provided by Loprest. Previous greensand supplies were reportedly provided by Loprest to CLOCWD. Unlike the Trident design which would include both chlorine and potassium permanganate to aid in the iron exchange process, Loprest does not typically include potassium permanganate, an additive highly recommended by previous operations staff. Costs for the Trident system appear to be lower, however this will need to be confirmed subject to the final concentrations in the raw water and the result of future pilot studies.

Regardless of the vendor and treatment process, the filter plant will require a connection to the existing plant clearwell, a backwash supply from the discharge side of the existing plant effluent pumps, and a waste line connecting to the sanitary sewer. In the absence of a detailed design and piping plan each of these lines were estimated at 100 feet with 8" pipe. It is assumed that chlorine would be fed from the existing plant sodium hypochlorite system using chemical metering pumps. The well would presumably be controlled via the level of water in the clearwell and would be operated by a minimum 25 HP submersible pump.

In order to obtain budget pricing, preliminary quotes were requested from the two packaged treatment manufacturers noted above. Additional planning level estimates for well rehab work and a new submersible pump were obtained from Eaton Drilling located in Woodland, CA. Other prices were estimated based on engineering judgement, prior project experience, and common industry standard costs. A 15% contingency was applied to the final estimate along with engineering and start-up costs estimated at 15% of the total project cost. See **Table 4.2** below.

***Table 4.2**, Clearlake Oaks Wellhead Treatment, Preliminary Opinion of Costs*

Item	Estimated Cost
Video Inspection of Well	$1,000
Test Pump and Purge/Rehab Well	$15,000
Water Quality Sampling	$500
Pilot Testing	$20,000
Greensand Packaged Plant	$210,000
Install Packaged Plant (25% of purchase assumed)	$52,500
Electrical (Power Supply)	$10,000
Site Work	
Backwash Feed Line	$9,600
Effluent Pipe to Clearwell	$9,600
Backwash Waste Line to Sewer	$9,600
Tie-in Piping	$10,000
Concrete Pad For Treatment Units	$5,000
Install 25 HP Submersible Well Pump (8” discharge)	$30,000
Instrumentation and Controls	$30,000
Subtotal:	$412,800
Contingencies (15%):	$61,920
Total Construction Cost:	**$447,720**
Engineering and Startup Services (15%):	$71,208
Project Total (w/o prime contractor markup):	**$545,900**

If activating the well is deemed feasible in the future, it is recommended that a video survey be conducted of the wells followed by prolonged pumping, swabbing, and testing to verify the specific capacity. Original well logs should be requested from the State, with permission from CLOCWD staff. Following the re-development of the well, representative samples should be taken and all potential regulated contaminants assessed with an emphasis on the expected iron and manganese concentrations. If this proves to be successful, a pilot study should be conducted by the selected vendor in order to verify the long term viability for treatment.

Preliminary estimates for chemicals provided by Trident engineers were in the range of $0.10/kgal. The impact of this increased chemical cost, and the cost for treating and discharging the backwash waste water would need to be evaluated as well. A temporary dewatering permit may be required during the testing and purging of the existing well. The capacity of the existing sewer system for handling backwash waste streams would also need to be confirmed. Consultation with the State Water Resources Control Board would be required prior to any significant investments in the proposed project. If these investigations

were favorable and the pilot test was deemed successful, a final design could be prepared and firm pricing solicited for the project including the related permanent well installation, treatment units, electrical, instrumentation, yard piping, and controls.

Project Alternative 2 – Install Secondary Raw Water Intake with Greater Depth
This project involves the installation of a secondary (or alternative) raw water intake with associated piping and pumping improvements. The second lake intake would be located at a greater depth than the existing raw water intake. This will allow for greater flexibility in avoiding cyanobacteria in lake water.

This project is not recommended since installing a second lake intake is not considered cost effective and viable given the reliability of WTP's current raw water intake and the ability to meet current regulatory requirements. Additionally, the depth of Clear Lake increases gradually past the current raw intake jetty (approx. 1-foot depth for 100 feet length), necessitating an intake far offshore to gain an increase in depth.

Project Alternative 3 – Install Self-Cleaning Screens over Raw Water Intake
This project would involve the installation of self-cleaning screens at the raw water intake to reduce clogging and prevent clots of algae from being drawn into the treatment process.

This project is not recommended as the cost of installing self-cleaning screens does not justify the expected benefit as cyanobacteria concentrations typically stratify at shallow depths.

Project Alternative 4 – No Project
This alternative is considered viable since, under current conditions, Clear Lake continues to be a reliable source of raw water for the District. While cyanobacteria and resulting DBPs are significant issues, other improvement projects recommended in this Water Master Plan are expected to mitigate these concerns.

Recommendation
Project Alternative 4 - No Project is recommended. Continuing to rely on Clear Lake raw water is acceptable provided the recommended DBP mitigation projects are completed. See **Section 5** for details on the project alternatives for DBP mitigation.

2024 Update
No new raw water sources or improvements to the existing raw water intakes are recommended. Instead, improvements to the plant production capacity can be made by installation of a prepackaged process unit which would be used to reduce the algae loading within the raw water prior to the upflow clarifiers. The use of a rapid ballast clarifier, or a dissolved air floatation (DAF) could be used to enhance the performance and capacity of the existing clarifiers by significantly reducing the algae concentration entering the process train.

4.2 Water Treatment Plant

4.2.1 Ozone Generator

Deficiency – Lack of Backup Ozone Generator
As discussed in **Section 3.5.5**, the WTP currently lacks of a backup ozone generator. Additionally, the WTP is unable to fully pre-treat raw lake water with ozone during algae blooms.

Project Alternative 1 – Installation of New Ozone Generator
This project involves the installation of a new ozone generator. A primary consideration is redundancy in the event the existing ozonator fails. Furthermore, without a second ozone generator, the WTP may not be able to comply with state regulations during algae blooms. Additionally, a second ozone generator will aid in DBP reduction if used for disinfecting treated water prior to distribution. If the plant staff elects to utilize the second ozone generator for disinfection, associated site piping would have to be modified to allow at least one ozone contact tower to be used for this purpose (See **Section 4.3**).

The estimated capital cost for this project is **$90,349**, as detailed in **Section 6.1.**

Project Alternative 2 – No Project
This alternative is not recommended since staff need redundancy under current operations and the fact that State regulations regarding cyanotoxins are expected to come into effect within the next few years. The unpredictability of the severity of seasonal algae blooms also increases the need for additional ozone treatment capacity and redundancy.

The estimated capital cost for this project is $0. The costs associated with maintaining the treatment process with only one ozone generator was not examined. The no project alternative does not eliminate the need for redundancy.

Recommendation
Project Alternative 1 – Installation of New Ozone Generator is **recommended**. The benefits to the plant outweigh the cost of a second ozone generator. See **Section 5.**2 for project details.

2024 Update
District staff has since installed a new ozone generator, proposed follow up improvements aimed at enhancing the performance of the ozone pretreatment is discussed further in Section 5.

4.2.2 High Service Pumps

Two separate deficiencies affecting the High Service Pumps were identified. The High Service Pumps lack VFDs, and High Service Pump 2 is old and needs replacement. Each deficiency is examined in more detail below.

Deficiency – Lack of VFD's on High Service Pumps necessitate throttling of pumps while reducing operator flexibility for managing CT times in the clearwell as required by State regulations.

As discussed in **Section 3.5.9**, VFDs are not currently installed on the High Service Pumps at the WTP. "Hand" throttling is used to control and modulate treated water flows out of the plant.

Project Alternative 1 – Install VFD's on High Service Pumps
The project will replace the existing across the line motor starters (motor control center in the electrical/pump room) with VFD's mounted in new cabinets located along an unused wall in the electrical/pump room. The cabinets will be NEMA 1 rated enclosures with all associated equipment located in the cabinet. The VFD's will be rated at 60 hp, 480 volt, 18 pulse and the system will be tested to insure compliance with IEEE 519. The VFD's will be connected to the SCADA system to allow control and monitoring of the pumps. A new control cabinet along with I/O modules and associated PLC programming will be required along with SCADA configuration. The installation will be completed with the plant operational, therefore, only one pump at a time will be modified. The first pump will be completed and tested before the next second pump is modified.

It should also be noted that proposed VFD motor control will help protect the existing infrastructure from the surge pressures associated with the current start-stop operation of the existing pumps. However, in the event of a power failure, the existing infrastructure is vulnerable to water hammer. To remedy this scenario, plant staff could consider installing a surge anticipation valve that would allow the release of flow back into the clearwell upon sensing pressure changes.

The estimated capital cost for this project is **$119,780**, as detailed in **Section 6.2**. Electricity costs for the High Service Pumps are expected to drop in the range of 10% to 20%.

Project Alternative 2 – No Project
This project alternative will leave the current pumping scheme at the WTP in place. This project is not recommended since the VFDs will lower energy bills at the WTP while providing greater operator flexibility for managing CT and related process parameters. The estimated capital cost for this project is **$0**. However, the no project option will leave energy costs for the High Service Pumps unchanged, whereas installing VFDs is expected to drop energy costs by about 10 to 20 percent.

Recommendation
Project Alternative 1 – Install VFD's on High Service Pumps is recommended. See **Section 5.3** for project details, and **Section 6.2** for costs associated with this project.

Deficiency – High Service Pump 2 at end of useful life

As discussed in **Section 3.5.9**, High Service Pump 2 is old and at the end of its useful life. Pump 2 has a higher horsepower than Pump 3, but it produces less flow and is considered to be less reliable.

Project Alternative 1 – Replace High Service Pump 2
This project would involve the replacement of the 60 horsepower High Service Pump 2 with a new Berkeley 75 horsepower centrifugal pump, or equal.

The estimated capital cost for this project is **$13,232**, as detailed in **Section 6.3**.

Project Alternative 2 – No Project
This option leaves High Service Pump 2 as it is without upgrading or replacing it. This option is **not** recommended as this pump is due for replacement. This project carries a **$0** capital cost.

Recommendation
Project Alternative 1 – Replace High Service Pump No.2 concurrent with new VFDs project.

2024 Update
The primary pump has been replaced with a 100 hp split case pump with VFD control. It is proposed that pump no. 2 serve as a standby pump and be equipped with VFD control.

4.2.3 Equalization Tank

Deficiency – Lack of an equalization tank for backwash flows puts a hydraulic load on sewer system Lift Station 7, Lift Station 2, and the WWTP.

As discussed in **Section 3.5.10**, an Equalization tank would reduce hydraulic demands on lift station 7, 2, and the WWTP since peak backwash flows would be stored in the tank and released in a controlled fashion instead of being discharged directly to the sewer.

Project Alternative 1 – Install Equalization Tank at WTP
The installation of the equalization tank at the WTP will include a 60,000 gallon welded steel tank, a flow meter, manual throttling valve, tank access for cleaning and maintenance, and a cleanout on the gravity effluent line to the discharge point which flows to a nearby manhole. This tank will require no site grading as a level pad already exists.

Design Criteria
Proper storage for flow equalization would need to accommodate the maximum filter and contact clarifier backwash event expected in a single day. There are a total of three pressure filters: two 144 sq. ft filters and one 288 sq. ft filter. Each filter consists of four cells which are backwashed at a rate of 11.5 gpm/sqft for approximately 6 minutes each. The resultant volume of water produced in the event all filters are backwashed in succession including filter to waste, would equate to approximately 50,000 gallons. Clarifier waste is discharged on an hourly basis at a rate of approximately 55 gpm with a duration ranging from as low as 10 minutes during the winter to 50 minutes during the summer.

Since the clarifier waste is discharged in a relatively uniform manner throughout the day, equalization storage would not be impacted as these flows are discharged continuously during plant opeartion. In addition to 50,000 gallons of equalization storage, it is estimated that approximately 10,000 gallons would be needed to sustain a minimum tank level and a measure of freeboard depending on the tank dimensions. A tank with minimum working volume of 60,000 gallons is recommended for equalization purposes. This volume is also in range of the AWWA recommended storage of 2 to 5 percent of daily facility production.

System Assumptions

During the summer Clear Lake experiences intense blue-green algae blooms requiring maximum ozone pretreatment. As mentioned, the excessive algae concentrations require more clarifier blowdown. The volume of clarifier waste is also exacerbated by the higher water demands during the summer which require the plant to run at or near the maximum operational capacity for up to 18 hours a day. These hours of operation are common throughout the summer and should be used as a basis for design of the proposed backwash recovery system. Summer process flows are presented in **Table 4.3** below:

***Table 4.3**, Summer Process Flows*

Process	Rate/Amount	Notes
Total Influent	775 gpm	Raw water flow ranges from 650 to 850 gpm, average of 775 gpm.
Lake Intake	705 gpm	Reduced in-tank flow from lake.
Recycled Flow	70 gpm	The additional 10% return flow would be used to supplement existing influent flow of 775 gpm. (Not recommended).
Backwash Flow & FTW	24,372 gal	Filter No. 1 used primarily in the summer, typically backwashed once a day.
Clarifier Waste	45.8 gpm	Average continuous flow.
Operation Time	18 Hours	Assumes plant is run in a continuous fashion.

It should be noted that if these flows were returned to the plant intake under these conditions, the excessive clarifier waste loading would significantly reduce the wash-water recovery system's capacity for returning backwash water in a timely manner. The rate at which filter backwash water could be recycled would be limited to approximately 24.6 gpm. This outflow rate would require that the recycle system run continuously during plant operation throughout the day (16.5 hrs) to dispose of the daily filter backwash flows. It is **not** recommended that backwash flows be returned to the plant intake.

Project Alternative 2 – Install Equalization Tank at WTP with Floating Decanter

As previously discussed a minimum volume of 60,000 gallons should be considered for equalization. If the equalization tank is to also perform as a sedimentation basin the tank would need to be augmented with a floating decanter to collect supernatant and drain to a wet well. The wet well would supply a duplex pump station to return flow to the headworks. The storage capacity needed for sedimentation is largely determined by the detention time required for backwash residuals and algae to settle. Jar testing to investigate the settling characteristics of blue-green algae and backwash residuals would ultimately be needed in order to determine the feasibility of this alternative. It may be necessary to enhance settling with a flocculator to decrease the volume and footprint of the tank. This is not currently a recommended project but may be a future consideration.

Project Alternative 3 – Install Equalization Tank at WTP followed by Plate Settler

If an equalization tank is impractical for sedimentation, a lamella plate settler could be considered downstream of the proposed 60,000-gallon equalization tank. A pilot settling unit would need to be tested during the summer to assess process performance under the loading of the algae laden clarifier

waste as well as backwash water. Pilot testing could also be used to investigate the effectiveness of utilizing a plate settler that is augmented with flocculation in the equalization tank. This is not currently a recommended project but may be a future consideration.

Project Alternative 4 - Install Equalization Tank at WTP followed by Dissolved Air Flotation Unit
An alternative to installing a plate settler is installing a Dissolved Air Flotation (DAF) unit for solids removal. DAF performance could likely be very good based on favorable reports regarding performance of other treatment plants with DAF units around Clear Lake. This is not currently a recommended project but may be a future consideration.

Project Alternative 5 – Install Equalization Tank at WTP with on site sludge dewatering
This alternative is would consider dewatering settled sludge on site rather than discharging solids sanitary collection system for subsequent dewatering at the WWTP. Regardless of the feasibility of the dewatering operations the system would consist of a plate settler and belt filter press (BPF) downstream of the 60,000 gal equalization tank. The BPF would be housed in a new building which would also store polymer needed to coagulate suspended solids within the clarifier. Similar to the operations at the wastewater treatment plant, the dewatered sludge would be stored in geotextile bags prior to trucking to a certified landfill.

Project Alternative 6 – No Project
The no project alternative would involve not installing any new facilities for handling backwash water. The plant is currently using a temporary rainwater collection container to help reduce the effect of backwash water surges on the sewer system. If the no project option is selected, this system would presumably continue.

Recommendation
Project Alternative 1, Install Equalization Tank, is recommended. Due to concerns regarding cyanobacteria and the added complexity anticipated with future regulatory compliance it is not recommended that the water in the tank be decanted and returned to the headworks.

2024 Update
Project Alternative 1 is still the preferred alternative for this project except that CLOCWD staff has indicated their preference for two 30,000 gallon open-top bolted steel tanks rather than one 60,000 gallon welded steel tank.

Furthermore, the added complication of handling solids, given the relatively finite site footprint and other operational challenges, suggest that continuing the current practice of sending solids to the sewer is more practical than solids management at both treatment facilities. There are large capital and operational costs associated with the addition of an on-site solids management at the WTP, these costs are presented below in **Table 4.4.**

***Table 4.4**, Onsite Solids Management Costs*

Description	Opinion of Probable Cost
Plate Settler	$215,000
Polymer Feed System	$10,000
Belt Filter Press	$350,000
Yard Piping	$45,000
Site Work	$20,000
Electrical and Controls	$66,000
Subtotal	**$726,000**

Operating costs for dewatering at the WTP are based on conversations with the operations staff and an average turbidity in the raw water of approximately 8 NTU. Assumptions were made to include an NTU to TSS ratio of 1.0. Additional loading is included based on a polymer dosage averaging 23 mg/L according to plant staff. The resulting operating cost is estimated at $97.26/ ton ($13,060.15) as reflected below in **Table 4.5**.

***Table 4.5**, Onsite Solids Management Costs*

Operating Cost Parameters	Value
Total Annual Plant Production (MG/Year)	230
Avg. Raw Water Turbidity	8
Percent Turbidity Reduction	90
Estimated NTU/TSS Ratio	1
Estimated lbs/day TSS	37.84
Avg. Polymer Dsage (mg/L)	18[1]
Polymer Loading (lb/day)	94.6
Total Solids Loading lb/day	132.43
% Solids off of Belt Press	18
Wet Sludge (Tons/Year)	134
Landfill Tipping Fee ($/Ton)	$51
Trucking Costs ($/Year)	$4,196[2]
Estimated Annual Operating Costs	
Polymer	$2,000[3]
Landfill	$6,864
Trucking	$4,196
Total Annual Costs	**$13,060**[4]

NOTE:
1. ***Assumes up to 4 tons/haul at $125/haul***
2. ***Existing Clarifiers***
3. ***400 gal/yr @ $5.00/gal***
4. ***Excludes staff labor and maintenance***

The $13,060 annual operational cost would equate to $97.26 per Ton of sludge, for comparison the historic disposal costs for dewatering sludge at the WWTP for 2015 were obtained from the WWTP operations staff. These costs were estimated at approximately $78.01/ton as reflected below in **Table 4.6**.

Table 4.6, Estimated 2015 Dewatering Costs at WWTP

Materials	Cost
Lambert Cost	$500/26 tons
Lambert Trucking	$19.23
Potrero Hills Disposal	$36.79
Total Cost/Ton	$56.02
Bag Cost (45x75)	$2,199
Tons/Bag	100 tons
Total Cost/Ton	$78.01

The cost for disposing sludge at the nearby Eastlake Landfill was used for estimating costs for the WTP disposal. It was further assumed that a bin capable of holding approximately 4 tons/load would be used due to the relatively limited space at the WTP for storing dewatered solids. By inspection, the Eastlake landfill tipping fee of $51.12/ton is considerably lower than the bulk tipping fee charged by Potrero Hills ($36.79/ton). When combined with the relatively frequent hauling needs at the WTP, trucking costs further exacerbate the costs for hauling solids from the WTP. Because the disposal costs are higher for the WTP dewatering alternative by almost $20/ton ($19.25) it is evident that savings is non-existent, thus making it cost prohibitive to justify the relatively large ($1,000,000 +/-) capital investment for dewatering facilities at the WTP.

The current annual solids disposal costs at the WWTP of $16,968 is considered reasonable when compared to the projected $13,060 per year for disposing only the WTP solids. The WTP solids constitute an estimated 45% of the solids generated at the WWTP. Costs would therefore be reduced at the WWTP by approximately 45% if solids were removed at the WTP for a savings at the WWTP of $7,635.00. This would be offset by an increase at the WTP of $13,060 for a total annual projected future cost of $22,393, representing a net increase annually estimated at $5,425. Based on this information, it is recommended that the proposed equalization tank be included at the WTP to attenuate peak flows while continuing to discharge all waste streams to the sanitary sewer for subsequent dewatering at the WWTP.

4.2.4 Disinfection Byproducts Mitigation

Deficiency – High levels of DBPs in treated water are bordering on non-compliance. Additional water storage will this exacerbate problem and likely result in future violations during critical times of the year.

With the addition of the water storage required to meet maximum day demands and fire-flow demands, DBPs are expected to be an issue for the District as discussed in **Section 3.5.6**. The following projects have the potential of mitigating these concerns.

Project Alternative 1 - One-Way Fill Line from Clearwell to Storage Tank
The construction of a one-way fill line from the clearwell located at the WTP to the Shady Lane storage tank will increase the District's ability to manage CT times. The longer CT afforded by additional storage would potentially allow staff to apply a lower dose of chlorine which, in turn, should reduce threats from

DBPs. The piping modifications at the Shady Lane tank would also reduce the residence time within the system near the tank because water would flow one way through the tank.

The estimated cost for this project is **$567,000**

Project Alternative 2 – Installation THM Removal System at clearwell
THM removal systems which employ mixing, spray aeration, and forced-air ventilation have been proven to successfully remove and volatile THMs from storage tanks. In addition to improvements which mitigate the potential for THM formation, a THM removal system may be necessary to maintain THMs below the MCL.
The estimated cost for this project is **$295,000**

Project Alternative 3 – Post Ozonation Disinfection
Modifying the site piping to allow ozone contactors to be utilized at the end of the treatment process will allow them to be used for disinfection, thus reducing the need for chlorinating water in the clearwell. This is expected to have a beneficial effect on DBP control.

The estimated cost for this project is **$282,300**

Project Alternative 4 – Acid Feed System
This project involves injecting acid into the water being treated to reduce and control pH. This would involve adding an acid injection point on the inlet line to the clarifiers. An injection pump, an additional chemical storage tank, and associated conduit and plastic tubing to make connections would be installed. This project is recommended as lower water pH is likely to improve the treatment process at the clarifiers, filters, and clearwell thus decreasing DBP levels. The details of this design are discussed further in **Section 5.1.8.**

The estimated cost for this project is **$46,000**, as detailed in **Section 6.7.**

Project Alternative 5 - No Project
Take **no action** until new storage is operational to determine if DBP levels exceed regulation limits.

Recommendation
It is recommended that adding an acid feed system to lower pH be implemented immediately. As discussed, a lower pH would reduce chlorine and coagulant dosing rates resulting in operational savings as well as reducing the potential for DBP formation. An additional ozone generator should be installed to ensure the facilities capacity to effectively treat algae blooms during the summer and provide redundancy should the existing generator fail. The additional ozone generator would also be used for post ozonation and is also highly recommended.

The installation of a THM removal system and/or relying on ozone for disinfection of treated water should be considered pending the results of future water quality sampling once all storage tank projects have been completed and distant locations, as well as immediate improvements at the treatment facility.

As discussed in **Section 3** it may be more effective to place a full THM removal system at the Harvey tank site instead of the clearwell, As part of the project alternative selection process for this *deficiency*, a 20-year life cycle analysis was completed and is presented below in **Table 4.7**.

***Table 4.7**, Present Worth Analysis for DBP Mitigation Project Alternatives*

Project Alternatives	Capital Cost	Annual O+M	Present Worth O+M	Salvage Value	Present Worth Salvage	Net Present Worth
One-Way Fill Line	$566,600	$500	$8,200	$113,320	$25,700	$549,100
Tank Aeration	$295,000	$6,200	$101,500	$59,000	$13,400	$383,100
Post Ozonation	$282,000	$5,500	$90,700	$56,500	$12,800	$360,200
Acid Feed	$46,000	$8,600	$140,800	$9,200	$2,100	$184,700

Note: All values are rounded to the nearest hundred.

The life cycle analysis shows that a one-way fill line would be most costly and an acid feed system the cheapest. It should be noted that this preliminary life cycle analysis does not directly reflect the cost effectiveness of each alternative in terms of THM. The rate of THM removal for each alternative need to be determined by plant scale tests and sampling.

2024 Project Recommendation Update

In general, it is recommended that THM removal equipment be installed at each tank site within the District's system, this should be a long term goal. The immediate goal is to improve water quality within proximity of the existing sampling points: Mesa Stubbs, and Paradise Cove. Since the installation of THM removal equipment at the clearwell within the WTP, it has been realized that there is no guarantee that additional improvements at the WTP, which aim to inhibit TTHM production within the process train, will be effective in reducing TTHM production within the distribution system. Chlorine residual must be maintained throughout the distribution system causing TTHMs to continue to develop in the presence of organic material within the pipelines. For this reason, the post ozonation and the acid feed project alternatives should not be considered for TTHM removal. However, the acid feed system should be considered to enhance clarification capacity. For similar reasons the one-way fill line to the Shady Lane tank will not significantly enhance water quality in the farther reaches of the system.

Section 3 identified piping modifications between Paradise Valley Boulevard and the Paradise Tank which would significantly reduce the TTHM concentrations within the west end of the Paradise Cove service area utilizing the existing THM removal equipment withing the Paradise tank, these piping improvements are recommended since they do not require significant construction costs which would typically be associated with installation of a new pipeline or additional treatment capacity.

The analysis of Section 3 also identified the installation of THM removal equipment within the Konocti tank as the most effective method of reducing TTHM concentrations at the Mesa Stubbs sampling point since it has the most influence of the sampling point being immediately upstream. Project details for these improvements of described in Section 5.

4.2.5 Corrosion Protection

Deficiency – Insufficient corrosion protection. Substantial corrosion has degraded the paint coatings down to the primer, and in many cases, to the bare steel surface, with some pitting noticeable. The existing coatings are insufficient and lack any supplemental cathodic protection. Renovations using high quality coatings should be considered to extend the service life of each tank and protect water quality.

Project Alternative 1 – Renovation of Clearwell and Clarifier
The renovation of the clearwell with a high quality coating (AWWA Specification) system will extend the service life of the tank preventing excessive corrosion and the potential for early structural failure (leaking or roof damage), which would require the District to incur extensive costs in tank repair and/or replacement in the near future.
Project Alternative 2 – No Project
The no project alternative would essentially lead to structural failure as the tank would continue to degrade from extreme un-inhibited corrosion. The service life of the tank would be minimized and ultimately require the construction of a new tank.

Recommendation
Project Alternative 1, Renovation of Clearwell and Clarifiers is recommended. The clearwell and clarifier are critical to maintaining reliable water production at the facility and should not be neglected. The life expectancy of welded steel tanks can range from 50 years or less with minimal maintenance and up to 100 years with good preventative maintenance practices. Both the clarifiers and clearwell are considered too new to be neglected. A high quality coating system would help ensure an additional 15 to 20 years of service life until recoating would be required. The recommended scheduling of renovation for the clearwell and clarifiers is discussed under the Capital Improvement Plan (**Section 7**).

2024 Update
As described previously, both clarifiers, and clearwell have been recoated and equipped with cathodic protection systems. No further improvements are recommended.

4.3 Water Distribution

4.3.1 Pipelines

Deficiency – Inadequate Main Sizes to Facilitate Fire Flows and High Water Losses due to Aging and Deteriorating Pipes in Existing Service Area

Project Alternative 1 – Comprehensive Pipeline Rehabilitation Project
A comprehensive engineering analysis was conducted that was based on acoustical leak detection and evaluation of pipelines as based on the criteria as listed in **Table 3.21**. The results of this engineering analysis identified sections of the distribution system that did not meet modeling or operational requirements, and are listed below:

- Harvey Blvd Area
- High Valley Area
- Keys Blvd Area
- Pluth Tank Site Area
- Shady Lane Area

The Distribution System Pipeline Project Priority table summarizes the prioritized ranking of main replacements and presents a phased approach that can be modified to meet funding capabilities in the future. The pipeline replacement projects would be implemented in four phases: immediate, Phase 1 (5-yr), Phase 2 (10-yr), and Phase 3 (25-yr). The pipelines selected for replacement within the matrix evaluation were prepared with the most current data from the operational staff of the CLOCWD. As a result of the analysis pipeline replacements prioritized for immediate replacement are shown below in **Table 4.8.**

In addition to the projects listed in the **Table 3.21** matrix, hydraulic modelling results concluded that an additional section of the distribution system is not meeting operation requirements. This *deficiency* and accompanying recommended project is described below:

Table 4.8, Immediate Pipeline Replacements

MP Project Area	Road Segment	From	To	Existing		Proposed		Mainline Replacement			Service Replacement						Meter Box Replacement			Valve Replacement			Hydrant Replacement			Total Cost per Segment
				Pipe Size (in.)	Pipe Type	Pipe Size (in.)	Pipe Type	Mainline Length (ft.)	Unit Cost ($/LF)	Total Cost ($)	Number of Single Services	Unit Cost ($/ea)	Total Cost ($)	Number of Double Services	Unit Cost ($/ea)	Total Cost ($)	Number of Meter Boxes	Unit Cost ($/ea)	Total Cost ($)	Number of Gate Valve	Unit Cost ($/ea)	Total Cost ($)	Number of Fire Hydrants	Unit Cost ($/ea)	Total Cost ($)	
Harvey	E. Harvey Blvd	Young Dr	Hwy 20			8	PVC	1,718	80	**137,460**	1	2,000	**2,000**	2	2,300	**4,600**	**5**	**300**	**1,500**	8	2,500	**20,000**	3	5,800	**17,400**	**$182,960**
Harvey	Terry Dr	W. Harvey Blvd	E. Harvey Blvd			6	PVC	616	75	**46,200**	4	2,000	**8,000**	10	2,300	**23,000**	**24**	**300**	**7,200**	2	2,000	**4,000**	3	5,800	**17,400**	**$105,800**
Harvey	W. Harvey Blvd	W. Dirt Road to Harvey Tank	Hwy 20			8	PVC	1,064	80	**85,102**	-	-	-	-	-	-	-	-	-	2	2,500	**5,000**	-	-	-	**$90,102**
Harvey	Mitchell Rd	W. Harvey Blvd	6" Tie-in			8	PVC	605	80	**48,400**	-	-	-	8	2,300	**18,400**	**16**	**300**	**4,800**	2	2,500	**5,000**	2	5,800	**11,600**	**$88,200**
Harvey/Comm	S. Hwy 20	E. Harvey Blvd	End of Pipe	2	GI	8	PVC	466	80	**37,243**	-	-	-	2	2,300	**4,600**	**4**	**300**	**1,200**	2	2,500	**5,000**	1	5,800	**5,800**	**$53,843**
Harvey	E. Dirt Road to Harvey Tank	Harvey Tank	W. Harvey Blvd			8	PVC	486	80	**38,863**	-	-	-	-	-	-	-	-	-	2	2,500	**5,000**	-	-	-	**$43,863**
Harvey	C. Hwy 20	Harvey Blvd	Harvey Blvd	2	GI	8	PVC	35	80	**2,803**	-	-	-	-	-	-	-	-	-	2	2,500	**5,000**	-	-	-	**$7,803**
Harvey	W. Dirt Road to Harvey Tank	Harvey Tank	W. Harvey Blvd			8	PVC	448	80	**35,858**	-	-	-	-	-	-	-	-	-	2	2,500	**5,000**	-	-	-	**$40,858**
Keys/Comm	Hwy 20	N. Short St	Lake St	4	AC			Abandon line and tie services onto current 12" AC			-	-	-	12	2,300	**27,600**	-	-	-	4	2,500	**10,000**	-	-	-	**$37,600**
Keys	Schindler St	Hwy 20	6th St	2	GI	8	PVC	1,501	80	**120,074**	4	2,000	**8,000**	15	2,300	**34,500**	-	-	-	12	2,500	**30,000**	-	-	-	**$192,574**
Keys/Comm	S. Hwy 20	Lake St	Schindler St	4	AC	12	PVC	1,397	90	**125,731**	4	2,000	**8,000**	6	2,300	**13,800**	-	-	-	8	3,350	**26,800**	3	5,800	**17,400**	**$191,731**
Keys/Comm	N. Hwy 20	Lake St	Schindler St	4	AC	10	PVC	1,668	85	**141,745**	4	2,000	**8,000**	6	2,300	**13,800**	-	-	-	8	2,500	**20,000**	3	5,800	**17,400**	**$200,945**
Keys/Comm	C. Hwy 20	N. Hwy 20	S. Hwy 20	4	AC	10	PVC	74	85	**6,290**	-	-	-	-	-	-	-	-	-	2	2,000	**4,000**	-	-	-	**$10,290**
Keys/Comm	Hwy 20	Butler St	Keys Blvd	4	AC	12	PVC	1,574	90	**141,660**	-	-	-	5	2,300	**11,500**	-	-	-	8	2,500	**20,000**	1	5,800	**5,800**	**$178,960**
Keys	Lake St	Hwy 20	6th St	2	GI			Abandon line and tie services onto current 6" PVC			2	2,000	**4,000**	2	2,300	**4,600**	-	-	-	11	2,000	**22,000**	-	-	-	**$30,600**
Keys	Shaul St	Hwy 20	6th St	4	AC	8	PVC	941	80	**75,318**	-	-	-	6	2,300	**13,800**	-	-	-	8	2,500	**20,000**	-	-	-	**$109,118**

Keys	1st St	Lake St	Schindler St	2	GI	6	PVC	1,244	75	**93,300**	-	-	-	17	2,300	**39,100**	-	-	-	4	2,500	**10,000**	3	5,800	**5,803**	**$148,203**
Keys	2nd st	Lake St	Schindler St	2	GI	6	PVC	1,113	75	**83,458**	-	-	-	18	2,300	**41,400**	-	-	-	4	2,500	**10,000**	3	5,800	**5,803**	**$140,661**
Keys	3rd St	Lake St	Schindler St	2	GI	6	PVC	965	75	**72,375**	3	2,000	**6,000**	10	2,300	**23,000**	-	-	-	4	2,000	**8,000**	3	5,800	**17,400**	**$126,775**
Keys	4th St	Lake St	Schindler St	2	GI			Abandon line and tie services onto current 6" PVC			-	-	-	13	2,300	**29,900**	-	-	-	2	2,500	**5,000**	-	5,800	-	**$34,900**
Keys	5th St	Lake St	Schindler St	2	GI	6	PVC	668	75	**50,117**	-	-	-	13	2,300	**29,900**	-	-	-	2	2,500	**5,000**	-	5,800	-	**$85,017**
Keys	6th St	Schindler St	Schindler St	2	GI	8	PVC	363	80	**29,040**	-	-	-	4	2,300	**9,200**	-	-	-	2	2,500	**5,000**	1	5,800	**5,800**	**$49,040**
Plaza	Oak St	Foothill Blvd	The Plaza	4	AC	8	PVC	1,050	80	**84,000**	1	2,000	**2,000**	13	2,300	**29,900**	6	2,500	**15,000**	2	5,800	**11,600**	-	-	-	**$142,500**
Plaza/Comm	Pine St	Foothill Blvd	The Plaza	4	AC	8	PVC	1,066	80	**85,307**	1	2,000	**2,000**	15	2,300	**34,500**				4	2,500	**10,000**	2	5,800	**11,600**	**$143,407**
Pluth	Peach Cir	Orchard Shore Dr	Orchard Shore Dr								-	2,000	-	4	2,300	**9,200**	-	**300**	-	-	2,500	-	-	5,800	-	**$9,200**
Pluth	Lemon Cir	Orchard Shore Dr	Orchard Shore Dr								5	2,000	**10,000**	3	2,300	**6,900**	-	**300**	-	-	2,500	-	-	5,800	-	**$16,900**
Pluth	Plum Cir	Orchard Shore Dr	Orchard Shore Dr								5	2,000	**10,000**	3	2,300	**6,900**	-	**300**	-	-	2,000	-	-	5,800	-	**$16,900**
Pluth	Grape Cir	Orchard Shore Dr	Orchard Shore Dr								-	2,000	-	5	2,300	**11,500**	-	-	-	-	2,500	-	-	-	-	**$11,500**
Total																										**$2,490,250**

Highway 20 & Keys Blvd Modeling

The car wash, restaurant, Big Oaks Shopping Center and laundromat located near Hwy 20 and Keys Blvd account for approximately half of the Average Day Demand point flows discussed in earlier sections. The main distribution line from the treatment plant to the Pluth tank is an 8" asbestos concrete (AC) pipe that runs through the Keys development. A 4" AC pipe runs along the northern portion of the Keys development, connected to a 12" section running under Schindler Creek. This pipe provides demands for the school and commercial point flows. The resulting conditions of high demands and under-sized pipelines cause the commercial area to pull water from both directions as shown in modeling results located in **Appendix F**.

The main pipeline running through the keys experiences relatively high flows and results in lower fire flow capacity at various points in the system and higher pressure losses under maximum flow conditions. This also causes the drawdown-fill schedule for the Pluth tank to be slower than the Shady Lane tank and reduces the transmission capacity of water from the Pluth tank to the western portion of the District's water system.

Removing and replacing the 4" pipeline or the addition of a larger capacity pipe would greatly improve the transmission capacity between the Pluth tank and the District's water system to the west of the Keys. This pipe could also facilitate future pressure zones in the Keys by limiting the number of points of connection to the transmission main in order to cost effectively install PRVs in select locations.

It is **recommended** that this project be included with the Phased Pipeline Replacement Project in order to improve water flow rates and fire flow capacity for Zone 1, particularly in the western portion of the system.

Project Alternative 2 – No Project

Taking no action would leave the existing distribution pipeline system as it is and retain the current deficiencies in fire-flow and transmission capacity.

Recommendation

Due to the severe need for repair and replacement of pipelines in the distribution system, a phased improvement project is strongly recommended for CLOCWD. Refer to the **Tables 4.6, 4.7**, and **4.8** for the phased listing of all project alternatives.

West Highway 20 Modeling

Hydraulic modeling presented in Section 3 analyzed various improvements to increase fire flow capacity to services located on west Highway 20, particularly near Henderson and Road. The immediate analysis in Section 3 showed that additional piping was insufficient to providing substantial flow and pressure to the Hydrants located on Hillcrest indicating that either a new tank would be required or a booster pump station. These two project alternatives are evaluated below.

Project Alternative 1 – Henderson Drive Tank

As an alternative to construction of additional pipelines to augment fire flow capacity, construction of an additional storage tank on the hill side north of Hillcrest Dr was also considered. Construction of a tank at this location (elevation of 1540) would provide adequate pressure to meet fire flow criteria at Hydrant 28 as well as Hydrants, 26, 27, 29, and 30. Since the low pressure at Hydrant 32 is primarily a result of the 4 inch alignment which feeds that hydrant alone, only a marginal increase in flow would be realized by construction a new tank near Hillcrest for this hydrant, and as mentioned, an increase in performance at Hydrant 32 would require installation of a 6 inch main on Swanson Rd between Highway 20 and Pingree Rd.

A conceptual site layout of the tank is shown below in **Figure 4.1** with Terrace Drive located in the south and the Henderson Tank located on the hillside towards the north. The tank would connect to the existing 6 inch main located at the intersection of Terrace Dr. and Hillcrest Dr. by installation of an 8 inch forcemain as shown in the Figure. Alternatively the alignment could be routed near the east side of the parcel and pass through the vacant parcel on the north side of Hillcrest and connect to the main there.

To continuously provide a residual pressure of at least 20 psi the tank would need to be placed at an elevation near 1,550; which is higher than the Harvey tank. Thus, only the Konocti and Shady tank would be able to supplement flows with the new tank contributing around 210 gpm out of a 1,000 gpm demand. With this in mind, the tank would need to be sized for 190,000 gallons to achieve the 4-hour duration requirement.

Figure 4.1, Conceptual Henderson Tank Site



Project Alternative 2 – Spring Road Pump Station

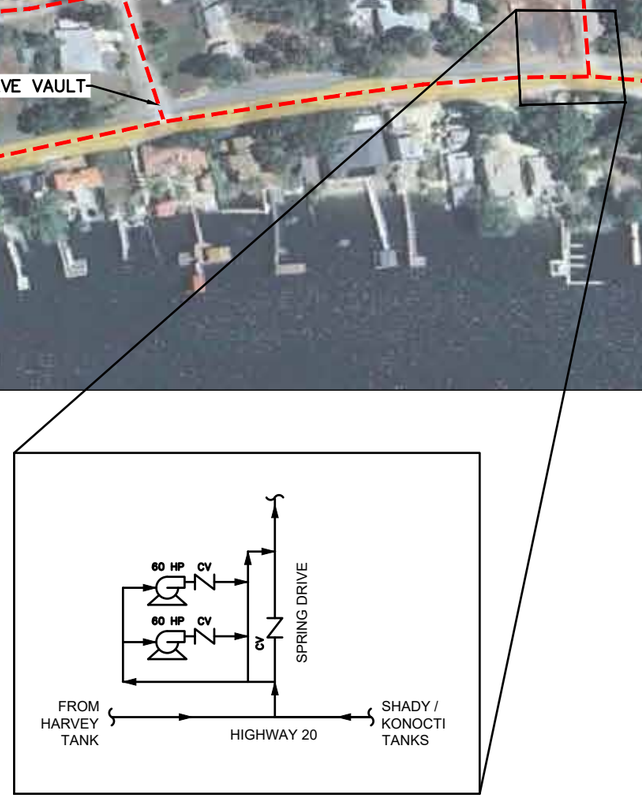
As an alternative to construction of an additional storage tank it is also possible to pressurize hydrants 26, 27, 28, 30, and 32 by installation of a booster pump station on the northwest corner of Spring Drive. This would also require the installation of check valves on both Spring Drive and Henderson Drive to prevent circular flow when the booster pump station is in operation. Installation of a new 8" forcemain on Put Drive would also be required to connect Spring Drive and Henderson Drive. The pump station would consist of two 60 HP multistage pumps operated on VFDs. The pumps would operate by maintaining a pressure set point, and thus would only be activated under high flow low pressure conditions. A schematic showing the location of the proposed pump station and piping configuration is presented in **Figure 4.2.**

This project alternative proposes installation of a booster pump station on the west side of Spring Road and Highway 20 as presented in **Figure 4.2** on the following page.

Recommendation

Project Alternative 2 – Spring Road Booster Pump Station is recommended. Currently, CLOCWD staff limit the maximum level of the Harvey tank to reduce the detention time within the tank in an attempt to minimize TTHM levels within the Paradise Cove area. Construction of an additional tank , in nearly equivalent size would, without doubt , generate THMs concentrations above the MCL requiring THM removal equipment. In general, the tank would seldomly be used and would only add age to the water withing the west side of the system. Construction of the either the tank or booster pump station would incur significant capital cost which would be comparable; however, steel tanks are guaranteed to corrode internally and require costly recoating every 15 to 20 years. Thus, in terms of present worth, the booster pump station would be a more cost-effective alternative since the seldomly used pumps could provide service well beyond their life expectancy of 35 years.





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PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 4.2

SPRING DRIVE FIRE PROTECTION
BOOSTER PUMP STATION

4.3.2 Meter Replacement Program and AMI Systems

Deficiency – Meter reading is labor intensive, does not accommodate detailed water loss evaluation and related analytics, and is currently comprised of outdated equipment and technology.

Currently, District staff read meters monthly through a combination of drive by radio and manual reading depending largely upon meter age and location. Approximately 25% of the meters are read using drive by technology. There are a number of disadvantages associated with reading meters manually, including the amount of time required to complete a cycle and the ability to utilize the metered consumption for tracking water loss effectively. Manual reading requires meter readers to visit each physical location, lift lids, visually record register reads, and enter them manually onto a handheld device. Some of the disadvantages associated with this method for meter reading include difficulty reading the meters that are often covered with dirt or submerged, increased potential for workman's comp claims due to injury, higher propensity for meter reading errors, and additional time requirements associated with having to drive or walk to each customer's meter location. The District staff's familiarity with AMR reading technology may help while transitioning to a system-wide AMR or AMI deployment.

Water meters and meter reading technologies have evolved significantly over the past decade. These advances are being recognized and many utilities have converted from manual and touch read technology to automated meter reading (AMR) or advanced meter reading infrastructure (AMI) solutions. Meters were predominantly read manually until around the early 1980s at which point water utilities began to install meters with solid state electronics that were able to accommodate the use of touch read systems. Beginning in the late 1990s and, in many cases still surviving as the preferred technology, new radios were developed that accommodated "drive by" (i.e. AMR) reading capabilities, thus eliminating the need to visit each customer location to read meters and providing an incremental reduction in the associated manpower requirements. More recently, the use of AMI systems has become a commonly accepted technology standard that provides even greater benefits and efficiencies, particularly when tracking and recording water loss and inefficiencies.

Project Alternative 1 – Installation of AMI system

Advanced meter infrastructure (AMI) consists of "fixed base" antennas for intercepting radio reads from endpoints (meters), backhaul communications, and head end meter data management through an internet connected computer. AMI became the leading technology for reading meters in the early 2000s. To this day AMI has been gaining momentum and has been recognized by many in the industry as an important part of the future of water utility operations and management. Having survived several challenges associated with early versions of the AMI technology, the motivation for new systems has shifted from strictly considering labor savings associated with meter reading to emphasizing the benefits of the increased data availability and related meter data management (MDM) capabilities.

A variety of AMI systems are available today and, although similar in that meters are read from a fixed base, there are several important technology considerations. The most fundamental distinction has to do with the overall system architecture. The two basic structures are mesh (point to point), and star (point to multi-point) designs.

In a mesh system, meters communicate with each other and, in some cases, intermediate collectors, to convey meter reads to a common location where the data is transmitted back to the head end using a variety of options (typically radio or cellular communications). With meshed systems the meters can often communicate with each other and/or a variety of low power transceivers consisting of small antennas mounted on light poles, fire hydrants, or other strategic locations. Variables including the power of the radios in the meters, the type of frequency, and topography, often dictate the number of antennas needed for an AMI system. The number and type of collectors are important considerations, particularly since the collectors usually need a power source, communication medium, and potentially the acquisition of right-of-way or easements. Many organizations installing mesh type AMI systems have found that deploying a large number of antennas for the fixed base system is one of the biggest challenges.
With a star, or point to multi-point system, the collectors communicate with each end-point and may rely on a limited number of repeaters for receiving radio reads and polling or programming the meters remotely. Higher power systems often require fewer antennas but they may require greater heights and strategic placement to receive reliable readings.

Topography that provides a good line of sight from a central location is often conducive to cost effective fixed base designs. Mesh systems may have an advantage when peer to peer communications between meters can be used to offset limitations due to terrain, trees, buildings, and other obstructions. As a fallback, a hybrid approach that relies on both AMI and AMR transmitting capabilities may be the best approach in certain situations. In either case, the need to ensure good radio communications is of utmost importance.

Another major consideration with AMI system design is the level of communications between the head end and the endpoints that is accommodated by the system architecture. On-demand meter reads generally require two-way communications whereby the end user can query a meter and receive immediate feedback for up to date reads or re-programming. One way communications are typically based on the meter providing data to the end user on a pre-programmed interval. Other communications capabilities include:

- 1-1/2 Way: Full two-way communication between the controlling computer and the collectors but only one-way communication from the endpoint to the collector.
- 1-3/4 Way: A specific endpoint can be interrogated and respond but the endpoint cannot be reprogrammed through the controlling computer.
- 2-Way Variations:
    - Full two-way communication between the controlling computer and the endpoint but *only at scheduled intervals*, which prohibits interrogating a specific endpoint at will. This could be defined as “limited” 2-way communication.
    - Full two-way communication between the controlling computer and the endpoint. A specific endpoint can be interrogated and reprogrammed at will.

Regardless of the technology selected by CLOCWD, careful consideration should be taken to ensure compatibility with all existing meters. Experience has shown that having the same manufacturer for the meters and the AMI system has several benefits, primarily that there is only one vendor to look to when problems arise in the system. Given that the majority of the meters in the CLOCWD system are Badger meters, the BEACON system would be compatible but since most of the AMI systems run on the Sensus Protocol, there are other technologies that would work with the Badger meters and might prove to provide more coverage. This should be confirmed based on an official propagation study that would form the basis of a contractual obligation for read reliability.

Badger Meter Company offers a cellular based technology for reading meters that is under consideration as part of this study. Cellular has the advantage of lower infrastructure costs since it relies on pre-existing cell towers. A disadvantage of cellular is the recurring cellular fees charged by the cellular service provider. However, for small systems this cost may be justified when comparing to other AMI options and related on-going infrastructure related costs. Relying on a cellular service provider to maintain the existing reading capabilities could be a disadvantage when considering a long life cycle that may include changes in cellular radio technology making the related endpoints obsolete at some point in the future.

AMI Cost Analysis

An analysis was conducted to estimate the life cycle cost savings associated with a new Advanced Meter Infrastructure (AMI) system. The analysis was prepared in an effort to identify the potential return on investment from installing both new meters and new meter reading technology. The underlying premise in the analysis is that taken collectively, the new meters and AMI system has the ability to generate three key types of savings including:

1) A reduction in labor and related meter reading costs
2) Increased revenue from newer more accurate water meters
3) Aiding in the recovery of non-revenue water (NRW)

The assumptions involved in each of these components include a savings of approximately $12,500 per year for meter reading related labor savings and efficiency improvements based on cost data provided by District staff, recovery of approximately $40,308 per year in Real Losses (assuming 40% recovery of the Real Losses from the AWWA Water Audit), and recovery of the Apparent Losses from the AWWA water audit based on the new meter accuracy following the meter changeout program. This is valued at approximately $2,188 per year. A complete life cycle cost analysis along with annual cash flow estimates are presented in **Appendix M**. A summary business case analysis is presented below in **Table 4.9**.

***Table 4.9**, Summary Business Case Analysis*

Item	Cost/Term	Item	Cost/Term
Total Project Cost:	$743,670	Discount Rate:	3.00%
District Annual Capitol Contribution:	$0.00	Estimated Annual Rate Increase:	3%
District Funded Meter Contribution:	$0.00	Estimated Operational Cost Increase:	2%
Total Cost to Finance:	**$743,670**	**20 Year Net Present Value:**	**$46,923**
Rate of Financing:	2.50%	20 Year Internal Rate of Return:	0.90%
Term of Financing:	30 years	**Simple Payback (years):**	**13.5**
Note: Project start date will be in 2017.			

Benefits of AMI on Water Efficiency

AMI facilitates water efficiency through a two-fold approach, one focused on improved utility operations and a second that is based in increased customer awareness. When coupled with the appropriate meter data management software capabilities, AMI provides powerful tools for water purveyors to look at the system as a whole, easily identify anomalies, and manage water losses in real time. By employing a customer portal with alerting capabilities, customers are able to quickly analyze their individual water use, set targets, and improve their overall awareness of behavioral impacts on water use.

Real time consumption data can be analyzed by the water utility to compare differences between system input volume and customer consumption while using this same data for a variety of other enterprise-wide solutions. The proliferation of real time data allows investigations to be conducted to pinpoint where the Real or Apparent losses are occurring while identifying locations where the system is stressed throughout daily operations. Policies aimed at reducing water use during critical irrigation periods can be readily analyzed and enforced using AMI by comparing base line consumption with irrigation use and easily flagging accounts in violation of target consumption goals and drought response programs.

The ability to record hourly data is exclusive to AMI technology. Unlike AMR which only provides one monthly read, the more granular AMI data provides customers with the ability to truly understand daily consumption patterns. The benefits of this improved customer engagement have less tangible metrics to assign, although these should not be discounted. Most individuals are concerned with water conservation and the analytics provided by AMI allows them to address their water consumption throughout the day as compared to a monthly snapshot. Customer complaints of high water bills are often more easily resolved. By providing actual data related to consumption for irrigation, showering or other habits the related behaviors can be revised in response.

Leading Vendor AMI Technologies

As with any product, there tends to be a variety of options with a select few products distinguishing themselves as market leaders. For the purpose of this study, MC Engineering included analysis of 5 leading vendors with a brief summary of each technology discussed briefly below along with a picture of a typical endpoint and collector for each.

1. **Aclara (STAR_select network):** Aclara provides AMI solutions for the water, electric, and gas industry. Aclara MTUs transmit over the 450-470 MHz radio frequency over distances of about one mile, depending upon topology. The Aclara MTU is mounted under non-metallic lids. Multiple collectors would typically be required to effectively obtain reads from all endpoints within the PCWA service territory with an Aclara system. The MTUs typically communicates with at least three Data Collector Units (DCUs). These DCUs are typically mounted on utility poles or other convenient locations, some of which may need to include assets not belonging to the District thus requiring a lease option and easement. Power to each DCU and backhaul communications from multiple units would need to be considered. This technology is often convenient for investor owned electric utilities, like PG&E, with established locations for providing power and mounting DCUs.

2. **Badger METER (BEACON AMA Managed Solution):** Badger's BEACON AMA solution is capable of transmitting data either through a fixed-based system or through a cellular network. The fixed-based system uses the ORION Classic one-way endpoint to transmit a signal every 4 seconds over an FCC regulated 902-928 MHz frequency hopping modulation. The cellular two-way endpoint communicates with the encoder and captures the readings. These readings are then transmitted using the CDMA cellular network.

3. **Itron (Water AMI Choice Connect):** Itron water endpoints typically rely on their 100W ERT for transmitting data via a 900 MHz un-licensed frequency to a centrally located collector (CCU 100) coupled with their model 100 repeater units where necessary. The 100W can be connected to a thru the lid (TTL) antenna to improve signal strength. The 100 W is available with power outputs up to 1 watt. The 100W can communicate in both mobile (AMR) and fixed base (AMI) configurations.

4. **Sensus (Flexnet):** The Flexnet AMI system by Sensus will typically rely on the 520M meter transmitting unit (MXU). The 520M transmits via an FCC primary use licensed 900 MHz frequency to a central collector with or without their metro repeater which is used in select installations where warranted by terrain, obstacles, or distance. The "M" in the 520M stands for migratable, meaning it accommodates both fixed-base and drive-by reading (AMR) capabilities. The primary license allows endpoints to communicate with up to 2 watts of power, thus accommodating longer range transmissions and fewer collectors than most competing products.

5. **Mueller (Mi.Net):** Mueller provides a variety of products for water systems including leak detection equipment, AMI, and related products. The Mueller AMI endpoint consists of their "Hot Rod" transmitter which is mounted on a PVC pipe under the lid. Range is limited to approximately 1200 feet. One innovative feature is their reliance on repeaters installed on hydrants that are used to boost signals for ultimately transmitting data to the head end. The Mueller repeaters typically consist of high capacity long-life battery packs with a 10-15 year life expectancy. The repeaters communicate with the Mi.Hub data collector with a range of 1 to 3 miles over a 900 MHz radio frequency.

6. **Neptune:** Neptune utilizes the R450 System which is a two-way RF fixed network communications framework that operates in the 450-470 MHz licensed band. Using Neptune's R450 System, endpoints communicate with fixed network data collectors (DCs) which communicate to the host server via various backhaul options. The R450 MIU utilizes a C-cell battery that has a 20- year published warranty. The R450 utilizes a licensed frequency band with an output power between 100 mW and 1 Watt. Depending on environmental factors, the range of the system will cover multiple miles.

AMI Software Options

All leading AMI vendors provide some level of meter data management software package for use with their standard AMI system. Rather than describe the various features for each vendor in detail a hyperlink is provided below to the website describing each vendor's standard offering. Additional, non-vendor specific, MDM solutions are described below under the section on Third Party Software Developers. Cost for vendor supplied software can be high, in some instances, and the add-on features such as customer portals for viewing monthly usage can often be provided by one of the third party software development companies at a lower cost. In all cases MDM software is quickly evolving and generally requires an investment in user specific configuration to provide the desired benefits which tend to vary for each utility customer.

Third Party Software Developers

A number of software solutions are emerging that leverage customer billing data using a cloud computing platform based on data fed from either real-time (AMI) or monthly (AMR) billing data. These solutions offer programming resources and software dedicated to meter data analytics that can be customized to interface with data files from the metered accounts for making better use of billing data, often more cost effectively than software provided by the meter vendor. Three examples are listed below along with highlighted features. A link is provided to the on-line company resources for complete information.

A. Aqua Hawk

Aqua Hawk is a Web-based, customer portal solution for municipal utilities that use fixed base Advanced Metering Infrastructure (AMI) or Automated Meter Reading (AMR) systems. Aqua Hawk is a powerful customer service and efficiency application that water utilities can use to create a better customer experience. Some of the core features of the Aqua Hawk software include:

- Estimated bill to date calculations
- Usage threshold alerting
- Landscape watering guide
- Mobile device support
- Advanced leak detection notification
- Powerful graphic interface

B. Drop Counter

Drop Counter Software provides utility and software solutions in the form of their "Clear" software and related mobile apps, respectively. Clear is a powerful MDM solution that was

co-designed with water utilities to provide analytics and a platform for customer engagement. The software provides a graphic overlay using Google maps as a background to display account locations and statistics. Some key questions easily answered include:

- Who were the highest users in the last month?
- Which accounts are trending upward on usage?
- How should we sort accounts by leak flags?
- How should we sort accounts by geography?
- How should accounts be filtered into accurate groups for messaging and follow-up reporting?
- How can we generate intuitive and detailed reports quickly?

The mobile app provides alerting and a convenient tool for establishing water budgets with solutions similar to those listed above for the Aqua Hawk software.

C. Water Smart

One of the core features of the Water Smart software is to provide residential customers with personalized water reports that motivate and enable water use efficiency. Features include:

- A personalized home WaterScore every billing period
- Social norm-based, apples-to-apples comparison of water use with similar households
- Data insights to improve understanding of water use
- Customized, water-saving recommendations
- Targeted communications regarding investments, incentives, or other important utility messages

The emphasis for the Water Smart software is providing customers with benchmarks and comparisons to others within the community with similar landscape and occupancy characteristics. Many agencies have found that relying on social norms and comparisons is one of the most effective means for reducing water usage.

Project Alternative 2 – Installation of AMR System

AMR allows meter readers to drive within the general vicinity of a water meter with a device mounted in the vehicle to collect meter reads via radio transmissions. The AMR drive-by meter reading is in many cases the preferred meter reading technology where topography creates issues with radio signals thus precluding the use of fixed base AMI solutions.

AMR technology also improves employee health and safety by allowing staff to collect meter reads while remaining inside a vehicle. AMR minimizes the need for personnel to enter private property which is favorable for both customers and District employees. Some main disadvantages of AMR are that the reads are only available as often as the routes are read (i.e. monthly), there is no two-way communication capability, and real-time leak detection and alerting is not available. The incremental cost of installing a tower and moving to AMI is usually justified once all the radios are installed. Some radios can be used in both AMR and AMI applications. In areas where topography is not conducive to reading from a fixed

point, AMR may continue to be the best solution for CLOCWD. However, given the initial feedback from vendors and expected coverage offered by fixed base towers, paying the incremental cost and installing an AMI system to cover most of the existing cycles is recommended in this report as discussed further below.

AMI vs. AMR Comparisons

There are several key considerations when assessing the merits of AMI and AMR technology. **Table 4.10** below, lists various features and capabilities and compares the value provided by each technology. Items in green/teal are considered advantages whereas the red/rouge colored cells are considered disadvantages.

***Table 4.10**, AMR vs. AMI Benefits Comparison*

Feature	AMI	AMR
Capital Cost	Added cost for tower, software, and server	Lower cost
Recurring Costs	Backhaul communications fees (cellular), Higher technical support (IT costs), annual software and maintenance fees for collectors and servers	Limited recurring costs
Meter Data Availability	On-demand data (two-way communications with head end)	Monthly (or as needed based on drive-by schedule)
Customer Solutions	Enhanced Capabilities including: • Timely and accurate response to customer inquiries • Prompt notifications and alarms • Near real-time customer portal for increased awareness • Virtual “turn-ons” and “turn-offs” to reduce staff time	Limited Options for Viable Customer Solutions
Bill Date Flexibility	• Easily modified and spread out to eliminate one-time monthly work-load	Monthly (or as needed based on drive-by schedule)
Meter Data Analytics	• Accurate real-time data for modeling and planning purposes • Easily accommodates District Meter Areas (DMAs) • Enhanced Leak Detection	Limited to monthly consumption totals for subsequent analysis
Water Loss Leak Management System	• Critical in using real time data to target infrastructure needs and help reduce NRW	Limited to monthly consumption totals for subsequent analysis
Drought Response	• Real-time consumption data supports conservation pricing and enforcement of irrigation restrictions	Limited to monthly consumption totals for subsequent analysis

AMI and AMR Compatibility Considerations

Compatibility can be critical in that the District may decide to put in a drive by system in an area that does not have sufficient coverage for fixed-based but in the future coverage may improve and the District may want to migrate to a fixed-based system. System compatibility will vary by vendor. For example, Aclara does not have a migratable endpoint whereas Sensus and Itron do have migratable endpoints.. The ability for the same endpoint to provide both drive-by and fixed base coverage is something that should be considered when determining which vendor's equipment to select.

Radio Communication Alternatives

AMR and AMI systems typically rely on either the 450 MHz radio spectrum or spectrums in the 900 MHz frequency range. These frequencies can either be licensed or un-licensed with the FCC. A primary license is provided with the Sensus AMI system thus accommodating up to 2 watts of power at the endpoint affording the opportunity to minimize the number of collectors and improve read rate reliability. Vendors including Badger, Master Meter, and Metron Farnier provide cellular communications options. Costs for cellular service can be up to $0.89 per read, thus adding considerably to the monthly costs for communicating meter reads. Many cellular based AMI systems use 3G or older communications platforms. As the network providers transition to a 4G system the older communications platforms will likely become obsolete at some point. In general, radio reading technology using drive by or fixed base AMR in the 450 or 900 MHz frequency ranges will likely provide the lower long-term cost solution for systems with a large number of endpoints to read and communicate with on a regular basis. Cellular communications, on the other hand, can reduce initial capital costs and provide a viable solution to fill coverage gaps in service territories with a mix of urban, suburban, and rural geographies.

Project Alternative 3 – Installation of Touch Read System

Touch-read technology replaced manual reading for many utilities in the 1980s. CLOCWD does not currently rely on any touch-read technology. With a touch read system the meter reader can easily overlook anomalies such as a stuck meter if the handheld is not configured to alert to these conditions. Touch read capabilities do accelerate the meter reading process and allow the meter reader to obtain an accurate reading even if the meter box is filled with dirt or deep within an underground pit or vault. It does not rely on radios and battery life like AMR or AMI.

With the touch read system, meter reading data is downloaded to the utility billing office from handheld computers where it is used to generate customer bills. Although the meter reading process is accelerated with touch read technology, staff are still exposed to the elements and required to visit each physical location. Touch read does not offer as many benefits as radio reads by leveraging an increasing number of meter data management capabilities and customer solutions associated with the newer technologies. Being that a quarter of the district is already using drive by technology, using the touch read system would not be beneficial or cost effective.

Project Alternative 4 – No Project

This project is not recommended as an AMI or AMR system would be greatly beneficial to the District resulting in reduced staff time for collecting meter reads and, when coupled with DMAs, increased analytics for locating leaks and tracking lost water volume.

Recommendation

The opinion of probable cost for an AMI system and AMR system are presented below in **Tables 4.11** and **4.12** respectively. Although the estimated cost for an AMI system is approximately $224,000 more than an AMR system with an additional $1,200 in monthly maintenance an AMI system is capable of effectively identifying water loss and theft. It is expected that an AMI system would reduce real water losses by up to 50% realizing an annual savings of approximately $50,000. At this rate an AMI system would pay for itself over the course of 4 to 5 years.

It is recommended that the District install an AMI system where feasible and rely on AMR where necessary to minimize infrastructure costs in select locations that preclude the ability to accommodate radio reads without an extensive number of collectors. The proposed "hybrid" approach is discussed further in **Section 5**.

***Table 4.11**, AMI Probable Cost Estimate*

Item		Quantity	Average Cost
Handheld Devices		0	$3,235.83
Transmitters/Endpoints		1955	$184,747.50
Collectors		4	$55,600.00
Repeaters		1	$3,233.33
Head-End Hardware		0	$0.00
MDM/AMI Software		1	$2,837.50
Additional Analytical Software		1	$3,883.33
	Taxes		$20,029.11
	Training		$4,219.17
	Subtotal:		$253,152.45
	Engineering, Setup, and Project Mgmt (15%):		$37,972.87
		Subtotal	**$291,125.32**
Installation and Meter Retrofit			
	Install Collectors	4	$62,333.33
	Install Repeaters	0	$2,000.00
	Purchase New Registers (HRE LCD)	1955	$121,047.08
	New 5/8" x 3/4" Meters	701	$45,565.00
	New Intermediate (1.5" and 2") Meters	3	$3,000.00
	Fire Rated Master Meters	5	$60,000.00
	Replace Lids	1955	$68,425.00
	Install Intermediate Meter and Endpoint	3	$825.00
	Install 5/8" Register, Meter, and Endpoint	701	$45,565.00
	Install Register and Endpoint Only	1251	$43,785.00
		Subtotal	$452,545.42
		Total Cost	**$743,670.73**
Annual Maintenance Costs			**$16,220.18**

Table 4.12, AMR Probable Cost Estimate

Item		Price	Quantity	Extension
Devices (Panasonic Tough Book Laptop)		$10,650.00	1	$10,650.00
Transmitters/Endpoints		$82.00	1655	$135,710.00
MDM/AMR Software		$1,875.00	Existing	$0.00
Additional Analytical Software		$2,750.00	Existing	$0.00
	Taxes			$12,806.50
	Training	$750.00	Existing	$0.00
	Subtotal:			$159,166.50
	Engineering, Setup, and Project Mgmt (15%)			$23,874.98
			Subtotal	**$183,041.48**
Installation and Meter Retrofit				
	Purchase New Registers	$60.00	1655	$99,300.00
	New 5/8" x ¾" Meters	$65.00	701	$45,565.00
	New Intermediate (1.5" and 2") Meters	$1,000.00	3	$3,000.00
	Fire Rated Master Meter	$12,000.00	5	$60,000.00
	Replace Lids	$35.00	1655	$57,925.00
	Install Intermediate Meter and Endpt	$275.00	3	$825.00
	Install 5/8" Register, Meter, and Endpt	$65.00	401	$26,065.00
	Install Register and Endpt Only	$35.00	1251	$43,785.00
			Subtotal	**$336,465.00**
			Total Cost	**$519,506.48**
Annual Maintenance Costs		$107.50	12	**$1,290.00**

4.3.3 Flow Meters

Two deficiencies were identified in relation to water meters in the District. These deficiencies are under registration for small meters and an inadequately tested 6" compound meter. These are discussed below.

Deficiency – Average 2.43% under registration for meters smaller than 1 inch (Approximately 1,932 meters) resulting in loss of income for District.

Many of the meters are old and have lost accuracy. As meters age they lose accuracy. Testing indicated that, on average 2.43% under registration is adding to the Apparent Losses in the system. This condition further exacerbates the ability to track water losses in the system. The older meters are also incompatible with most modern AMI and AMR meter reading systems if high resolution accuracy is needed for tracking water losses. There are approximately 1,932 small meters (meters smaller than 1 inch) that were analyzed.

Project Alternative 1 - Replacement of Small Meters 10 years or Older

This project consists of implementing a meter replacement program that targets meters 10 years old or older as based on survey results in order to reduce revenue lost due to meter inaccuracies while accommodating new meter reading technology.

A reasonable goal of achieving a 15-year payback was established as a basis for developing a business case to justify replacement. To determine the number of meters needing replacement to achieve a 15-year payback, various assumptions were needed. The cost of installing a new meter was estimated at $85.00 which included an assumed $60.00 meter and $25.00 installation cost. This cost was divided by the anticipated annual savings assuming a monthly average consumption (5,692 gallons/customer based on historical billing data), the accuracy values discussed above, and the District's volumetric rate ($1.60/HCF) of water.

The $1.60/HCF represents the updated volumetric rate implemented in 2015. It was found that replacing a meter could be justified if the accuracy was reduced by approximately 3% using this approach:

(5,692 gal/month)*(1 HCF/748 gallons)*($1.60/1 HCF)*(12 months/1 year) = **$170.456/year**

Percent Loss for replacing a meter over 15 years = ($85/ (15 year*$170.456) = **3.32%**

Using an estimated accuracy loss of 0.2675% per year, as discussed in **Section 3.8**, the age of a meter that has a 3% accuracy loss can be estimated by dividing the overall percent loss by the yearly percent loss. (3.32% Loss/0.2675% loss/year = 12.4 years).

In order to achieve a 15-year payback on a new meter, a meter that is 12.4 years old and older should be replaced. It is ***recommended*** that any meter that is more than 10 years old be replaced given that one to two years is expected to elapse prior to replacing any meters.

Using meter age as a basis, and including all non-Badger meters for replacement, the total number of small meters identified for replacement was determined to be 701. This includes four 1-inch meters, and two 3/4-inch meters. It should be noted that the District has approximately 415 non Badger meters, of which 365 are greater than 10 years old or are of unknown age and type. Since approximately 80% of the District's meters are Badgers, it is assumed that the District will replace non-Badger meters with new Badger meters. It should also be noted that before embarking on any meter replacement program, a more thorough field survey should be performed to verify meter serial numbers since the District's database may have inherent inaccuracies for the age of the meter. Also, register compatibility for all intermediate and large meters should be evaluated once a final determination is made on the preferred meter reading technology.

As part of the Meter Removal and Testing project, dated April 2016, 55 of the small meters slated for replacement that are 10 years and older were already removed, replaced and tested. This included one 1-inch meter. For the purpose of this study, these 55 meters are **not** included in meter replacement costs and the Meter Reading Technology section below.

Project Alternative 2 – No Project

The no project alternative would involve the continued reliance of meters 10 years and older. These meters are expected to have a lower accuracy due to age and use. Financial loss to the District can be estimated at $5.66/meter/year (3.32% x $170.456/year) or approximately $7,924/year ($5.66/meter/year x 1,400 average number of active small meters). Furthermore, the ability to provide high resolution meter reading to complement an AMR or AMI system would be compromised.

Recommendation
Replace an estimated 701 small meters concurrent with register retrofits and new meter reading technology as discussed further below.

Deficiency – Lack of testing data for 400 Sulphur Springs Road (Mobile Home Park) Meter and Broken Valve

The meter at 400 Sulphur Springs Road, the largest billed user in the system, was tested but the meter should be retested due to the fact that the customer side valve could not be completely closed. It is recommended that the customer side valve be repaired and the test repeated. This meter is critical in terms of both consumption and revenue.

Project Alternative 1– Repair of valve and Testing of Large Meter at 400 Sulphur Springs Road
This project involves the repair of the customer side valve and testing of the 6-inch compound meter serving the 400 Sulphur Springs Road address (a mobile home park).

Project Alternative 2 – No Project
This project would leave the customer side valve as is (broken). This would preclude the ability to appropriately test this meter and is not recommended. The inability to test the meter registering water use for the District's largest consumer of water adds to the uncertainty concerning the relatively high non-revenue water.

Recommendation
Repair customer side isolation valve and re-test meter at 400 Sulphur Springs Road.

4.3.3.1 Flow Meters 2024 Update

Water meters were updated as described in previous sections. Section 3 describes the need for three new meters capable of transmitting flow data to Badger cellular endpoints. The cost for the 3 new meters is considered negligible in comparison to the nearly $200,000 spent annually supplying roughly twice the customer usage to the system due to water loss. Furthermore, the existing spreadsheet DMA analysis is cumbersome due to the complexity of converting SCADA data to a format that is in the same format as the Badger meter reads. If, for example, a total of $10,000 per year is spent in engineering analysis with the current DMA model, a $30,000 investment in meters would pay for itself in three years, notwithstanding additional savings that can be realized by reducing the non-revenue water, even if only by a small percentage, as a result of better analytical capabilities. To illustrate, a 10% reduction in non-revenue water combined with 50% savings in engineering analysis (0.1 x $196.798 + 0.5 x $10,000) =

$24,700. Based on these assumptions, the investment in the 3 new meters would potentially result in a one year payback.

4.3.4 Pressure Reducing Valves

Deficiency – Pressure head differential between existing District Service Area and proposed annexation service area (CSA-16).

The difference in pressure between the current District service area and the proposed annexation area (CSA-16), combined with the need to cycle the existing Paradise Cove tank to maintain water quality while maintaining pressures in the CLOCWD system, result in the need for a new PRV at Highway 20 and Harvey Blvd. or other means of controlling flows in the far westerly reaches of the distribution system.

Project Alternative 1 – Installation of Pressure Reducing Valve at Harvey Blvd. and Highway 20
Recommended control parameters were initially prepared by MC Engineering and provided to CLOCWD and Lake County Special Districts on June 29th, 2015. Scenario 1 in TM 1 included installing a valve that is tied to the existing telemetry control system at the Paradise Cove tank site. The PLC at the tank would continue to monitor and control levels in the tank while controlling the operation of the valve at Harvey Blvd. **Table 4.13** shown below lists some of the critical control features recommended for the control valve.

***Table 4.13**, Control Valve Recommended Requirements*

Control Feature	Control Requirement
Altitude	Valve opens and closes based on operator adjustable Paradise Cove tank set points.
Pressure sustaining (6" Line)	Valve closes when pressure in 6" pipeline falls to an operator adjustable low pressure setpoint.
Pressure sustaining (8" Line, optional)	Valve closes when pressure in 8" pipeline rises to an operator adjustable high pressure setpoint. Potential remote altitude control during periods of telemetry communication loss.
Flow limiting	Valve closes when flow into the proposed 8 inch main is in excess of 100 gpm or based on operator adjustable set points.
Timed Fill	Valve restricts conveyance to annexation area during non-operation of clearwell pumps.
Metering	Flow metering data is obtained with SCADA system for additional control, monitoring, and water loss management.
Flushing/Fire Flow	Isolation required when flushing. Flow to be fed from Paradise Cove (west to east) to accommodate flushing and valve to open to accommodate fire flow demands near Harvey Blvd. if the pressure drops to an operator adjustable low level during emergencies.

Project Alternative 2 – Installation of Valve at the Paradise Cove Tank Site
This project would consist of installing a valve at the Paradise Cove tank site that would include filling the tank from a dedicated line tied directly to the new 8" line in lieu of connecting the 8" line directly to the existing Paradise Cove System. The valve at the Paradise Cove tank would be operated based on tank elevation set points. In the absence of a dedicated line, the altitude valve would close and demands in the

annexation area would presumably be met from the District's water system directly, thus limiting the ability to draw and fill the tank in order to maintain water quality and keep turnover in the tank at acceptable levels.

Under this scenario, the ability to include pressure sustaining capabilities for the existing District's water system is limited. Two options could be considered to help maintain adequate flows and pressures if deemed critical by the District's staff. These may include:

- Installing a flow limiting devise such as an orifice plate at the point of connection near Harvey Blvd.
- Constructing additional storage near Harvey Blvd to help buffer system flows and pressures
- Other control and monitoring operations deemed acceptable by the District's operations staff

In either of the options above, accommodations should be considered for having the ability to feed the District's water system near Harvey Blvd from the annexation area if the pressures in that area drop too far due to high demands in the area, fire flows, etc.

Project Alternative 3 – No Project
This project is not recommended as a valve is required to ensure proper operation of the District's water system when CSA-16 is annexed.

Recommendation
Project Alternative 1 is recommended which involves the installation of a PRV valve near Harvey Blvd. and Highway 20 to control flows and pressures between the District and CSA-16 annexation area.

4.3.4.1 Pressure Reducing Valves 2024 Update

The Harvey Blvd PRV Project was completed as of 2017. Additional PRVs have been recommended as a pressure management strategy intended to reduce water losses. Section 3 discussed the initial results from the DMA analysis and it was recognized that water losses are systemic and widespread throughout the distribution system. The average system-wide loss was found to be 1.48 gpd/ft of pipe. For comparison, the South-east Keys DMA loss as estimated at 0.82 gpd/ft and the West Keys losses were found to be 2.13 gpd/ft.

A pressure management approach to reducing water loss was introduced in Section 3 and is included in this section for alternative analysis purposes. This analysis considers the installation of six PRVs (four for the Keys and two for Orchard Shores) with the intent of lowering system pressures as a way of reducing water loss. A brief analysis follows:

Assumptions:

- Current Average Water Loss: 1.48 gpd/ft
- Miles of Pipe to be Isolated (Keys and Orchard Shore Area): 70,516 feet
- Theoretical Loss in Areas to be Isolated: 1.48 x 70,516 = 104,364 gal/day

Value of Losses

The variable production cost was estimated at $1,687.82/MG for the 2023 updated water audit. The value of the lost water at this rate is estimated as follows: 104,364/1000000 x $1688 = $176/day (i.e. $64,240/year).

By reducing the pressure by 50% it is estimated that this would result in roughly a 30% reduction in water loss which would equate to a 31,309 gal/day reduction valued at an estimated $19,290 annually.

Installing 6 new PRVs would cost an estimated $480,000 (assuming $80,000/PRV). The simple payback from this would be $480,000/$19,290 or 25 years. This payback does not account for the time spent repairing leaks and other collateral damage and costs that are exacerbated by the existing high pressures. Metered usage would also likely come down if the pressure was reduced where appropriate to a maximum of say 55 psi vs. the 110 to 115 psi that currently exists.

Applying this approach to the areas with the highest pressure and highest water loss would result in faster payback periods. For instance, if the South Pluth area (Orchard Shores) is found to be as high or higher than the Pluth area as a whole (3.08 gpd/ft of pipe) the resulting losses would be estimated at 45,239 gpd. A 30% reduction here would result in a reduction of 13,572 gpd valued at an estimated $8,362 per year. If two PRVs are installed at an estimated cost of $80,000 each to achieve this goal, the payback would be reduced to 19 years, not including the various ancillary benefits discussed above.

The above analysis does emphasize the potential benefits associated with pressure reduction. In order to demonstrate this potential loss reduction, it is recommended that at least one PRV be installed initially and the results verified prior to proceeding with additional installations.

It should be noted that reducing the supply pressure will also limit the fire flow capacity and resulting residual pressures. It will be difficult to maintain minimum fire flows in the range of 1,000 gpm in most areas of the Keys due to the one-way 6-inch diameter distribution mains and resulting headlosses. Considerations should include the availability of lake water for pumping flows during fires and/or the ability to open bypass valves on the PRVs in emergency situations to provide for greater pressures during events.

By comparison, replacing all of the distribution mains in the areas of consideration is a relatively costly endeavor. If for instance, all new 8” service lines were installed the approximate cost would be in the range of $13 million (assuming 13.4 miles of pipe at a replacement cost of $180/ft). Installing six new PRVs would be in the range of $.5 million for perspective.

The above analysis suggests that installing PRVs to zone off the Keys and south Pluth zone does make economic sense when compared to replacing all of the lines. Brand new mains would have additional benefits including lower overall water loss, however the return on investment diminishes since the cost is considerably higher and the system as a whole would still be subject to issues due to the high pressures in the absence of the proposed PRVs. It is therefore recommended that the PRV installations be given priority with, perhaps, the ability to do an initial phase that might be a smaller subset of the areas covered by the proposed 6 PRVs. A map showing the location of the six PRV installation is presented in Section 5 including more project details.

4.4 Water Storage and Pump Stations

4.4.1 Booster Pump Stations

Booster pump station improvements are recommended at the Shady Lane, High Valley, and Cerrito tank sites. A new pump station is also recommended for the proposed Harvey Blvd. site. These pump station improvements are evaluated as one project. A second "no project" option is also evaluated.

Deficiency – Old and deteriorated Booster Pump Stations

Old pumps at several stations are nearing the end of their useful life. Most stations have insufficient capacity to meet fire flows upstream of the booster stations. Deficiencies include old pump age, lack of backup power, lack of backup pumps, deteriorating pump houses at Shady Lane and Cerrito, no pump house at High Valley, and leaky valves at High Valley and Shady Lane. A new pump station at Harvey Blvd. is required to pump water from the Harvey Tank back into the current District Zone 1 service area. The lack of durable weather proof buildings at each site exposes pumps and related equipment to the elements and reduces life expectancy, reliability, and ease of maintenance. Vandalism also poses a significant risk at each booster station. Enclosing equipment is therefore highly recommended.

Project Alternative 1 – Pump Station Upgrades

The proposed booster pumps to be installed are presented below in **Table 4.14**.

***Table 4.14**, Booster Pump Locations*

Pump Location	Number of Pumps	Pump Horse Power
Shady Lane	2	22
High Valley	3	40
Cerrito	3	20
Harvey	2	4.5

Related site piping improvements would be installed as part of this project including installation of silent check valves downstream of the booster pumps to reduce the risk of water hammer. Each booster station would also include a diaphragm type control valve that would allow water stored in upper zones to flow back to the lower zones under emergency conditions. Masonry or precast concrete buildings would be included at each site. A surge control valve should be at each booster pump station to minimize high-pressure surges on pump start up, pump stops, and potential power failures while pumping. Site specific details are as follows:

Shady Lane

In addition to having only one large pump with potentially higher than necessary flows, there is no redundant pump at the Shady Lane site to ensure reliable service to Zone 3 if the single pump present at this location fails. A duplex pump station should be considered for the purpose of providing fire flows as well, thus allowing staff to meet the original design intent of approximately 500 gpm with both pumps running while running only one pump under normal operations to minimize pressure surges and high

demands on Zone 1. A smaller 20 HP pump with a flow rate of around 280 gpm would be capable of refilling the Konocti tank in approximately 20 minutes each day.

It is important to note that future costs are expected to drop by at least 60% more in the future once the appropriately sized pumps are in operation and operators no longer need to throttle the pump, thus resulting in monthly energy costs in the range of around $30/month ($380/year) in the future or a savings of roughly $8,420 annually for the pump station compared with current conditions.

High Valley

Three 40 horsepower pumps are recommneded to supplement gravity flows from the Cerrito tank to meet fireflows in Zone 2. Much of this area borders undeveloped land that is susceptible to wild fires. Due to the size and age of the piping system throughout Zone 2, it is expected that 1000 GPM will be the maximum flow rate that can be provided without putting an inordinate amount of pressure and risking bursting pipes in Zone 2.

Cerrito

Three 15 horsepower pumps are recommended to provide fireflows for Zone 4. As with High Valley, pipe size and age is expected to restrict the water flow to approximately 700 gpm. Additionally, many homes in this are are adjecent to undeveloped grassland which is susceptible to wild fires.

Harvey

Booster pumps at the Harvey Tank site are not required to meet water system demands, but are highly recommended to allow water stored in the Harvey Tank to be pumped back into Zone 1.

Site details and project information are located in **Section 5** – Recommended Projects and Prioritization.

Project Alternative 2 – No Project

A “No Project” alternative was not considered viable for any of the sites under consideration. The “No Project” alternative would result in the following:

- Inability to provide fire flow capacity upstream of each booster station
- Unable to backfeed from upper reservoirs (Cerrito and Konocti) into Zone 1
- Compromised service in westerly portion of the system (particularly in the absence of the proposed booster station tank site near Harvey Blvd.)
- Lack of standby power to accommodate pumping in the event of a power outage
- Exposure to sun, weather, and fire in the absence of proposed fire resistant buildings resulting increased maintenance and reduced equipment life

***Recommendation*:** Install all proposed booster stations and related appurtenances at each site as described further in **Section 5.**

4.4.2 Water Storage Tanks

Deficiency – Lack of storage in District service area which limits fire flow and diurnal demand storage. Redwood tanks at the Cerrito and Pluth sites are deteriorating. Additionally, there is a lack of adequate storage volume to serve CSA-16 annexation area.

Project Alternative 1 – Decommission and Remove the Cerrito Redwood Tank. Decommission the Pluth Redwood Tank. Install a new bolted steel tank at Harvey Blvd. Install new bolted steel tank at High Valley. Install new bolted steel tank at Cerrito. As described in **Section 3.9**, two of the existing tanks (i.e., the redwood tanks at the Pluth and Cerrito sites) are scheduled to be decommissioned. Pre-existing redwood tanks at the High Valley site were demolished as they failed and were never replaced. The decommissioning of these tanks, combined with the proposed extension of service to Paradise Cove required a reassessment of the CLOCWD's water storage and supply needs. The detailed assessment was discussed previously in **Section 3.7.2** of this report.

This project proposes the installation of one new bolted steel storage tank at the Cerrito site, the installation of one new bolted steel storage tank at High Valley site. This project would also involve the demolition of the leaking redwood tank at the Cerrito reservoir site and the decommissioning of the Pluth redwood tank. Piping and other site improvements are also included for each site.

Cerrito Tank Site
A new 100,000-gallon tank is proposed to replace the deteriorated redwood tank at this site. This tank will provide storage for Zone 2 and Zone 4.

Pluth Tank Site
A 165,000-gallon tank is tentatively proposed for future installation at this site. This tank will replace the redwood tank currently in service at the Pluth tank site. Current conditions do not require the replacement of the Pluth redwood tank upon its decommission if new tanks are installed at Cerrito, High Valley, and Harvey. If these tanks are not installed, then replacement of the Pluth redwood tank will be necessary.

High Valley Tank Site
A new 215,000-gallon tank is proposed for this site. This tank will provide water storage for Zone 1.

Harvey Tank Site
The proposed 220,000 gallon Harvey tank has been planned in response to a need to assist in providing fire flows to the Paradise Cove annexation area. The tank will also have several benefits to the CLOCWD by improving the existing system operations. This memo was prepared to provide a brief overview of how the tank will benefit the CLOCWD existing system in the future based on the following:

- Additional fire flow storage for the existing CLOCWD east of the proposed Harvey tank site
- Improved service to accommodate outages in the westerly portions of the CLOCWD distribution system

- Ability to provide future fire flow capacity to potential annexation areas that might include the Glenhaven area or other areas west of the proposed Harvey tank site

Although the precise percent allocation of benefits is somewhat subjective, District staff has indicated that the benefits of the proposed tank can be considered 75% in favor of the CLOCWD. MC Engineering was asked to provide a more objective breakdown of this benefit which is included below based on the three areas of benefit listed above.

When considering fire flow capacity, hydraulic modeling indicates that approximately 450 gpm of the required 1200 gpm Paradise Cove fire flow will be fed from the Harvey tank in the future. Based on a duration of 2 hours this will, ideally, only impact approximately 54,000 gallons of the planned 200,000-gallon capacity of the future Harvey tank. In this instance 73% of the remaining capacity (146,000 gallons) will remain available to the District by utilizing the proposed booster pumps that will be designed to convey flow back to the CLOCWD Zone 1 service area.

Additional benefits, though somewhat subjective, include the fact that up 100% of the Harvey tank storage could serve the District in the event of a line break on the relatively vulnerable 6" line feeding the Harvey Blvd area. The tank can provide similar 100% benefit to the District in the event supplemental storage is needed to meet fire flows in the existing CLOCWD system.

Other factors to consider is that existing grading of the Harvey tank site will likely result in requiring less environmental impacts than other sites that were evaluated as well as lower capital costs. Drawbacks to the site include the relatively steep access road that may impede access and pose additional risks during winter months. These factors have reportedly been considered by the local Fire official, District staff, and the County and the site determined to be acceptable based on consideration of the above benefits.

The new water tanks proposed for the District are presented in **Table 4.15,** below.

***Table 4.15**, New Water Storage Tanks*

Dimensions					
Tank	**Dia**	**Height**	**Storage**	**Base Elevation**	**Active Storage**
Cerrito – New	29.66	20.00	103,370	2081.00	80,100
Pluth – New[1]	34.16	24.00	164,500	1588.00	128,500
High Valley - New	38.60	24.00	215,090	1586.00	179,500
Harvey Blvd[2] - New	34.16	32.00	219,380	1515.00	205,700

Note:

[1] ***Future Tank – not required to meet existing demands.***

[2] ***96,000 gallons of the water storage volume provided by the Harvey Blvd Tank is proposed to be allocated for the CSA-16 annexation area. 109,700 gallons will be available as CLOCWD storage.***

Project Alternative 2 – Same as Project Alternative 1, with exception of Welded Steel Tanks instead of Bolted Steel Tanks

This project proposes the installation of one new welded steel storage tank at the Cerrito site and the installation of one new welded steel storage tank at High Valley site, and the installation of one new welded steel storage tank at Harvey Blvd. This project would also involve the demolition of the leaking

redwood tank at the Cerrito reservoir site. The recommended yard piping and other site improvements are also included under this alternative.

This project is identical to Project Alternative 1 with the exception of the installation of welded steel tanks instead of bolted steel tanks. A design comparison and present worth analysis between bolted and welded steel tanks follows:

Welded Steel Tank Design vs Bolted Steel Tank Design

Bolted steel tanks were initially designed for use in storing dry agricultural products. The design was introduced into communities for use as storage vessels for water supply as a cheaper alternative to welded steel due to low capital costs. Relative to welded steel, bolted tanks are known for their short life cycle of approximately 40 to 50 years and are commonly used as temporary storage structures. The maintenance cycle usually consists of an exterior topcoat and interior touchup at 15 years, interior/exterior renovation at 30 years, and another exterior topcoat and interior touch up by 40 years before the tank is finally replaced. Difficulties associated with maintaining a bolted steel tank are:

- Thousands of bolts are used to assemble the tank; these areas are highly prone to corrosion.
- Maintenance of the bolts and seams requires thick mastic coating, which in turn requires to be recoated.
- The tank panels can be protected with glass coating which is susceptible to cracking and, if pigmented, fades over time and may not be recoated.
- As expected, the numerous panels introduce a potential for leaking to occur at the seams.
- Bolted steel tanks typically employ a thin steel gauge.

Because welded tanks are essentially a monolithic structure leaking is less of an issue. According to the Steel Tank Institute welded steel tanks (if properly maintained) can provide a life cycle of up to 100 years. After approximately 25 years, the tank can be cleaned, spot primed recoated and returned to service for another 25 years. While the capital costs for welded steel tanks are typically greater than those for bolted steel tanks, the required maintenance cost is much less and less frequent.

Bolted Tank vs Welded Tank Life Cycle Analysis

A present worth analysis was prepared to compare the cost of ownership between welded steel and bolted steel. The costs include the aforementioned frequency of maintenance over the span of 50 years; it should be mentioned that the life expectancy of a welded steel tank can range from 75 to 100 years if properly maintained whereas a bolted steel tank is limited in most all cases to a 50 year life span. If a life cycle analysis were to consider a 75 year period the net present worth of the welded steel tank would be significantly less. **Table 4.16** shows the capital costs and net present value for both tank designs assuming an interest rate of 2% and salvage value of 20%. Based on the net present values shown below, the obvious long term solution is to consider welded steel tanks despite the greater capital cost. A life cycle cost analysis is presented in **Table 4.16** below.

Table 4.16, Cost Comparison Bolted Steel vs Welded Steel

Tank	Bolted vs Welded	Capital Cost	Annual O & M	P.W. O & M	Salvage Value	P.W. Salvage Value	NET Present Worth
High Valley	Welded	$246,600	$2,100	$66,000	$49,300	$18,300	$294,300
	Bolted	$140,000	$6,700	$211,000	$28,000	$10,400	$340,100
Cerrito	Welded	$212,000	$1,500	$47,800	$42,400	$15,800	$244,000
	Bolted	$106,000	$4,800	$151,000	$21,200	$7,900	$249,000
Harvey	Welded	$280,300	$2,200	$67,600	$56,000	$20,800	$327,000
	Bolted	$136,000	$8,300	$260,800	$27,200	$10,100	$386,700

Project Alternative 3 – No Project

The no project alternative is not recommended as this will limit the District's ability to provide adequate fire flow to areas of the service area. Additionally, diurnal storage requirements will not be met upon removal of deteriorated redwood tanks.

Recommendation

Project Alternative 2 is recommended. It is recommended that the District construct welded steel tanks at each of the proposed storage sites. This will provide water storage for firefighting purposes and for diurnal demands. It is considered a high priority project to replace the deteriorating redwood tanks and replace them with new welded tanks to ensure basic water service remains in place for District customers.

2024 Update

These general recommendations for storage improvements are still except for the Cerrito tank has since been replaced in addition to the construction of the Harvey tank. Other details for the proposed High Valley tank are discussed in Section 5.

4.4.3 Disinfection Byproduct Mitigation

Deficiency – High THM levels within the distribution system threaten the District's ability to meet regulatory compliance. There are no facilities in place to mitigate or monitor DBPs. The potential for DBP formation will increase as the distribution system is expanded in regions farthest from the water treatment plant.

The rate by which DBPs form within a given system (particularly THMs) is unique to each system. Fast reactions can develop THMs in the clearwell before water has entered the system, or slow reactions form THMs with the distribution system at the far extents of the system. Assuming that the previously discussed recommendations are acted upon immediately by the District to develop process improvements at the water treatment plant and storage improvements within the distribution system; subsequent sampling would need to be performed to determine the locations with high THM concentrations.

Depending on the level of removal required for compliance, effective reduction rates could be accomplished by mixing, and ventilation improvements alone; or if necessary also include spray aeration.

Project Alternative 1 – Installation of mixers and ventilation systems at storage tanks furthest from treatment facility.
This project recommends procuring funds for a partial THM removal system by use of a mixer and forced-air ventilation system for storage tanks furthest from the treatment facility. Storage tanks to receive the system include: Pluth, Cerrito, Konocti, and the proposed tank Harvey.

Project Alternative 2 – Harvey Spray Aeration
This project alternative would consist of a full THM removal system installed at the Harvey tank site which would include spray aeration, mixers, and forced-air ventilation. The system would be installed in addition to a similar system installed in the clearwell. This alternative would not include the installation of systems at any other storage tank.

Project Alternative 3 – No project
The no project alternative would assume that all THM mitigation improvements at the treatment facility would be sufficient in maintaining an MCL less than 80 µg/L within the distribution system.

Recommendation
Project Alternative 1, Installation of mixers and ventilation systems at storage tanks furthest from the treatment facility, is recommended. The mixer and ventilation system is discussed further in **Section 5.**

4.4.3.1 2024 Disinfection Byproduct Mitigation Update

This update proposes new project alternatives and recommendations based on recent water quality modeling as presented in **Section 3.8.2.1**. These modeling efforts focused on identifying the improvements which would immediately reduce THM concentrations as measured at the two sample points within the distribution system as recommended projects.

Project Alternative 1 – Harvey THM Removal Equipment
Installation of a mixer and power vent would allow the Harvey tank to be operated at full capacity without exceeding the MCL for TTHMs. The existing features 3 phase 240 volt 200 amp service which is capable of powering the mixer and power vent. Improvements would consist in installing a new MCC panel in the pump house and trenching over to the tank with galvanized steel conduits mounted up to the top of the tank to power the equipment. Programming and integration with the existing PLC would also be required in addition to updates to SCADA.

Project Alternative 2 – Konocti THM Removal Equipment
Installation of a mixer and power vent at the Konocti tank would enhance water quality to the services within the Konocti pressure zone while also significantly reducing THM concentrations at the Mesa Stubbs sample location. Improvements would consist of either coordinating with AT&T to provide additional amperage from the adjacent cell tower site or applying for a new power service separate from AT&T as the existing 30 amp supply allotted to the CLOWCD is insufficient to power the existing panel

in addition to a mixer and power vent. Other improvements would include conduit work through the site and on the tank to power the equipment as well as a slab on the north side of the site to mount the MCC panel. Programming and integration with the existing PLC would also be required in addition to updates to SCADA.

Project Alternative 3 – Shady THM Removal Equipment
Installation of a mixer and power vent at the Shady Lane tank would reduce the THMs to a concentration comparable to the clearwell effluent. The equipment would be powered assuming the improvements associated with the site's pump station are completed where the existing 100 amp service would be upgraded to a 200 amp service.

Project Alternative 4 – Paradise Valley Boulevard Piping Improvements w/ Check Valves
This improvement consists of rehabilitating the existing 6" pipeline between the Paradise tank and Paradise Valley boulevard. This work includes installation of ductile iron fittings to connect the paradise tank to the existing piping and approximately 20 feet of C900 pipe to bypass the remains of the existing well head structure on the south side of the site. At the bottom of the pipeline, on Paradise Valley Boulevard, a check valve would be installed on the 6" pipeline as well as the 8" pipeline. These check valves would be housed within precast concrete vault within the landscaped area about 10 feet from the roadway. Since these improvements would require that the east end of Lagoon Drive become a dead end, installation of a blowoff valve would also be required.

Project Alternative 5 – Paradise Valley Boulevard Piping Improvements w/ Intertie
This project alternative also includes rehabilitation of the existing 6-inch pipeline between the Paradise tank and Paradise Valley Boulevard as described in Project Alternative 5. Instead of using check valves to prevent slugs of Harvey tank effluent from entering the west side of Paradise Cove this improvement uses an intertie to effectively isolate the east side of Paradise cove from the west side such no Harvey tank effluent can enter the west side of Paradise cove without first passing through the Paradise tank. The intertie piping would require installation of two ductile iron tees, two gate valves and only a few feet of PVC or ductile iron piping. These valve modifications would be located on Paradise Valley Boulevard within the path of travel.

Recommendation
The analysis presented in Section 3 indicates that installation of THM removal equipment at the Konocti tank would be most effective at reducing the measured THM concentration as the Mesa Stubbs sample location due to the tank's close proximity with the sample point. Installation of THM equipment at the Shady tank would not directly reduce the THM concentrations measured at the Mesa Stubbs sample point unless the Shady Lane booster pump is conveying flows to the Konocti tank during the time at which samples are being collected. The analysis of Section 3 also showed that installation of THM removal equipment withing the Harvey tank would not noticeably enhance the water quality within Paradise Cove. For this reason, Project Alternative 2 is recommended to mitigate the high THM concentrations measured at the Mesa Stubbs sample point. Since the reduction in THM levels at both sample locations cannot be improved by installation of a single THM removal system Project Alternative 5 is also recommended as a

high priority improvement. Project alternative 5 is superior to alternative 4 since the intertie directs all flows through the Paradise tank prior to entering the west side of paradise cove. As mentioned in Section 3 installation of check valves on the inlet and outlet piping to the Paradise tank would not prevent Harvey effluent flows from bypassing the Paradise tank while the Paradise tank is being filled. The intertie project is small in scope and could be completed by District staff or a local contractor.

4.4.4 Corrosion Protection

Deficiency – Insufficient corrosion protection. Substantial corrosion has degraded the paint coatings down to the primer, and in many cases, to the bare steel surface. Renovations using high quality coatings should be considered to extend the service life of each tank and protect water quality.

Project Alternative 1 – Renovation of Tank Site Coating Systems
The renovation of each tank with a high quality coating system will extend the service life of the tank preventing excessive corrosion while minimizing the potential for structural failure (leaking or roof damage), which would require the District to incur extensive costs in tank repair and/or replacement.

Project Alternative 2 – No Project
The no project alternative would essentially lead to structural failure as the tank would continue to degrade from extreme corrosion. The service life of the tank would be minimized and ultimately require the early construction of a new tank.

Recommendation
Project Alternative 1, Renovation of Tank Site Coating Systems, is recommended. The storage tanks are critical to the performance and reliability of distribution system and should not be neglected. The life expectancy of welded steel tanks can range from 50 years or less with minimal maintenance and up to 100 years under with good preventative maintenance practices. A high quality coating system would help ensure an additional 15 to 20 years of service life until recoating would be required. The Konocti steel tank is in dire condition and should be renovated immediately; the recommended renovation schedule for each tank is discussed further in **Section 7**.

4.5 Operational Improvements

4.6.1 Filter Pump Room

Deficiency – No HVAC in filter feed pump room
No HVAC system in the filter feed pump room means that staff working in this building are in an unventilated and uncooled environment, particularly in the summer. Pumps and VFDs work harder and receive more wear when operated in a hot environment and consequently have a shorter useful life.

Project Alternative 1 – Install HVAC in pump room
A ductless HVAC system would ventilate and control the temperature in this space. Insulation and weatherproofing as required would bring this structure in compliance with Title 24 regulation.

Project Alternative 2 - No Project
No project would leave this structure as is with no improvements to ventilation, cooling, or insulation.

Recommendation
A ductless HVAC system installation with associated insulation is recommended to protect equipment and staff operating within this structure.

4.6.2 Granular Activated Carbon Filter

Deficiency – GAC filter media at end of useful life.
The GAC filter media is no longer functioning as intended as indicated by test results showing TOC at levels comparable to where they were before the filter media was previously replaced.

Project Alternative 1 - Replace GAC filter media
This project would involve the removal and disposal of existing GAC filter media, interior cleaning of the GAC tanks, and replacement with new granulated activated carbon media. It is recommended that monthly samples for TOC, taste, and odor be taken to estimate the optimal length of time the GAC filter media should be kept in service before replacement in order to optimize the cost-benefit ratio associated with using the GAC filter system as a part of the water treatment process.

Project Alternative 2 - No Project
This project would continue to use the existing GAC filter media for TOC, taste, and odor removal.

Recommendation
It is recommended that the filter media should be replaced to remove THM precursors and maintain taste and odor issues to avoid customer complaints.

4.6 Alternative Evaluation Matrix

Table 4.17 on the following page outlines all the aforementioned project alternatives and indicated which projects are recommended for implementation.

***Table 4.17**, Alternative Evaluation Matrix*

Water Master Plan Section	Improvement Location	Deficiency	Project Alternatives	Description of Project	Evaluation	Capital Cost	**Project Status**	Alternative Project Selection
Section 4.1	Raw Water Intake (WTP)	Source Water Contaminated with Cyanobacteria during Algae Blooms	Project Alternative 1 – Rehabilitate One Groundwater Well	Rehabilitate one ground waterwell and install treatment system capable of reducing high levels of iron and manganese and associated piping and sitework. Will allow operators to supplement lake water, particularly during bloom events.	Not recommended as treatment of iron and manganese is cost-prohibitive given the reliability of Clear Lake as a primary source of raw water.	$447,720		Not Selected
			Project Alternative 2 - Install Secondary Raw Water Intake with Greater Depth	Install a secondary raw water intake with associated piping and pumping improvements at a greater depth than existing raw water intake. Will allow greater flexibility in avoiding cyanobacteria in lake water.	Not recommended as installing a second lake intake is not cost effective given the reliance of WTP's current raw water intake. Additionally, the depth of Clear Lake increases gradually past the current raw intake jetty (approx. 1 ft depth for 100 ft length), necessitating an intake far offshore to gain an increase in depth.	N/A		Selected (Note: completion of this project has not fully resolved the algae issue)
			Project Alternative 3 - Install Self-Cleaning Screens over Raw Water Intake	Install Self-Cleaning Screens at the raw water intake to reduce clogging and prevent clots of algae from being sucked into the treatment process.	Not recommended as the cost of installing self-cleaning screens does not justify the expected benefit as cyanobacteria concentrations typically stratify at shallow depths.	N/A		Not Selected
			Project Alternative 4 - No Project	Take no action and continue to rely on existing infrastructure to draw lake water for treatment.	Recommended as Clear Lake continues to be a reliable source of raw water for the WTP despite concerns about cyanotoxicity.	N/A		Not Selected
Section 4.2.1 - Ozone Generator	Ozone Generator (WTP)	Insufficient ozone production to handle algae blooms. No redundancy.	Project Alternative 1 - Install New Ozone Generator and Air Compressor	Install a new Pacific Ozone generator and air compressor to aid in algae treatment and to provide system redundancy to the existing ozone treatment system. The District has indicated the desire to modify the ozone injection type so as to achieve finer bubble diffusion and enhance disinfection capacity.	Recommended as there is no redundancy in the current ozone treatment system. Also recommended as the completion of this project will allow ozone to be used for disinfection as well (pending future piping upgrades). Currently, the District owns (2) Pacific Ozone 9M23 ozone generators with one in service. A hydrovane Rotary Vane air compressor is available as a spare to the Atlas Copco GA18 air compressor which is used primarily.	~~$85,300~~ **$40,000**	Project Initiated	**Recommended**
			Project Alternative 2 - No Project	Take no action and continue to rely on sole ozone generator for pre-treatment of lake water.	Not recommended as there is a lack of redundancy in ozone process.	N/A		Not Selected
Section 4.2.2 - High Service Pumps	High Service Pumps (WTP)	Lack of VFD's on HSPs necessitate throttling and reduces operator ability to manage CT times.	Project Alternative 1 - Install VFDs on High Service Pumps	Replace existing motor starters on pumps 2 and 3 with VFDs. Install associated electrical improvements. The primary 100 hp split case pump has VFD control, while the existing 60 hp secondary pump does not. Staff believes VFD controls for the primary and secondary pumps are sufficient and that VFD controls for the 60 hp external pump are not needed in the near future.	Recommended as there is currently no way to control flows aside from throttling which is energy inefficient. Additionally, will provide plant staff with greater control over pumped flows.	$79,900	Project Initiated	**Recommended**
			Project Alternative 2 - No Project	Continue to rely on throttling to control flow rates leaving plant	Not recommended as this will continue an energy inefficient process.	N/A		Not Selected
		High service pump 2 at end of useful life As indicated in Section 5.2.3 the secondary pump is now considered the standby pump and should be equipped with VFD control. Pump replacement is not high priority but should be planned for.	Project Alternative 1 - Replace High Service Pump 2	This project would consist of replacing the 60 HP service pump no. 2 with a new 75 HP pump and VFD motor control.	Recommended as the pump has reached the end of its life expectancy	$13,200		**Recommended**
			Project Alternative 2 – No Project	No improvements would require the existing pump to continue service until failiure	Not recommended, the loss in capacity to convey finished water to the distribution system would pose a serious threat to the distribution system			
Section 4.2.3 - Equalization Tank	West Yard (WTP)	Lack of equalization tank puts hydraulic load on LS7, LS2, and WWTP	Project Alternative 1 - Install Equalization Tank at WTP	Install 60,000 gallon Equalization Tank at WTP with associated piping and instrumentation. A recent review of tank types and placement with staff found that two 30,000 gallon open-top tanks piped together would be preferable to one large tank.	Recommended as District is currently relying on a rented rainwater collection container to provide storage for backwash water. A dedicated storage tank would prevent surges of backwash water from entering the sewer system.	$321,600	Project Incomplete	**Recommended**

			Project Alternative 2 - Install Equalization Tank at WTP with Floating Decanter	Install 60,000 gallon Equalization Tank with Floating Decanter to collect solids. Install associated piping and instrumentation.	Not recommended as solids handling complicates operations and the WTP and is better suited for the WWTP. Recovered washwater would be minimal.	$474,350		Not Selected
			Project Alternative 3 - Install Equalization Tank at WTP followed by Plate Settler	Install 60,000 gallon Equalization Tank followed by Plate Settler Unit to collect solids from backwash process. Install associated piping and instrumentation	Not recommended as solids handling complicates operations and the WTP and is better suited for the WWTP. Recovered washwater would be minimal.	$606,350		Not Selected
			Project Alternative 4 - Install Equalization Tank at WTP followed by Dissolved Air Flotation Unit	Install 60,000 gallon Equalization Tank followed by Dissolved Air Flotation Unit to collect solids from backwash process. Install associated piping and instrumentation.	Not recommended as solids handling complicates operations and the WTP and is better suited for the WWTP. Recovered washwater would be minimal.	$643,350		Not Selected
			Project Alternative 5 – Install Equalization Tank at WTP with on site sludge dewatering	This alternative would consider dewatering settled sludge on site in addition to the 60,000 gallon Equalization Tank and plate settler.	Not recommended as there are considerable capital and operational costs associated with processing the sludge and hauling off site.	$726,000		Not Selected
			Project Alternative 6 - No Project	Continue to drain backwash water directly to sewer.	Not recommended as the District needs an equalization tank to mitigate surges of backwash water to the sewer. The rainwater collection container is a stopgap measure.	N/A		Not Selected
Section 4.2.4 – Disinfection Byproducts Mitigation	Water Treatment Plant	High level of DBPs in treated water are bordering on non-compliance Currently, the District can achieve their minimum CT-value requirements without compromising production.	Project Alternative 1 - One-Way Fill Line from Clearwell to Storage Tank	Install pipeline from WTP Clearwell to the Shady Lane Tank. This will allow operators to fill the Shady Lane Tank directly from the WTP and will allow CT to continue at Shady Lane instead of being restricted to WTP clearwell. This will aid operators in controlling DBPs.	Not recommended as would be costly to install a one-way fill line to the Shady Lane tank and it is expected that other DBP mitigating projects will be able to reduce DBPs to the point that this project would be unnecessary.	$567,000		Not Selected
			Project Alternative 2 – Installation THM Removal system at clearwell	Install PAX aerators or similar devices which will allow THMs to dissipate into air that is introduced to water stored in tanks. DBPs will be reduced.	Recommended as tank aeration is a cost effective way to drastically reduce DBPs in the water storage system. This project was completed in 2023 as part of the USDA Rural development Grant and Loan funding program.	$295,000	Project Completed	**Recommended**
			Project Alternative 3 – Post Ozonation Disinfection	Install bypass piping to allow treated water to be routed to ozone contact tower, allowing much lower CT to be used.	Recommended as site piping that allows ozone towers to be used either as pre-treatment or disinfection would help operators manage DBPs and allow for greater future flexibility in maintaining an effective treatment process. Staff recognize that the implementation of an acid feed system, to lower the pH, will also reduce the minimum CT-value required for disinfection. Moreover, the recent installation of the THM system within the clearwell has demonstrated that regardless of the reduction of TTHM concentrations within the finished water, TTHM formation will continue to develop within the distribution system. Other concerns reported by staff include the additional plant complexity, project cost, and loss of redundancy in primary disinfection capabilities with one of the two ozone towers being repurposed. Due to these reasons this project will no longer be considered as a future plant improvement.	$282,300	Project Shelved	Not Selected
			Project Alternative 4 – Acid Feed System	Installation of an acid injection system to allow for acid to be used in lowering the pH thereby decreasing DBP formation potential in treated water.	Recommended as lower pH can have dramatic results on DBP production. Recently Staff has indicated that many of the materials and equipment for piloting this project have been acquired and that they intend to conduct the pilot in-house with coordination with the SWRCB DDW.	$46,000	Project Initiated	**Recommended**
			Project Alternative 5 - No Project	Make no changes and wait to be cited for non-compliance after additional water storage is added.	Not recommended as DBPs are expected to be one of the primary issues the District faces in the future, particularly if Microcystis regulations come into effect.	N/A		Not Selected

Section 4.2.5 - Corrosion Protection	Water Treatment Plant	Insufficient corrosion protection	Project Alternative 1 – Renovation of Clearwell and Clarifier	Renovation of the clearwell with high quality coating to extend the service life of steel tanks including installation of cathodic protection system.	Recommended as paint coating is the primary protection against corrosion. This project was completed in 2023 as part of the USDA funded water system improvement project.	$128,500	Project Complete	**Recommended**
			Project Alternative 2 – No Project	Take no action until structural integrity of tank is compromised.	Not recommended as repairing or replacing a welded steel tank would not be cost effective.			Not Selected
Section 4.3.1 - Pipelines	Distribution System		Project Alternative 1 – Comprehensive Pipeline Rehabilitation Project	Pipeline Replacement per Table 4.6.	Recommended due to high volume of water leakage, undersized pipelines, low system pressures, inadequate fireflow, and deteriorated pipelines and appurtenances.	$3,943,859	Project Pending	**Recommended**
			Project Alternative 2 - No Project	Take no action and leave pipelines identified for Phase I replacement in service.	Not recommended due to severity of deficiencies.	N/A		Not Selected
Section 4.3.2 - Meter Replacement Program and AMI System	Distribution System	Labor intensive meter reading program	Project Alternative 1 – Installation of AMI system	Installation of fixed base antenna system for intercepting radio reads from endpoints to central location.	Recommended as the system would significantly reduce labor time needed to collect data. AMR would be used where necessary to minimize infrastructure costs in select locations which preclude the ability to accommodate radio reads without an extensive number of collectors.	$743,640 No Updates on this project		Not Selected
			Project Alternative 2 – Installation of AMR System	Allows meter readers to drive by meters to rapidly collect data. Avoids vault or pit access.	Not recommended as the technology still requires significant labor time to collect data.		Project Complete	**Project Selected**
			Project Alternative 3 – Installation of Touch Read System	Touch screen installation would accelerate the data collection process with touch screen technology	Not recommended as the technology still requires significant labor time to collect data.			Not Selected
			Project Alternative 4 – No project	Take no action and continue current methodology to collect meter data	Not recommended as an AMI or AMR system would be greatly beneficial to the District resulting in reduced staff time for collecting meter reads and the ability to track lost water volume			Note Selected
Section 4.3.3 - Flow Meters	Small Meters in Distribution System	Average 2.43% under registration for meters smaller than 1 inch (Approximately 1,932 meters) resulting in loss of income for District.	Project Alternative 1 - Replacement of Small Meters 10 Years or Older	Conduct a meter replacement program that targets meters 10 years or old as based on survey results in order to reduce revenue lost due to meter inaccuracies.	Recommended as the Cost to Benefits ratio indicates that revenue recovered will cover replacements. This project was completed in 2023 as part of the USDA funded water system improvement project.	Included in the Cost Analysis for AMI and AMR	Project Complete	**Recommended**
			Project Alternative 2 - No Project	Take no action and accept lost revenue due to meter inaccuracies.	Not recommended as District is losing revenue due to underperforming meters.	N/A		Not Selected
	Intermediate to Large Meters in Distribution System	Lack of testing data for 400 Sulphur Springs Road Meter and Broken Valve	Project Alternative 1– Repair of valve and Testing of Large Meter	Repair valve and test large meter at 400 Sulphur Springs Road. As this is the largest user of water in the District's system, the is a large potential for recovering lost revenue due to meter inaccuracies.	Recommended as this large meter (6" compound) has not been accurately tested and is potentially the cause of apparent losses. This project was completed in 2023 as part of the USDA funded water system improvement project.	$750	Project Complete	**Recommended**
			Project Alternative 2 - No Project	Take no action and accept possibility of lost revenue due to meter inaccuracy.	Not recommended as reduced meter accuracy results in decreased revenue for the District.	N/A		Not Selected
Section 4.3.4 – Pressure Reducing Valves	Harvey Blvd CSA-16 Tie-In	Pressure head differential between existing District Service Area and proposed annexation service area (CSA-16)	Project Alternative 1 – Installation of Pressure Reducing Valve at Harvey Blvd. Tank Site	Install PRV and flow meter at site of connection between CSA-16 and current District service area. This installation will regulate pressure between zones and the meter will allow for the volume of water being provided to CSA-16 to be accurately quantified.	Recommended as the installation of a PRV valve near Harvey Blvd. and Highway 20 to control flows and pressures between the District and CSA-16 annexation area. This project was partially completed in 2023 as part of the USDA funded water system improvement project.	Cost by Others	Project Complete	**Recommended**
			Project Alternative 2 – Installation of Valve at the Paradise Cove Tank Site	This project would consist of installing a valve at the Paradis Cove tank site that would include filling the tank from a dedicated line tied directly to the new 8” line in lieu of connecting the 8” line directly to the existing paradise system.	Not recommended due to the absence of a dedicated line the altitude valve would close and demands in the annexation area would presumably be met from the District’s water system directly, thus limiting the ability to draw and fill the tank in order to maintain water quality and keep			Not Selected
			Project Alternative 3 – No Project	Take no action	Not recommended as a valve is required to ensure proper operation of the District’s water system when CSA-16 is annexed			Not Selected
Section 4.4.1 - Pump Stations	Shady Lane Pump Station	Lack of backup pumps, lack of backup power, aging pump	Project Alternative 1 - Booster Pump Upgrades	The pump house will consist of CMU construction and feature (2) 25 HP multi-stage vertical in-line pumps. The building foot print will measure approximately 16’ X 13’	Recommended to meet fireflow and basic system redundancy requirements.	See Section 5	Project Incomplete	**Recommended**

		insufficiently sized for fireflows, old and deteriorating pump house		and also house two VFD panels, general PLC panel, power panel, lighting panel, magnetic flow meter, discharge piping, and fittings.				
			Project Alternative 2 - No Project	This option involves the continued reliance on the current booster pump at this site.	Not recommended as pump station is unable to meet fire flow requirements	N/A		Not Selected
Section 4.4.1 - Pump Stations	High Valley Pump Station	Lack of backup pumps, lack of backup power, aging pump insufficiently sized for fireflows	Project Alternative 1 - Booster Pump Upgrades	The pump house will be constructed using CMU and will have (3) 50 HP multi-stage vertical in-line pumps. The building will be about 20' X 20' and will house VFD panels, a PLC panel, power panel, transformer, lighting panel, magnetic flow meter, discharge piping, and fittings.	Recommended to meet fireflow and basic system redundancy requirements.	See Section 5	Project Incomplete	Selected
			Project Alternative 2 - No Project	This option involves the continued reliance on the current booster pump at this site.	Not recommended as pump station is unable to meet fire flow requirements	N/A		Not Selected
Section 4.4.1 - Pump Stations	Cerrito Pump Station	Lack of backup pumps, lack of backup power, aging pump insufficiently sized for fireflows, old and deteriorating pump house	Project Alternative 1 - Booster Pump Upgrades	Upgrade PG&E Service to 200 amps. Install THM removal system (1 mixer and 1 power vent). Coating of piping inside pump house and suction piping outside of pipe house. Installation of non-slam check valve on pneumatic tank discharge piping. Building insulation and mini-split install.	Recommended to meet fireflow and basic system redundancy requirements. The pump house was upgraded with new pumps, control panel, instrumentation, flow meter, piping, air compressors, valves, and siding. The building's exterior electrical components were also replaced. Additional pending improvements are listed in Table 5.19.1.	See Section 5	Project Incomplete	Selected
			Project Alternative 2 - No Project	This option involves the continued reliance on the current booster pump at this site.	Not recommended as pump station is unable to meet fire flow requirements	N/A		Not Selected
Section 4.4.1 - Pump Stations	Harvey Blvd. Pump Station	Booster pump required at proposed Harvey Tank site to allow water to be pumped into Zone 1 as needed.	Project Alternative 1 - Booster Pump Upgrades	Install booster pump at proposed Harvey Tank site to allow water in Harvey Tank to be pumped back into Zone 1	Recommended to meet fireflow and basic system redundancy requirements. Also allows for water stored at the Harvey Blvd. tank to be reintroduced to the current District service area to meet typical water demand or fireflow.	See Section 5	Project Complete	Selected
			Project Alternative 2 - No Project	This option involves the installation of the Harvey Blvd. tank without a booster pump station.	Lack of a booster pump will keep Harvey Tank from being used as additional storage for Zone 1	N/A		Not Selected
Section 4.4.2 - Water Storage Tanks	High Valley Tank Site	Previously the site of two water tanks, the High Valley Tank Site is in good location for a new water tank to add more storage to the District.	Project Alternative 1 – Install 215,000 gallon Bolted Steel Storage Tank	Install 215,000 gallon bolted steel tank and associated piping and controls.	Not recommended as bolted steel tanks are highly susceptible to corrosion.	$594,185		Not Selected
			Project Alternative 2 – Install 215,000 gallon Welded Steel Storage Tank	Install 215,000 gallon welded steel tank and associated piping and controls.	Recommended as welded steel tanks have a long life and have good performance. This project will increase water storage in the District by adding a new tank.	See Section 5	Project Incomplete	Selected
			Project Alternative 3 - No Project	Take no action and rely on other tanks for Zone 1 water storage	Not recommended as water storage at the High Valley site will provide a reserve for fireflows and also take hydraulic load off Zone 1 in the event that the proposed High Valley pump station pumped at full capacity to Zone 3 for fireflow.	N/A		Not Selected
Section 4.4.2 - Water Storage Tanks	Cerrito Tank Site	The existing 100,000 gallon redwood tank is severely deteriorated and actively leaking water. This tank provides the only water storage for zone 3.	Project Alternative 1 – Demo Existing Redwood Tank and Install 105,000 gallon Bolted Steel Storage Tank	Demolish and remove the existing redwood tank and install 105,000 gallon bolted steel tank and associated piping and controls.	Not recommended as bolted steel tanks are highly susceptible to corrosion.	$422,237		Not Selected
			Project Alternative 2 – Demo Existing Redwood Tank and Install 105,000 gallon Welded Steel Storage Tank	Demolish and remove the existing redwood tank and install 105,000 gallon welded steel tank and associated piping and controls.	Recommended as welded steel tanks have a long life and have good performance. This project will increase water storage in the District by adding a new tank. In 2023, the USDA-funded water system improvement project included demolishing and replacing the old redwood tank with a new bolted steel tank. Additional pending improvements are listed in Table 5.19.1.	$704,206	Project Complete	Selected
			Project Alternative 3 - No Project	Take no action and continue to rely on severely deteriorated tank.	Not recommended as redwood tank is past the end of its useful life.	N/A		Not Selected
Section 4.4.2 - Water Storage Tanks	Harvey Tank Site	Tank required to be installed to provide service to CSA-16. Tank	Project Alternative 1 – Install 220,000 gallon Bolted Steel Storage Tank	Install 220,000 gallon Bolted Steel storage tank to provide storage capacity for Zone 1 and CSA-16	Not recommended as bolted steel tanks are highly susceptible to corrosion.	$544,270		Not Selected

		will also provide storage for Zone 1.						
			Project Alternative 2 – Install 220,000 gallon Welded Steel Storage Tank	Install 220,000 gallon Welded Steel storage tank to provide storage capacity for Zone 1 and CSA-16	Recommended as welded steel tanks have a long life and have good performance. This project will increase water storage in the District by adding a new tank. A bolted steel tank was installed in lieu of a welded tank.	$892,433	Project Complete	Selected
			Project Alternative 3 - No Project	This option involves no pump station installation at the proposed Harvey Tank site.	Not recommended as storage is required at this site to provide CSA-16 with storage for water supplied from the WTP and to provide reserve for the current District service area.	N/A		Not Selected
Section 4.4.2 - Water Storage Tanks	Pluth Tank Site	The existing 100,000 gallon redwood tank is severely deteriorated and actively leaking water. Additionally, the working height of water in the tank limits the fill capacity of Shady Lane and Pluth steel tank.	Project Alternative 1 – Demo Existing Redwood Tank and Install 165,000 gallon Bolted Steel Storage Tank	Demolish and remove the existing redwood tank and install 165,000 gallon bolted steel tank and associated piping and controls.	Not recommended as bolted steel tanks are highly susceptible to corrosion.	$292,429		Not Selected
			Project Alternative 2 – Demo Existing Redwood Tank and Install 165,000 gallon Welded Steel Storage Tank	Demolish and remove the existing redwood tank and install 165,000 gallon welded steel tank and associated piping and controls.	Recommended as welded steel tanks have a long life and have good performance. This project will increase water storage in the District by adding a new tank and increasing the maximum fill level of the Shady Lane tank and the Steel Pluth Tank. The old redwood tank was recently taken out of service and has since been abandoned, level instrumentation and telemetry has been relocated to the adjacent welded steel tank.	$487,400	Project Incomplete	Selected
			Project Alternative 3 - No Project	Take no action and continue to rely on severely deteriorated tank.	Not recommended as the redwood tank is in severe need of replacement and full operating capacity of steel tanks at Pluth and Shady Lane sites not being utilized because of limiting factor of redwood tank height.	N/A		Not Selected
Section 4.4.3 – Disinfection Byproduct Mitigation	Pluth, Cerrito, Konocti, and Harvey Tank Sites	High THM levels within the distribution system threaten the District's ability to meet regulatory compliance. There are no facilities in place to monitor or mitigate DBPs.	Project Alternative 1- Installation of mixers and ventilation systems at storage tanks furthest from treatment facility.	This project recommends procuring funds for a partial THM removal system by use of a mixer and forced-air ventilation system for all tanks furthest from the treatment facility.	Recommended as the procurement of funding for robust THM mitigation measures to remedy high THM levels. A THM removal system has since been installed within the Paradise Cove tank.	Per tank site see **Section 5**	**Partially Complete**	**Recommended**
	Harvey Tank Site		Project Alternative 2 - Harvey THM Removal System	This project alternative would consist of a full THM removal system installed at the Harvey tank site.	Not recommended, a single THM removal system may be insufficient to mitigating THM levels in other parts of the distribution system	$295,000		Not Selected
			Project Alternative 3 – No project	This alternative assumes that all improvements made at the treatment facility are sufficient in mitigating THM levels	Not recommended, based on the limited sampling data available it is evident that THMs form within the distribution system and would be problematic at the far extents of the distribution system	N/A		Not Selected
Section.4.4.3.1 Disinfection Byproduct Mitigation Update		Reduce TTHM concentrations within the Paradise Cove service area.	Project Alternative 1 – Harvey THM Removal Equipment	This project alternative would require a mixer and power vent that would allow the Harvey tank to be operated at full capacity without exceeding the MCL for TTHMs.	The analysis of Section 3 also showed that the installation of THM removal equipment within the Harvey tank would not noticeably enhance the water quality within Paradise Cove.	N/A		Not Recommended
			Project Alternative 2 – Konocti THM Removal Equipment	This project alternative would consist of adding a mixer and power vent at the Konocti tank would enhance water quality to the services within the Konocti pressure zone while also significantly reducing THM concentrations at the Mesa Stubbs sample location.	The analysis presented in Section 3 indicates that installation of THM removal equipment at the Konocti tank would be most effective at reducing the measured THM concentration as the Mesa Stubbs sample location due to the tank's close proximity with the sample point. Project Alternative 2 is recommended to mitigate the high THM concentrations measured at the Mesa Stubbs sample point.			**Recommended**
			Project Alternative 3 – Shady THM Removal Equipment	This project alternative would require installation of a mixer and power vent at the Shady Lane tank would reduce the THMs to a concentration comparable to the clearwell effluent.	Installation of THM equipment at the Shady tank would not directly reduce the THM concentrations measured at the Mesa Stubbs sample point unless the Shady Lane booster pump is conveying flows to the Konocti tank during the time at which samples are being collected.	N/A		Not Recommended

			Project Alternative 4 – Paradise Valley Boulevard Piping Improvements w/ Check Valves	This improvement consists of rehabilitating the existing 6” pipeline between the Paradise tank and Paradise Valley Boulevard.	As mentioned in Section 3 installation of check valves on the inlet and outlet piping to the Paradise tank would not prevent Harvey effluent flows from bypassing the Paradise tank while the Paradise tank is being filled.	N/A		Not Recommended
			Project Alternative 5 – Paradise Valley Boulevard Piping Improvements w/ Intertie	This project alternative also includes rehabilitation of the existing 6-inch pipeline between the Paradise tank and Paradise Valley Boulevard. This improvement uses an intertie to effectively isolate the east side of Paradise cove from the west side such no Harvey tank effluent can enter the west side of Paradise cove without first passing through the Paradise tank.	This is recommended as a high-priority improvement. Instead of using check valves to prevent slugs of Harvey tank effluent from entering the west side of Paradise Cove this improvement uses an intertie to effectively isolate the east side of Paradise Cove from the west side such no Harvey tank effluent can enter the west side of Paradise cove without first passing through the Paradise tank.	See Section 5		**Recommended**
Section 4.4.4 Corrosion Protection	Pluth, Konocti, and Shandy Lane Tank Site	Insufficient corrosion protection. Substaintial corrosion has degraded the paint coatings down to the primer, and in many cases, to the bare steel surface.	Project Alternative 1 - Renovation of Tank Site Coatings System	Renovation of each tank with a high quality coating system will extend the service life of the tank preventing excessive corrosion while minimizing the potential for structural failure.	Recommended as the storage tanks are critical to the performance and reliability of the distribution system and should not be left neglected.	Per tank site see Section 6		**Recommended**
			Project Alternative 2 – No Project	Tank no action. Reactive maintenance would be used to remedy issues associated with failing infrastructure	Not recommended, the neglect of corrosion protection would ultimately cut the service life of the tank short requiring significant costs associated with a new tank or extensive repair work.			Not Selected
Section 4.4.2 - Acoustic Leak Detection	Distribution System	Lack of a comprehensive leak detection program	Project Alternative 1 - Institute Comprehensive Leak Detection Program	Institute a leak detection program that surveys the entire District's water lines over a period of two to three years on a rolling basis.	Recommended as acoustic leak detection program is a cost efficient way to discover hidden leaks and ensure real water losses are kept to a minimum.	$20,000		**Recommended**
			Project Alternative 2 - No Project	Take no action and continue to respond to leaks as they are discovered in the field.	Not recommended as hidden leaks may never be discovered and as a consequence of this, real water losses may be very high.	N/A		Not Selected
	Distribution System	Lack of backflow protection on at-risk connections	Project Alternative 1 - Install Backflow Preventers	Install backflow devices on approximately 771 at-risk connections.	Recommended to ensure continued compliance with treated water regulations This project was completed in 2023 as part of the USDA funded water system improvement project.	~~$708,606~~ $545,097	Project Complete	**Recommended**
			Project Alternative 2 - No Project	Take no action and run the risk of contaminated water backflowing into distribution system.	Not recommended as water system is currently as risk of contamination via backflowing connections.	N/A		Not Selected
Section 4.5 – Operational Improvements	WTP Lab		Project Alternative 1 - Purchase Streaming Current Monitor and Microscope	Purchase Chemtrac LCA-01 Current Monitor and Nikon Eclipse Ci-E Microscope	Recommended to facilitate plant staff duties and reduce coagulant usage and thus cost.	$18,402		**Recommended**
			Project Alternative 2 - No Project	Continue to rely on coagulant overdosing. Continue to rely on WTP magnifying glass to examine water samples.	Not recommended.	N/A		Not Selected
Section 4.5.2 – Filter Pump House HVAC	WTP Filter Pump House	Lack of HVAC in pump house to protect equipment	Project Alternative 1 – HVAC Installation	A ductless HVAC system would ventilate and control the temperature to protect electrical panel, VFDs, and other electrical components from overheating.	Recommended as an HVAC system would extend the service life of electrical components, ensure reliability and optimum performance	$55,500	Project incomplete	**Recommended**
			Project Alternative 2 - No Project	Take no action.	Not recommended as there is a risk that the VFDs controlling the filter pumps could over heat and fail compromising the ability to properly operate flows from the clarifiers to the pressure filters, GAC, and clearwell	N/A		Not Selected
Section 4.5.3 – Granular Activated Carbon	WTP Yard	GAC filter media at the end of useful life	Project Alternative 1 – Replace GAC media	Removal and disposal of existing GAC filter media, interior cleaning of the GAC tanks, and replacement with new granulated activated carbon media.	Recommended as the GAC is critical to ensuring removal of THM precursors and providing taste and odor control	$95,000		**Recommended**
			Project Alternative 2 – No Project	Continue using the existing media	Not recommended as the media has a limited capacity to adsorb constituents. A loss in aesthetic water quality could result in customer complaints.	N/A		Not Selected

SECTION 5 – Recommended Projects and Prioritization

Based on the analysis of deficiencies as discussed in **Section 3** and the project alternatives evaluations as discussed in **Section 4**, projects that are recommended for implementation are presented in this section. Select projects and proposed project scheduling is presented **Section 6**. The subsections that follow are presented at the planning level with the understanding that more detailed design will follow in accordance with funding availability and District priorities. Funding for immediate high priority projects are currently being pursued through the SWRCB DWSRF program.

Projects designated as high priority, are recommended water system improvements that were both identified in previous Master Plan(s) and within this 2024/25 TA Grant – Updated Water Master Plan. Following the overall water system evaluation, it was determined that major portions of the overall water system are considered to be "failing". Factors used in prioritizing the "high priority" projects included unsafe drinking water due to violations and "boil water notices" that have been issued to customers, challenges in meeting production demands at the WTP, TTHM violations, potential health and safety issues, and overall readiness to complete the projects including design and environmental clearance (NEPA and CEQA). It should also be noted that certain projects as shown in **Table 5.1**, below have been completed recently, with a majority of the completed projects receiving United States Department of Agriculture Rural Development grant and loan funding due to the public health risks to the District customers.

All projects presented in this section are recommended for future implementation by the District and have been identified in past USDA Project Engineering Report(s), original DWR Water Master Plan and SWRCB funded Water Master Plan Update. It should be noted that some of the recommended priority projects are more critical in terms of public health and safety. Some projects will bring more benefit to operational effectiveness than others. Therefore, projects were sorted and ranked based on the relevant needs of the District. An overall list of recommended projects is presented below in **Table 5.1**. Project status and prioritization as of 2025 are noted in red.

***Table 5.1**, Recommended Immediate Projects*

Improvement Projects	2024/25 Project Status	Project Priority (immediate, 5 and 10yrs)
Water Treatment Plant Improvement Projects		
Ozone Generator (injector improvement)	Project Initiated	Immediate
High Service Pumps VFD	Project Initiated	5-year*
High Service Pump 2 Replacement	**Project Completed**	10-year*
Equalization Tank	Project Incomplete	Immediate
Clearwell THM Removal System	**Project Completed**	NA
Facility Corrosion Protection	**Project Completed**	NA
Post Ozonation	Project Eliminated	NA
Acid Feed System	Project Initiated	5-year*
Pretreatment Pilot and 1 MGD Unit	Project Incomplete	5-year

GAC Filter Media Replacement	Project Incomplete	5-year*
Filter Building HVAC & Insulation	Project Incomplete	10-year
Valve and Actuator Rehabilitation	Project Incomplete	5-year
SCADA System Upgrades	Project Incomplete	Immediate
Storage and Booster Pump Station Systems		
High Valley Tank and Pump Station	Project Incomplete	Immediate
Cerrito Tank and Pump Station	Project Completed in 2023 by USDA funding with minor outstanding improvements	5-year
Harvey Tank and Pump Station	**Project Completed** in 2023 by USDA funding	NA
Pluth Redwood Tank Replacement	Project Incomplete	10-year
Shady Lane Pump Station	Project Incomplete	Immediate
Shady Lane Coating / Corrosion Protection	Project Incomplete	Immediate
Konocti Coating / Corrosion Protection	Project Incomplete	Immediate
Pluth Coating / Corrosion Protection	Project Incomplete	5-year
Distribution System Improvements		
Pipeline Replacement	Project Initiated (Design/Environmental)	Immediate
Paradise Tank Pipeline Rehabilitation	Project Incomplete	Immediate
Small Meter Replacement	**Project Completed**	NA
400 Sulphur Springs Road Meter Testing	**Project Completed**	NA
Backflow Prevention	**Project Completed**	NA
Phase 2 Backflow Prevention	Project Incomplete	Note 1
AMI Improvement	**Project Completed**	NA
Meter Data Consolidation & Water Loss Management System	Project Incomplete	Immediate
Konocti THM Removal System	Project Incomplete	Immediate
Harvey THM Removal System	Project Incomplete	5-year
Cerrito THM Removal System	Project Incomplete	5-year
Pluth THM Removal System	Project Incomplete	10-year
High Valley THM Removal System	Project Incomplete	5-year
Leak Detection Program	Project Initiated (Ongoing)	Immediate
Pressure Management Project (PRVs)	Project Incomplete	5-year

*Improvements to be completed by District

Notes:

(1) Recently an emphasis has been placed on a system-wide backflow prevention program that may result in the need for additional backflow devices.

Project cost estimates as presented in the following sections below have been prepared in accordance with the Class 4 estimates defined by the Association for the Advancement of Cost Engineering

International (AACEI). The classifications are intended to provide a guideline for generally accepted cost engineering practices; the Class 4 estimate is defined as:

> *"Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams (PFDs) for main process systems, and preliminary engineered process and utility equipment lists. Typical accuracy ranges for Class 4 estimates are -15% to -30% on the low side, and +20% to +50% on the high side, depending on the technological complexity of the project, appropriate reference information, and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks."*

The estimates presented below reflect development costs associated with each project **excluding** costs for engineering and administration, contingencies, and general contractor overhead and profit.

5.1 Raw Water Supply

There are no recommended improvements for the raw water supply, Clear Lake will continue to be the preferred source for treatment and distribution. Changing conditions within Clear Lake, including water temperature, algae blooms, and other natural occurrences may require the District to take appropriate steps to mitigate impacts to its pumping and intake facility. The District should budget for pump maintenance and replacement along with other intake improvements over the next 25 years.

2024 Update

As discussed in Section 2 and 3, the District was provided with a grant to fund an emergency intake as part of the DWR Drought Relief program. The new intake pump and pipeline was required to mitigate the effects of drought related low lake levels severely impacting the District's ability to pump raw water from the lake along withl minimizing the excessive algae content due to the new pump intake location. The Department of Fish and Wildlife permitted construction of the new intake as a temporary facility intended for emergency use only. The new emergency intake included the construction of over 1300 linear feet of 12-inch HDPE, fish screen, and "onshore" booster pump pumping 850-900 gpm of raw water to the WTP. The project was 100% funded through the Department of Water Resources. Since construction of the new intake District staff have been able to temporarily optimize plant production and avoid the operational challenges associated with low lake levels and the high turbidity within the raw water entering the process train. Beyond maintaining the existing intake pumps, there are no recommended improvements to further enhance the raw water supply. Future analysis is recommended for optimizing clarifier performance, including consideration of a new DAF system upstream of the existing clarifiers, which will reduce the algae related high turbidities effecting the WTP treated water production rates

5.2 Water Treatment Plant Improvement Projects

5.2.1 Ozone Generation

It is recommended that a new Pacific Ozone 9M23 ozone generator be installed which will provide for the necessary redundancy and improvement in the ongoing treatment of source water algae blooms. This new generator will be installed in the ozone generator building and will allow for ozone to be used as a disinfection agent. A 10- horsepower Hydrovane Rotary Vane air compressor (HR 07) will be installed adjacent to the new ozone generator. An oxygen generator capable of 320 Standard Cubic Feet per Hour (SCFH) maximum flow at 60 Standard Cubic Feet per Minute (SCFM) will be required to supply the ozone generator with clean air for conversion to ozone. The ozone generator and associated equipment will be installed in the same location where the previous generator against the north wall in the building. This obsolete generator has been removed by plant staff, but electrical supply and piping remain in place. The suitability of the existing electrical and piping connections must be field verified prior to installing the proposed equipment. An image of the existing ozone generator is presented in **Figure 5.1**. **Table 5.2** below summarizes the project.

2024 Project Update

Currently the District owns (2) Pacific Ozone 9M23 ozone generators with one in service. A hydrovane Rotary Vane air compressor is available as a spare to the Atlas Copco GA18 air compressor which is used

primarily. The District has expressed a desire to upgrade the ozone feed to a fine bubble injector which utilities a 7.5 hp recirculation pump between the upstream and downstream locations of the contact tower. The use of fine bubble zone injection will significantly enhance the disinfection capacity of the ozone contact tower and reduce ozone demand.

Table 5.2 Updated

Project Name	WTP Ozone Improvement Project
Purpose	To add redundancy to the ozone treatment process and to aid in treating water during algae blooms.
Project Details	Install 7.5 hp recirculation pump, DO3 flow cell assembly, feed lines, dissolved ozone analyzer, and PLC programming
Estimate Cost	**$40,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	2 months

Sequence of work (general)

- Coordinate closely with WTP staff prior to and during construction
- Verify condition of existing plumbing and electrical
- Install required power and control connections
- Test system
- Place into service

***Figure 5.1**, Existing Pacific Ozone Generator at WTP*



5.2.2 Post Ozonation

The ozone generation improvement described above would also act a prerequisite for a post-ozonation system. The post ozonation system would dramatically reduce the CT time required for disinfection and would utilize existing infrastructure at the facility. The process would consist of re-routing the GAC effluent to the line upstream of contactor no. 2 as presented in **Figure 5.2** below. After disinfection by the contactor the effluent would be lifted to the clearwell by use of a high-flow low-head duplex pump station to overcome the elevation difference between the clearwell at high levels and contactor height. The 5 HP close-coupled centrifugal pumps would lift effluent to the clearwell by VFD control. The piping of the ozone system is currently configured such that each contactor could be supplied by either generator. The design would also require air gaps within the piping modifications to prevent cross connections including new overflow piping for contactor no.2.

2024 Project Update

Currently the District can achieve their minimum CT-value requirements without compromising production. Staff also recognize that implementation of an acid feed system, to lower the pH, will also reduce the minimum CT-value required for disinfection. Moreover, the recent installation of the THM system within the clearwell has demonstrated that regardless of the reduction of TTHM concentrations within the finished water, TTHM formation will continue to develop within the distribution system. Other concerns reported by staff include the additional plant complexity, project cost, and loss of redundancy in primary disinfection capabilities with one of the two ozone towers being repurposed. Due to these reasons this project will no longer be considered as a future plant improvement.

Table 5.3

Project Name	WTP Piping Improvement Project
Purpose	To allow for the ozone contactor no. 2 to be used for post ozonation to reduce the CT value and disinfection byproduct formation potential.
Project Details	This project will modify piping at the WTP to allow water to be pumped through the contactor no. 2 and include a duplex pump station
Estimate Cost	$282,300
Scheduled Start Date	(Immediate upon approval of grant funding) On hold
Construction Time	6 months

5.2.3 High Service Pump VFD

This recommended project includes the installation of two Allen-Bradley PowerFlex, t-3-Phase Pump Drives for High Service Pump 2 (existing pump is 60HP, proposed new pump is 75 HP) and High Service Pump 3 (60 HP). A PLC will be installed to control VFD operation based on set points set by District staff. Plant SCADA systems will be upgraded at this time to allow for seamless interface between VFDs, PLC, and SCADA controls. An image of the electrical cabinets is presented below in **Figure 5.5.** The location of electrical improvements is presented below in **Figure 5.6. Table 5.4** below presents a summary of the project.

2024 Project Update

The primary split case pump (100 hp motor) has been equipped with VFD control. The existing 60 hp secondary pump has not been equipped with a VFD. Staff have indicated that VFD controls for the primary and secondary pumps would be adequate and that VFD controls on the 60 hp external pump (tertiary pump) is not necessary in the foreseeable future. Since it is proposed that the secondary 60 hp pump be upgraded to 75 hp it is recommended that improvements be made together as described below in **Section 5.2.4**.

Table 5.4

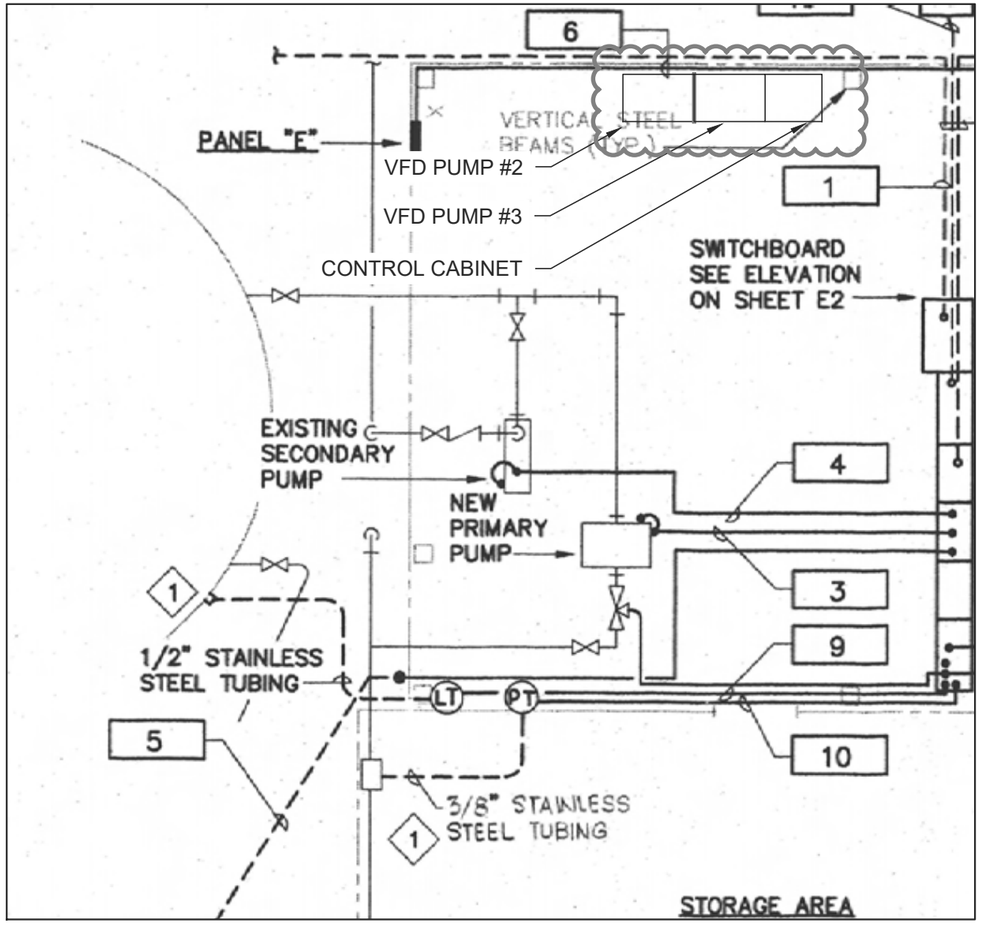
Project Name	High Service Pumps VFD Improvement Project
Purpose	To add control of treated water flow rates and eliminate need for throttling high service pumps.
Project Details	This project will include installing one (1) new VFD drive and an associated electrical/control cabinet. A controller and associated PLC programming and SCADA interface will be included.
Estimated Cost	$65,000 (See Section 5.2.4)
Scheduled Start Date	2030
Construction Time	2 months

Sequence of work (general)

- Coordinate closely with WTP staff prior to and during construction
- Remove existing empty electrical cabinet and storage cabinet along wall.
- Install housekeeping pad, VFD's, and control cabinet.
- Remove existing pump No. 2 and motor starter and install new pump (more details on this portion of the project are found in **Section 5.3**)
- The existing circuit breaker will remain and be used to feed the VFD.
- Install conduit and conductors from VFD to pump and VFD to motor control center.
- Test VFD and pump.
- Install PLC and program.
- Upgrade SCADA screens and operator interface (concurrent with previous items)

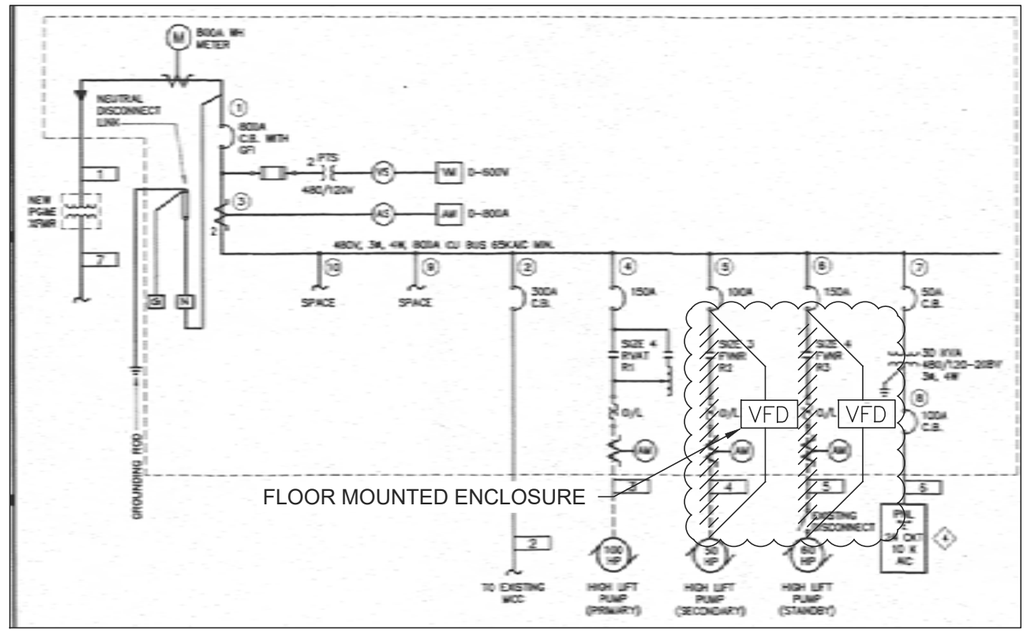
***Figure 5.5**, Existing Electrical Cabinets*





ELECTRICAL ROOM PLAN

3/16" = 1'



SINGLE LINE DIAGRAM

NO SCALE

MC Engineering, Inc.
1000 River Rock Dr #205, Folsom, CA, 95630
Tel.: 916.223.3828
Fax: 916.860.1863
www.mc-engineers.com

PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 5.6

HIGH LIFT PUMP STATION IMPROVEMENTS

5.2.4 High Service Pump 2 Replacement

This recommended project will replace the existing 60 horsepower High Service Pump 2 with a Berkeley 75 horsepower centrifugal pump. Providing a larger pump and motor for High Service Pump 2 will allow plant staff to meet peak demands during the summer with one duty pump running while relying on Pump 3 as a standby that can act in a lead/lag configuration to meet most demand variations throughout the year. **Table 5.5** below presents a summary of the project.

Table 5.5

Project Name	High Service Pump 2 Replacement Project
Purpose	To replace High Service Pump 2, which has reached the end of its useful life and has limited pumping capacity.
Project Details	This project will replace existing HSP 2 (60 HP) with a new 75 HP Berkeley centrifugal pump
Estimate Cost	**$30,000**
Scheduled Start Date	2035
Construction Time	2 months

With the addition of the VDFs as described in **Section 5.2**, pump speeds will be operator adjustable from the SCADA screen as required to maintain desired flow set-points and detention time in the clearwell without the need for throttling. This will allow greater control overflows while minimizing energy costs and aiding process control. An image of the existing pump is presented in **Figure 5.7**; a plan improvement is presented in **Figure 5.8.**

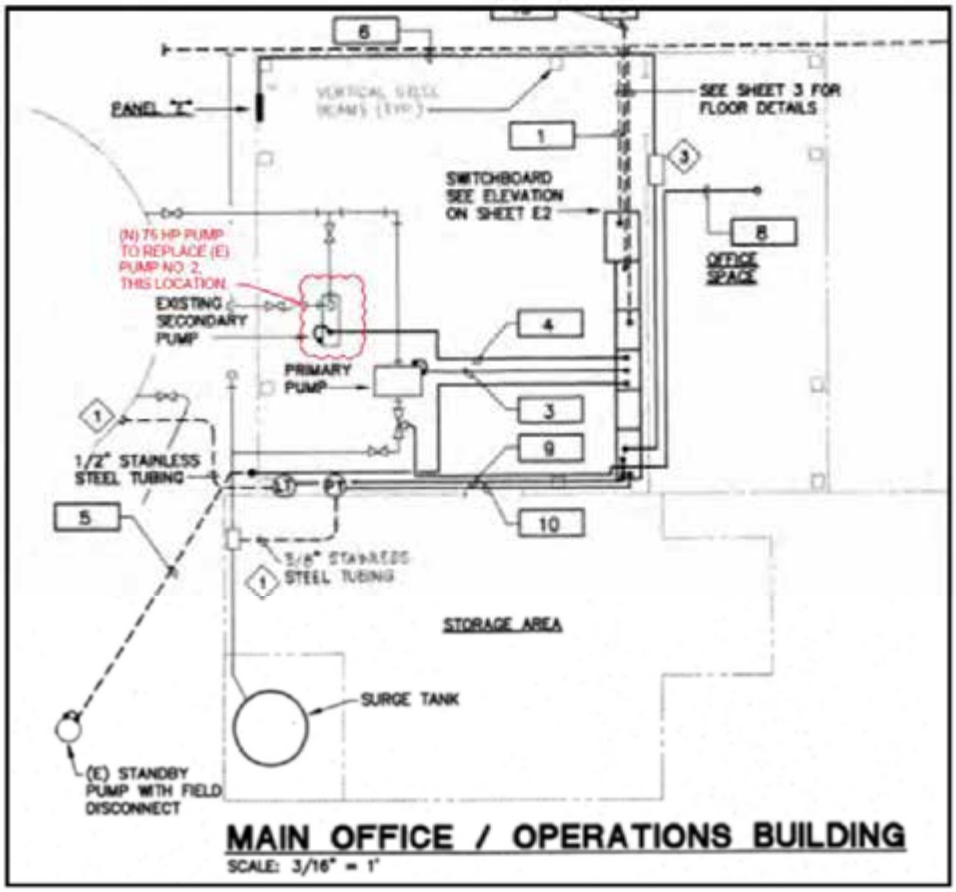
Sequence of work (general)

- Coordinate closely with WTP staff prior to and during construction
- Verify HSP 1 and HSP 3 in good working order to handle flows during HSP 2 shutdown
- Isolate HSP 2 by closing appropriate valves
- HSP 2 offline and disconnect
- Remove existing 60 HP pump and replace with new 75 HP pump
- Install PLC and SCADA control system and complete programming
- Test 75 HP pump
- HSP 2 startup
- Implement VFD upgrades per **Section 5.2**

***Figure 5.7**, Existing High Service Pump 2*



***Figure 5.8**, Location of High Service Pump 2 Replacement Project*



5.2.5 Equalization Tank

This recommended project includes the installation of a new welded 60,000-gallon storage tank which will eliminate the need for a temporary holding container that has been used to equalize backwash flows prior to the discharge of the wastewater collection system. This will provide the ability for plant staff to permanently and cost-effectively control the rate of discharge into the sanitary sewer thereby minimizing related disruptions to downstream sewer pump stations, the collection system pipelines, and the wastewater treatment plant (WWTP). This will help mitigate potential health and safety issues and prevent violations at the WWTP due to process upsets associated with peak influent flows that are exacerbated by the peak filter backwash flows from the WTP. This becomes particularly important during peak rainfall events whereby processes are already being stressed by inflow and infiltration in the collection system. **Table 5.6** below presents a summary of the project.

2024 Project Update

A recent review of tank types and site placement with staff found that two 30,000 gallon open-top bolted steel tanks piped together would be preferable to a single 60,000-gallon tank.

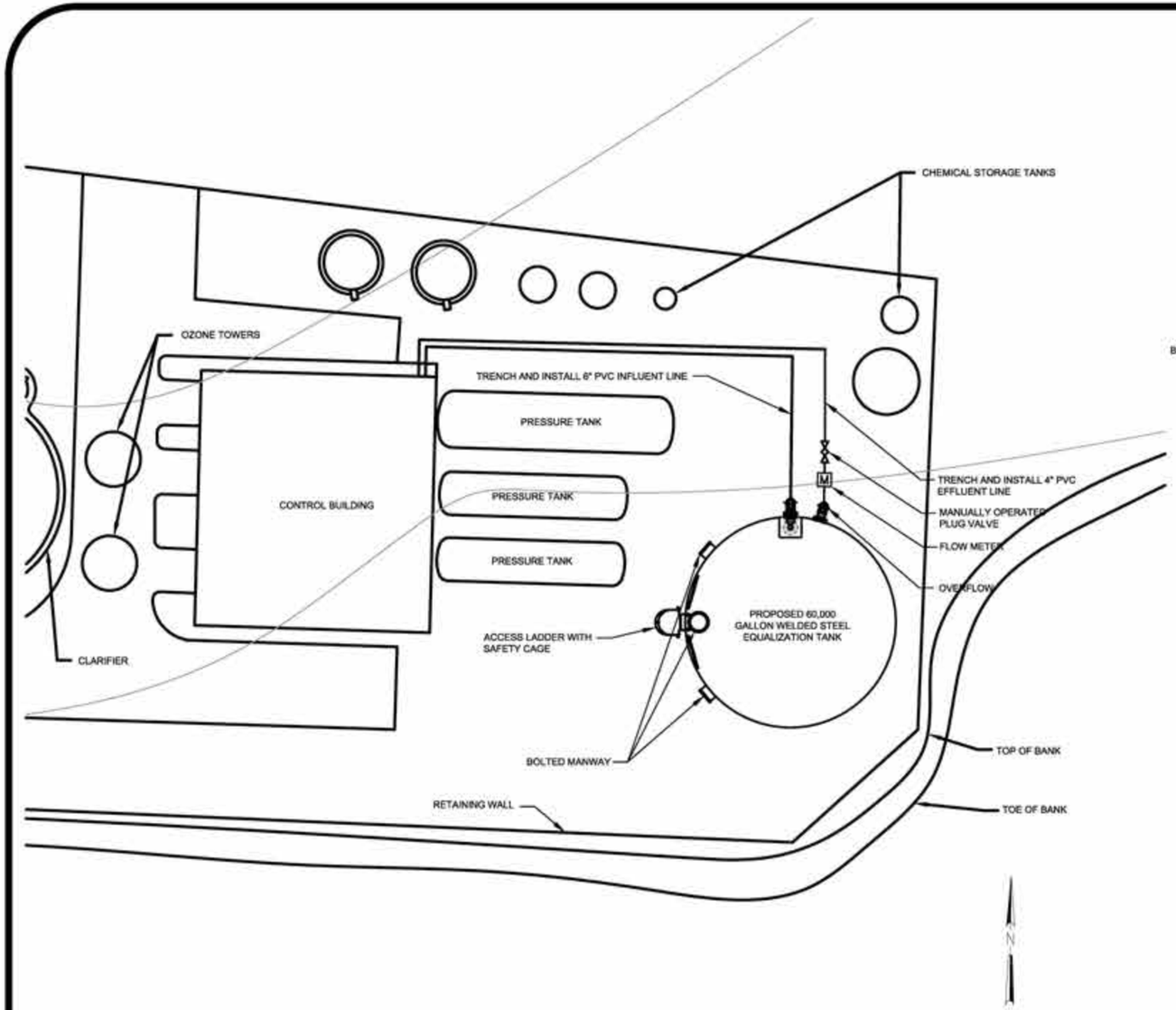
Table 5.6

Project Name	Equalization Tank Improvement Project
Purpose	To construct an Equalization Tank to mitigate peak flows at Lift Station 2, Lift Station 7, and the WWTP.
Project Details	This project will install a 60,000-gallon equalization tank and associated electrical and plumbing improvements at the WTP.
Estimate Cost	**$586,200**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	8 months

A minimum 60,000- gallon welded steel tank will be installed along with associated site piping and appurtenances. The steel tank will have a minimum of two manways to accommodate staff access for cleaning and maintenance. The bottom of the tank will be sloped to help facilitate cleaning and draining of settled sludge. A manual plug valve will control flow from the tank to the sanitary sewer. A conceptual design of the backwash system is presented below in **Figure 5.9**.

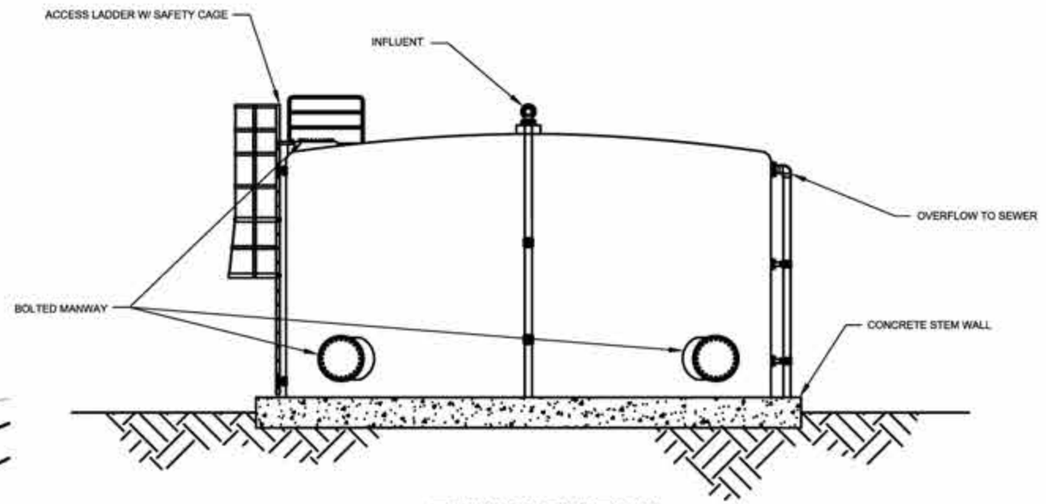
Sequence of work (general)

- Coordinate closely with WTP staff prior to and during construction
- Stage temporary backwash tanks, and related piping south of clarifiers
- Relocate storage Connex and decommission existing backwash tanks
- Trench and install piping for backwash flows and tank drain line
- Excavate and grade site
- Install new 60,000 gallons welded steel tank
- Apply tank coatings
- Calibrate instruments and provide SCADA programming for monitoring tank levels and flows.



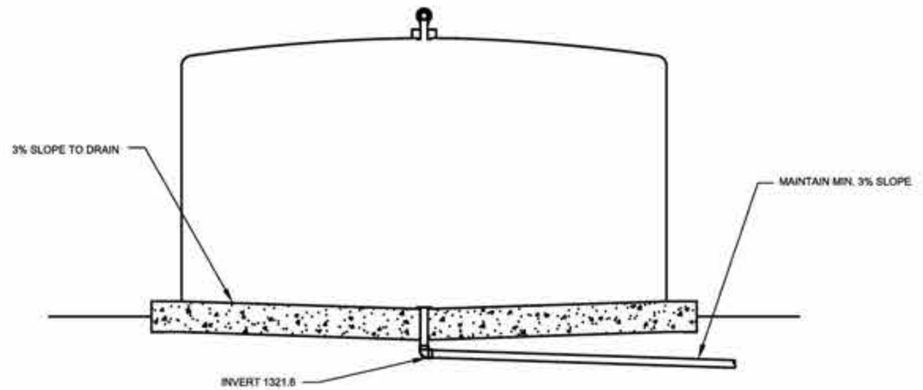
SITE PLAN

SCALE: 1" = 20'



TANK ELEVATION

SCALE: 1" = 10'



TANK SECTION

SCALE: 1" = 10'

GATE VALVE
MAGNETIC FLOW METER
ALTITUDE VALVE
TURBINE PUMP
CHECK VALVE

NOTES

1. TANK TO BE WELDED STEEL, MINIMUM WORKING CAPACITY 60,000 GALLONS.
2. EXISTING BACKWASH STORAGE TO KEPT IN OPERATION CONCURRENT WITH CONSTRUCTION

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FIGURE 5.9

EQUALIZATION TANK SITE PLAN

5.2.6 Clearwell THM Removal System (Project Completed)

The intent of this recommended project is to remove DBPs from the WTP's clearwell before entering the distribution system. Aeration has been proven to be an effective means of removing THMs from finished drinking water and is accomplished by three methods: bubble aeration, surface aeration, and spray aeration. For this project, spray aeration is recommended due to its ability to remove THM species at equal rates while being most energy efficient. **Table 5.7** below presents a summary of the project.

The system works by a set of spray nozzles mounted in the roof of the tank where water is expelled; and THMs within the droplets volatilize out of the water and into the air. This process is supplemented by a forced air ventilation system mounted on the roof to exhaust volatized THM's, as well as a mixer at the bottom of the tank to mitigate short-circuiting. A conceptual drawing of the system is presented below in **Figure 5.10**.

2024 Project Update

This high priority project was completed in 2023 as part of the USDA Rural Development Grant and Loan funding program.

Figure 5.10

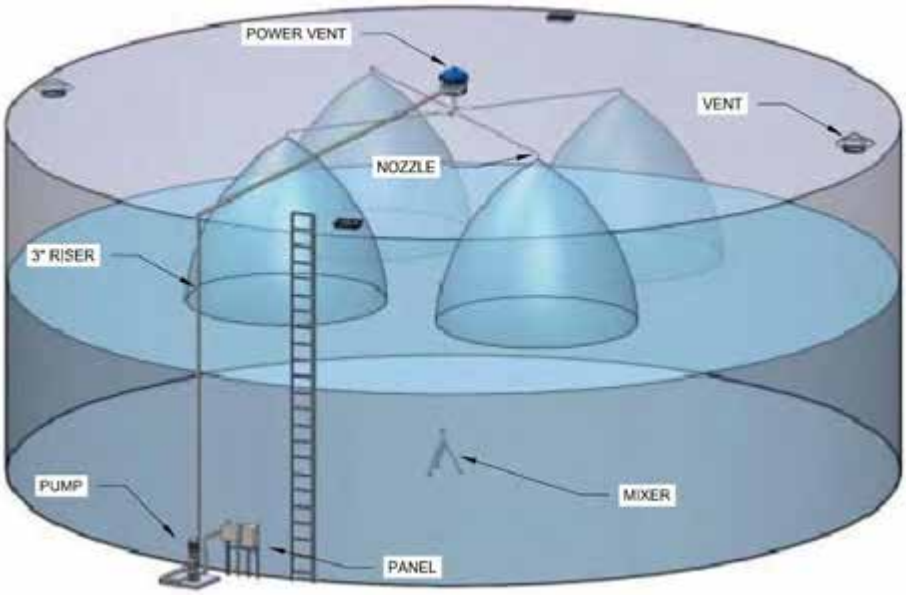


Table 5.7

Project Name	Clearwell DBP Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	
Estimate Cost	$295,000
Scheduled Start Date	2022 (Funding by future grants or loan)
Construction Time	3 months

Sequence of work (general)

- Coordinate closely with WTP staff prior to and during construction
- Drain clearwell
- Cleaning of interior clearwell floors and walls with pressure waster to remove silt, and any foreign sediment
- Removal of any bio-film using an NSF 60 approved chemical cleaning agent followed by a fresh water rinse to remove any cleaning agent
- Installation of NSF approved pumps and spray nozzles positioned in the tank roof
- Installation of forced air ventilation system on the roof of the tank in accordance with AWWA D100
- Installation of mixer on tank floor
- Upon completion of installation tank disinfected in accordance with AWWA C652
- Furnish 3 phase power to the base of the tank with necessary trenching, conduit, and electrical connections.
- Furnish electrical control boxes, tank sidewall penetrations, and electrical connections within and on the tank
- Electrical and control panel start up and verification of equipment installation
- Tank fill followed by THM sampling to ensure performance

5.2.7 Acid Feed System

The intent of this recommended project is to provide a method of feeding acid into the process train upstream of clarifier which will reduce the CT value required for disinfection by lowering the pH and improving the clarifier and filter performance by reducing polymer dosing. A lower CT value would in turn mitigate the potential for DBP formation by reducing the amount of sodium hypochlorite needed meet required system residual level. To lower the pH of the water treated at the plant, acid will be injected utilizing the existing rapid mixer on the inlet to the clarifiers. Acetic acid (CH_3COOH), hydrochloric acid (HCl), and sulfuric acid (H_2SO_4) are all commonly used to reduce pH, ultimate selection will depend on the availability by local suppliers. Initial jar tests were performed at the facility to investigate the feasibility of a plant scale test.

The results of the jar test showed that the pH was effectively lowered with reasonable application of HCl for each major process unit. Another set of jar tests were performed to evaluate the effectiveness of polymer coagulation/flocculation with reduced pH. The results showed that a reasonable amount of HCl could be used to effectively lower the pH throughout each process unit, and that sufficient coagulation and flocculation occurred with lower polymer dosages at HCl. It should be noted however that the jar tests act only as a requisite to confirm the feasibility and design criteria for a plant scale test, not for preliminary design of a permanent system. The effectiveness of an acid feed system and initial design criteria would be determined by conducting a full-scale plant test with the approval of the Department of Public Health. **Table 5.8** below presents a summary of the project.

2024 Project Update

Recently Staff has indicated that many of the materials and equipment for piloting this project have been acquired and that they intend to conduct the pilot in-house with coordination with the SWRCB DDW.

Table 5.8

Project Name	Acid Injector Improvement Project
Purpose	Reduce pH throughout the facility to reduce CT values, mitigate potential DBP formation, enhance clarifier performance, and realize savings in operational costs
Project Details	This project will add an acid injector to the existing flash mixer as well as associated piping and chemical storage facilities.
Estimate Cost	$46,000
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	3 months

Regardless of the acid selected and other pending design criteria the system would, at a minimum will include installing a bulk storage tank on the chemical pad and a 55-gal day tank within the chemical room equipped with a metering pump. Existing conduits from the chemical feed room to the flash mixer will be utilized to pull plastic tubing which will connect the acid storage container to the flash mixer. The acid feed system would be automated by control with a pH probe to account for pH fluctuations throughout the day. An image showing the location of the proposed injection point and chemical storage location is

presented in **Figures 5.11** and **Figures 5.12** respectively**.** A detail showing the equipment and staging necessary for a plant scale test is presented in **Figure 5.13.**

Sequence of work (general)

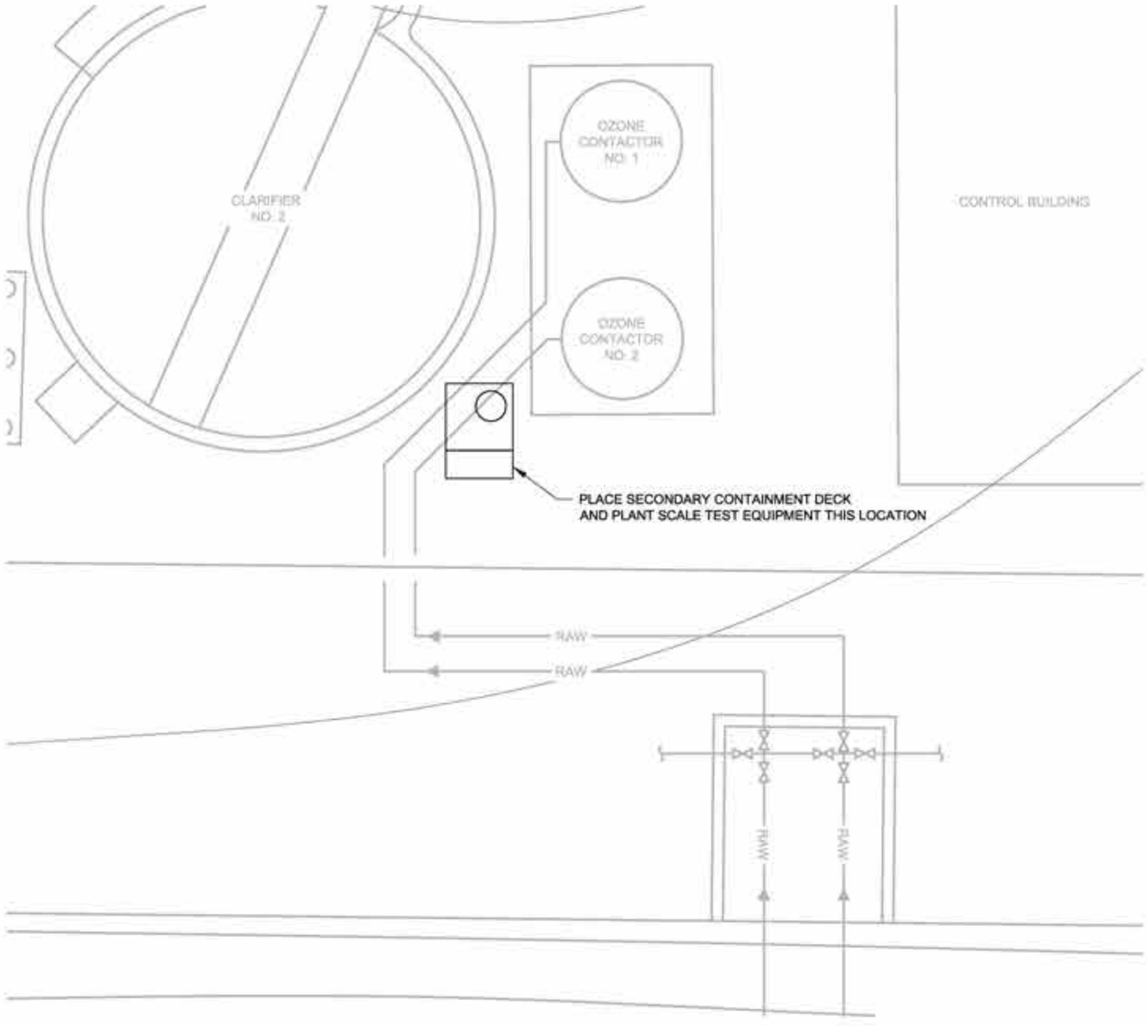
- Coordinate closely with WTP staff prior to and during construction
- Install 5,000-gallon Acid Storage Tank
- Install Injection Pump and pull plastic tubing through existing conduits
- Install Injection Port and connect Pump and Tank
- SCADA Integration and system test

***Figure 5.11**, Existing injection points and feed tubes at Flash Mixer*



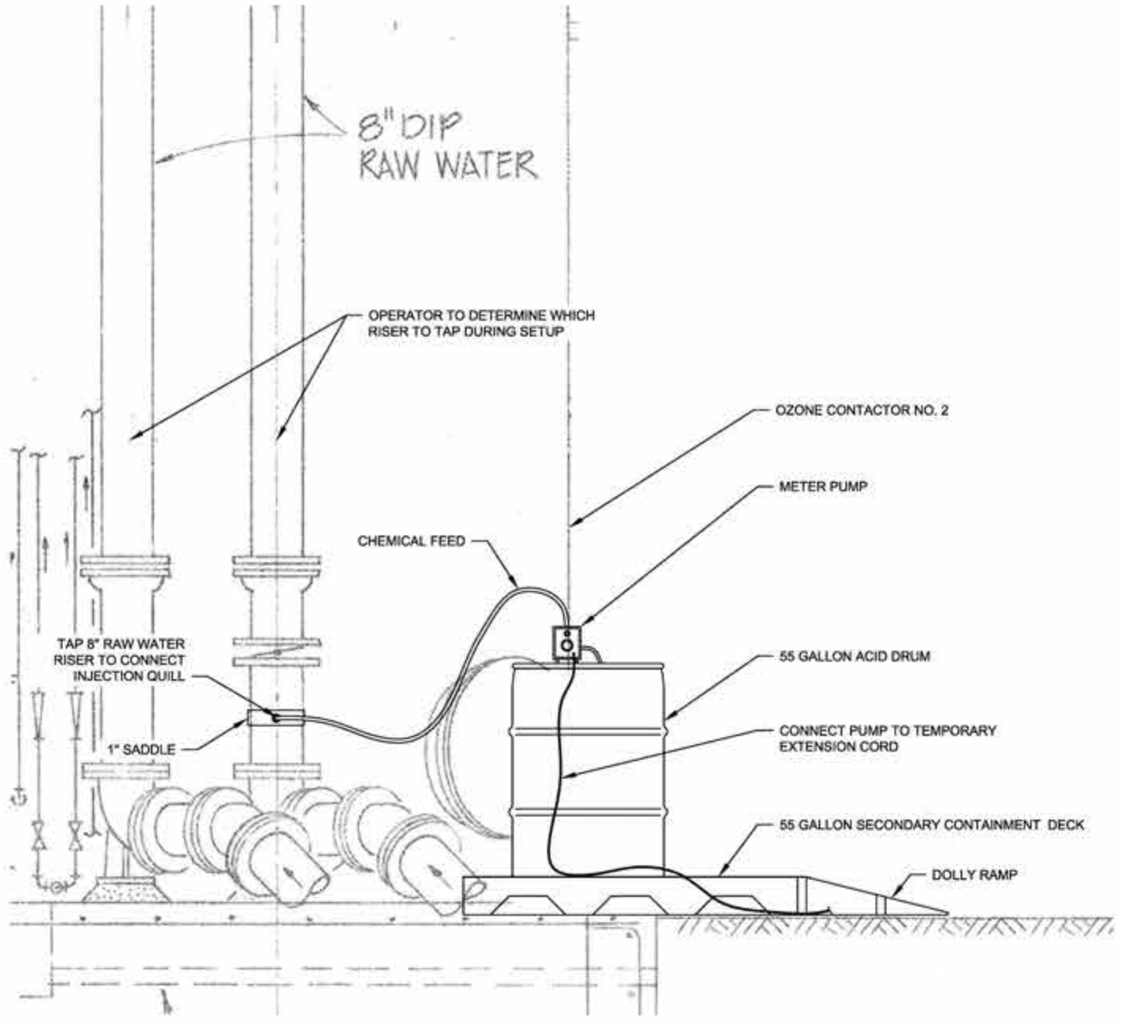
***Figure 5.12**, Bulk Chemical Storage Pad*





STAGING PLAN

SCALE: 1" = 10'



CHEMICAL FEED DETAIL

SCALE: 1" = 2'-0"

LEGEND

GATE VALVE

RAW WATER — RAW

1"=10' — 0 — 10' — 20'

N

NOTES

CONTACTOR OVER FLOW PIPING, SPLITTER BOX, AND CLARIFIER CONNECTIONS NOT SHOWN FOR CLARITY. SEE FIGURE #.##

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FIGURE 5.13

PLANT SCALE ACID FEED TEST

5.2.8 Facility Corrosion Protection (Project Completed)

These recommended projects are intended to rehabilitate the welded steel clarifier tank's corrosion protection systems. Improvements consists of new washouts, new coatings, and installation of cathodic protect systems. **Tables 5.9** and **5.10** are below present project summaries.

2024 Project Update

This high priority project was completed in 2023 as part of the USDA Rural Development funded water system improvement project.

Table 5.9

Project Name	Clarifiers 1 and 2 Corrosion Protection
Purpose	Extend the service life of the existing clarifiers and protect water quality.
Project Details	This project will include renovation of the interior and exterior of the clarifiers and the installation of a cathodic protection system. After draining, the clarifiers should be inspected to assess the extent of internal corrosion.
Estimate Cost	$169,300
Scheduled Start Date	(Funding by future grants or loans)
Time to Completion from Start Date	10 days

Table 5.10

Project Name	Clearwell Corrosion Protection
Purpose	Extend the service life of the existing clearwell and protect water quality.
Project Details	This project will include renovation of the interior of the clearwell and the installation of a cathodic protection system.
Estimate Cost	$128,500
Scheduled Start Date	(Funding by future grants or loans)
Construction Time	10 days

Exterior Renovation Sequence of Work

- Coordinate closely with WTP staff prior to and during construction
- Exterior pressure wash
- Rusted areas tool cleaned per SSPC standards
- Cleaned areas spot primed with high quality primer
- Full exterior coating with intermediate primer
- Full exterior coating with finish coat
- Film thickness and wet-sponge testing prior to being placed in operation

Interior Renovation Sequence of Work

- Remove all dust and blast products by high-pressure air, vacuum cleaning or brushing and apply the first coat of paint before any surface develops
- Using epoxy, thinned 10%, stripe paint all weld/lap seams and pitted areas with roller or brush
- Apply one full coat of epoxy at a DFT of 4 to 6 Mils to complete interior of the tank, riser pipe, and all other interior surfaces
- Apply a second full coat of epoxy at a DFT of 5 to 7 Mils to the complete interior of the tank, riser pipe, and all other interior surfaces
- Allow surfaces to cure with adequate ventilation
- Film thickness and wet-sponge testing prior to being placed in operation
- Disinfect the interior using the spray method, verify quality of work, and seal tank for service

Cathodic Protection Sequence of Work

- Mounting of test station, and anodes
- Installation of conduit and wire followed by Startup and testing in accordance with NACE criteria

5.2.9 Dissolved Air Floatation Pretreatment

This project has been identified as a long-term high priority need, to address high algae concentrations associated with the surface water supply. As previously discussed, the plant capacity is currently limited by the upflow clarifiers which become overloaded due to the algae blooms in the summers which is also the same time when max day or near max day demands occur. As outlined within Section 4, a rapid ballasted clarifier pretreatment technology was previously piloted at the WTP. The pilot unit proved to be capable of reducing the raw water turbidity but at the same time the unit also posed operational challenges as the water quality of the Lake varied. Furthermore, the reduction in turbidity by the rapid ballasted clarifier did not prove, with the desired level of certainty, to be a competitive alternative relative to the performance of a DAF pretreatment unit. This project will also include contacting other publicly owned water treatment plants that have or are receiving raw surface water from Clearlake and that have installed and operating DAF system(s) to remove algae from the lake. Consideration will be given to related "Suspended Air Flotation" or SAF systems as identified by DDW staff as an alternative.

Table 5.10.1

Project Name	DAF Pretreatment
Purpose	Maximize the plant capacity by reducing the high turbidity associated with algae blooms during the summer by use of DAF pretreatment.
Project Details	This project will consist of two phases: a small-scale pilot plant phase to verify effectiveness of the technology followed by installation of a 1 MGD unit.
Pilot Plant Estimate Cost **1 MGD Unit Installation**	**$200,000** **$2,300,000**
Scheduled Start Date	(Funding by future grants or loans)
Pilot Plant Duration 1 MGD Unit Construction Time	4 months 6 months

5.3 Distribution System Improvement Projects

5.3.1 Pipeline Replacement and Improvement

2024 Project Update

It is recommended that the District replace approximately 14.5 miles of deficient, leaking, and undersized water mains. Replacement of failing mains is considered one of the most critical elements of future capital funding with anticipated reductions in water loss impacting all other system components. These high priority pipelines have been recommended for replacement and have been identified within past engineering documents as mentioned within this report. The various pipeline replacement projects include the construction/installation of 6-inch, 8-inch, 10-inch, and 12-inch mains to be constructed with C900 PVC-DR 14 pipe, air relief valves, hydrant, and possibly PRV's. The mainline project will also include the construction of either single or double ¾-inch or 1-inch house services, respectively. These services will be installed during the main construction and include a service saddle, polyethylene pipe, valves and meter box.

A typical trench depth will accomodate a minimum of 36-inches of cover, and is subject to site conditions including and limited to; existing dry and wet utilities, culverts, ditches, and other sub-surface native materials with theexisting mains to be abandoned in place. All new mains are to be constructed within the existing Lake County R/W and CLOCWD easements. Future phases will include acquiring necessary County and Caltrans Encroachment Permits.. USA locations of underground infrastructure in proximity to the pipelines will be provided both during design and prior to construction.

Table 5.11 below presents a summary of the recommended pipeline projects. An important consideration that needs to be stressed is that these priority water mains pose health and safety issues and risks relating to potential drinking water contamination. Since 2017 there have been over 88 "Boil Water Notices" issued to the customers of the District, resulting in a lack in customer confidence. During the summer months the leaking mains have also put stress on the ability of the water system to maintain adequate treated water storage throughout the water system. It is important to note that other system appurtenances, such water storage tanks and booster pump stations, or the lack thereof, have created similar issues with water availability and dependability that is exacerbated by the leaking pipes.

All project components and appurtenances will be designed and constructed per industry and standards, including standards already being utilized by the CLOCWD. A map showing proposed pipeline replacements for immediate, 5-year, and 10-year phases is presented in **Figure 5.14** on the following page.

Several of the high priority pipelines (previously identified in the original WMP) were replaced in 2022 as part of the USDA Rural Development grant and loan funded water system improvements project. These improvements included the installation of 3738 linear feet of new 2, 6, and 8-inch mains on Harvey Boulevard, Mitchell Road, Terry Drive, and Spring Road which included the installation of service lines, meters, hydrants, ARVs, and blowoffs. These water line replacement projects resulted in a noticeable decrease in water loses in that specific system zone, thus confirming the direct correlation between pipeline replacements and reduction in water losses.

Recent review of the leak repair history has prompted the need to re-evaluate the pipeline replacement prioritization throughout the CLOCWD system. As described in Section 3, it is now apparent that a substantial amount of water loss is occurring in the General DMA zone which includes the Keys where a majority of service line and main break repairs have been made. It is important to note that DMA Zones along with the installation of DMA meters were established as a part of the completed USDA Rural Development grant and loan program. Previous leak detection surveys also indicated that main line leaks are likely occurring at the end of many pipelines within the multiple cul-de-sacs within the Keys. It is likely that these leaks are a result of saturated soil yielding under the high pressure on existing thrust block restraints allowing movement between AC fittings. The lower elevation of the Keys area also results in the highest pressure and thus saddle failures due to corroded hardware under high pressure was also reported as a common failure. The DMA analysis also indicated that water loss is excessive in the Pluth Zone. Pipeline replacements in the Pluth Zone will require additional targeting and analysis in subsequent phases through leak detection, zone isolation, draw down tests, and other means.

A revised version of **Figure 5.14** is presented as **Figure 5.14.1** on the following page which presents an updated pipeline replacement priority map. Phase 1 projects focused on the replacement of the small diameter brittle galvanized iron pipes encountering high levels of corrosion that are primarily found within the Keys and within pressure zone 1. As noted by "Boil Water Notices" and leak repair records these older pipelines have been prone to failure as previously identified in the original WMP. This includes the west side of 1st Street through 6th Street, Schindler Street, Island Drive, Garden Court and Center Way. Not only does the Phase 1 project to include replacement of old and deteriorated iron pipes it also recommends the replacement of small diameter AC pipes which continue to fail under the high pressure of the Keys area. These failing AC pipelines include Island Drive, Shoreview Drive, Island Circle, Blue Heron Court, Oak Knoll Avenue, Island Drive, Short Street, and Highway 20. These pipelines were identified as high priority since replacement would improve water quality by eliminating the likelihood of leaks within these areas and reducing water boil notices and related drinking water contamination(s) . Adding to the priority ranking is the adverse impact the related leaks have on staff's ability to maintain maximum day capacity at the WTP, especially during peak summer month usage periods. An updated summary and cost estimate for Phase 1 improvements is presented in **Table 5.11** with quantities presented in **Table 5.12**. It is important to note that these pipeline replacement projects have been analyzed for environmental impacts through the completion of both the NEPA and CEAQ processes, including Notices of Determinations.

Table 5.11 Immediate (Phase I) Pipeline Replacement Project 2024 Update

Project Name	Immediate Pipeline Improvement and Replacement Project
Purpose	To eliminate hydraulic bottlenecks, inefficiencies, and leaking pipelines located within the District
Project Details	
Estimate Cost	**$9,605,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	8 months

The recommended **immediate** mainline replacements as shown in **Table 5.12** will consist of:

Table 5.12 Phase 1 Pipeline Replacement Mainline Installation Quantities

Mainline Replacement		House Services	PRV Replacement	Hydrant Replacement	Air Relief Valve Replacement
Mainline Rep (LF)	Rep Size (inch)	Single	PRVs (1.5-6-inch)	Hydrants	ARVs
17,387	6,8,10,12	338	none	39	none

Phase 2 Projects encompass the continued replacement of AC mains in the Keys area, following the same objectives as Phase 1. Additionally, Phase 2 includes the installation of interconnection pipelines to enhance water quality by reducing the number of dead-end mains and creating additional loops within the system. Specific improvements include:

- Connecting Spring Drive and Henderson Drive through the installation of a pipeline on Put Drive, which also replaces a section of the small-diameter galvanized iron pipeline in that area.
- Installing a pipeline on Lakeview Drive to interconnect and partially replace the pipeline between Hillside Lane and Konocti Drive.
- Adding piping on Mesa Drive to reconnect two dead-end lines created by recent roadway and pipeline failure due to a landslide.

Other pipeline upgrades in Phase 2 involve replacing aging and undersized AC pipelines on Sulphur Bank Road which serve the Elem community and the wastewater treatment plant (WWTP).

It should be noted that the proposed Phase 2 improvements are likely to be subject to revision as the on-going investigative efforts continue to identify the location and sources of water loss, particularly in the Pluth zone. For example, current water loss analysis indicates that the Pluth DMA zone features a particularly high amount of water loss. If it is discovered that a majority of the leaks are located on the hillside near Morine Ranch Road, Tomalee Lane, and McBride Court, for example, then these pipelines would likely be promoted from Phase 3 to Phase 2 while the AC line on Sulphur Bank Road would be demoted from Phase 2 to Phase 3. A summary and cost estimate for Phase 2 improvements is presented in **Table 5.11.1** with quantities presented in **Table 5.12.1**.

Table 5.11.1 Phase 2 Pipeline Replacement Projects

Project Name	Immediate Pipeline Improvement and Replacement Project
Purpose	To eliminate hydraulic bottlenecks, inefficiencies, and leaking pipelines located in the District and to allow for water to be effectively delivered in the event of a fire.
Project Details	
Estimate Cost	**$8,941,000**

Scheduled Start Date	**2030 (5-year)**
Construction Time	8 months

The recommended **immediate** mainline replacements as shown in **Table 5.12** will consist of:

Table 5.12.1 Phase 2 Pipeline Replacement Mainline Installation Quantities

Mainline Replacement		House Services	PRV Replacement	Hydrant Replacement	Air Relief Valve Replacement
Mainline Rep (LF)	Rep Size (inch)	Single	PRVs (1.5-6-inch)	Hydrant	ARVs
20,386	6,8	268	none	30	none

Sequence of Work (general)

- USA locations, permits, and field staking.
- Signage
- Standard dust and noise controls.
- Removal of some trees.
- Permits (Caltrans, Lake County, SWRCB SWPPP and OSHA)
- Excavation, shoring, and installation of mains and services
- Backfill (*typical*-sand, Class II AB base, slurry, AC)
- Pressure testing and disinfection
- Paving (temp. and permanent)
- Final walk-through and NOC

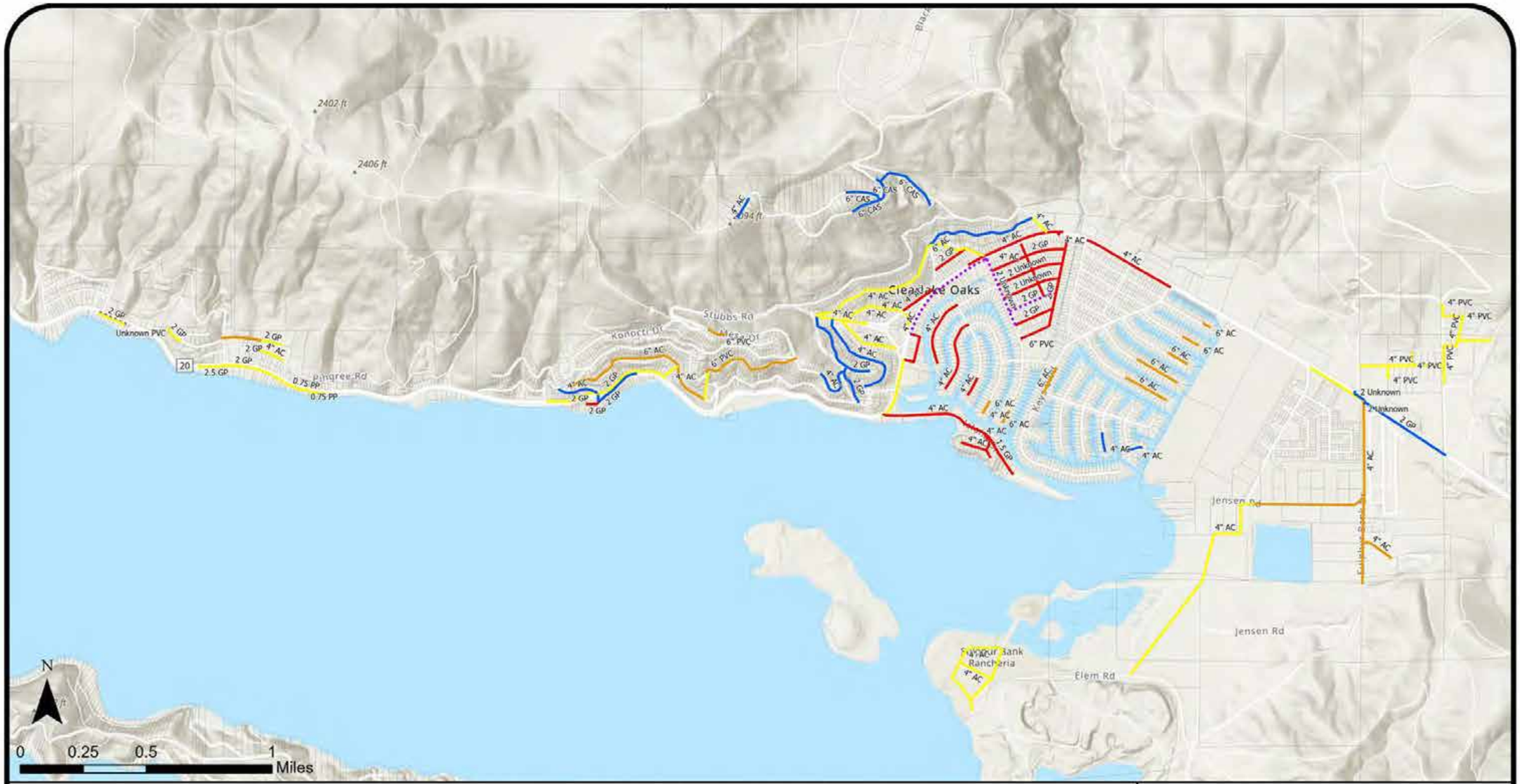


Figure 5.14 Water Distribution Pipe Replacement Phases

Parcels
Abandon in Place
Phase I
Phase II
Phase III
Phase IV

Note: Existing pipe size are depicted. The proposed lines will be replaced with 6",8", & 12" PVC, reference Table 4.5 - 4.7 for further details.

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5.3.1.1 Paradise Tank Pipeline Rehabilitation

This project has been separated from the pipeline prioritizations previously outlined since the purpose of this pipeline project is specifically to enhance water quality within the Paradise Cove area. The project consists of hydraulicly separating the west side of the Paradise Cove community from the east side such that all flows entering the west side are downstream of the THM removal equipment within the Paradise tank. This improvement will significantly enhance water quality and ensure compliance with DDW requirements for TTHM concentrations. TTHM concentrations have been periodically spiking and are considered a very high priority. In the absence of proposed future mitigation and related projects it can only be concluded that the TTHM issue will persist and get worse over time as the WTP struggles to keep up with system demands in the future.

Table 5.12.1

Project Name	Paradise Tank Pipeline Rehabilitation
Purpose	Reduce TTHM concentrations within the Paradise Cove service area.
Project Details	Rehabilitate existing 6-inch mainline between the Paradise Valley Boulevard and the Paradise Tank and modify piping connections.
Estimate Cost	**$60,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	2 months

5.3.2 Small Meter Replacement (Project Complete)

As discussed in **Section 4.2.2**, this project will include replacing all meters over 10 years old to reduce NRW and recover lost revenue due to meter inaccuracy while accommodating new registers and meter reading technology that will help facilitate tracking and management of Real Losses. **Table 5.13** below presents a summary of the project.

2024 Project Update
This project was completed in 2023 as part of the USDA Rural Development funded water system improvement project.

Table 5.13

Project Name	Small Meter Replacement Project
Purpose	To eliminate apparent losses due to inaccurate small meters while accommodating new registers and reading technology.
Project Details	All small meters (1" or smaller) that are 10 years old or older will be replaced with new Badger disc meters.
Estimate Cost	**See AMI Project (approx. $83,980)**
Scheduled Start Date	**2018/2019**
Construction Time	5 months

The total number of meters identified for replacement is 701. Note that as part of the Meter Removal and Testing project, 55 of the 701 meters identified for this project were tested and replaced. Therefore, the number of meters remaining for replacement is 646.

Sequence of Work (general)

- Field survey of meters and analysis of District's billing system to identify and prevent potential issues with referencing meter serial numbers and register numbers.
- Removal of old meters and installation of new meters. Installation crew routing will be optimized using GIS data of meter locations.
- New meter serial number linking with database
- Testing of old meters to verify projected inaccuracy

5.3.3 400 Sulphur Springs Road Meter Testing (Project Complete)

This project will provide accurate data on the meter at 400 Sulphur Springs Road, the largest water consumer served by the District. This location is a mobile home park. Based on testing results, the meter may be repaired in-place or replaced in order to begin accurately metering water flows to this location. **Table 5.14** below presents a summary of the project.

2024 Project Update

This project was completed in 2023 as part of the USDA Rural Development grant and loan funded water system improvement project.

Table 5.14

Project Name	Large Meter Testing Project
Purpose	To eliminate apparent losses due to the large 6" compound meter at 400 Sulphur Spring Road.
Project Details	The valve on the customer side of this meter will be repaired, allowing an accurate test of 6" compound meter to take place. Test results will determine if the meter is replaced, repaired, or left as-is.
Estimate Cost	$750,000
Scheduled Start Date	2017 (Immediate upon approval of grant funding)
Construction Time	1 month

Sequence of Work (general)

- Customer Side Valve repair
- Testing of 6" Compound Meter
- Replacement or repair as required

5.3.4 Backflow Prevention (Project Complete)

2024 Project Update

This project was completed in 2023 as part of the USDA Rural Development grant and loan funded water system improvement project. It should be noted that the State is requiring CLOCWD to re-evaluate the need for additional backflow devices throughout the system. The need for some additional backflow devices will likely be identified as discussed further below.

The proposed backflow program will involve installing a new B09 box and related backflow devices on select residential and commercial properties. A typical installation detail is presented on the following page in **Figure 5.15**. It is proposed that the District contract out the installation of the backflow devices concurrent with the proposed meter replacement program. Regular testing would ideally be performed by the property owner. However, given the demographics and high number of vacation homes it is recommended that the District perform the testing service annually and bill customers accordingly as an added surcharge to select accounts. **Table 5.15** below presents a summary of the project.

Table 5.15

Project Name	Backflow Prevention Project
Purpose	To protect public health and safety and minimize the likelihood of untreated water from entering the District distribution system.
Project Details	This project will involve the installation of approximately 771 backflow preventers at predetermined at-risk locations
Estimate Cost	$545,097
Scheduled Start Date	2017 (Immediate upon approval of grant funding)
Construction Time	6 months

The District should implement a public outreach program prior to implementing this project. This should include a combination of mailers, door hangers, and public meetings. The program should include identifying other possible high-risk accounts prior to implementation. These may include commercial accounts or select high-risk residential accounts in upper pressure zones. A map of existing backflow prevention devices along with parcels requiring a backflow device is presented in **Figure 5.16.**

Sequence of Work (general)

- Verify extent of backflow program through more detailed investigations
- Implement public outreach program and conduct public meetings as required
- Incorporate backflow device installation into the meter installation contract if feasible to reduce costs
- Install or require customer to install backflow prevention devices concurrent with new meter installations
- Perform annual testing and reporting with all costs to be borne by the customer
- Modifications and or additions to Ordinance(s)

5.3.4.1 Phase 2 Backflow Prevention

The Phase 2 Backflow Prevention Project would consist of installing additional backflow prevention devices to satisfy the requirements of the State mandated cross-connection hazard assessment as outlined within the cross-connection control policy handbook. Currently the number of additional backflow prevention devices is unknown and a quantity of 100 installations has been assumed for planning purposes.

Table 5.15.1

Project Name	Phase 2 Backflow Prevention Project
Purpose	Install additional backflow prevention devices as determined by the cross-connection hazard assessment. Number of installations to be determined, recommend budgeting up to 100 installations for planning purposes.
Project Details	Work includes development of a Cross Connection Control Plan (CCCP) as well as a cross-connection hazard assessment. This plan will revise the District's cross-connection ordinances and identify the location and quantity of additional backflow devices to be installed.
CCCP Development Estimate: Installation Cost Estimate:	$40,000 $95,000 (Installation of 100 backflow prevention devices)
Proposed Funding:	TBD
Scheduled Start Date:	2030
Construction Time:	8 months

Legend

- Backflow Prevention Device Required (771)
- Existing Backflow Prevention Location (119)

N

0 0.25 0.5 1 Miles

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Client/Project

FIGURE 5.16 RESIDENTIAL AN DCOMMERCIAL BACKFLOW PREVENTION DEVICES

Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: C:\Projects\CLOCWD\Water Master Plan\GIS\Maps\Backflow_Lakefront_Locations_20140712_rev02.mxd

5.3.5 AMI Improvement (Project Complete)

The installation of a new fixed base meter reading system will allow for a meter data management program that will streamline the billing and meter reading process and allow for more thorough accounting of water use in the District. With the annexation of CSA-16 additional collectors would be required to collect signals from all installed endpoints in the Paradise Cove service area. Approximately 2,000 new endpoints will need to be installed District-wide. **Table 5.16** below provides a summary of the project. This project was completed as a result of USDA Rural Development grant and loan funding.

Note this improvement was completed using an AMR system in 2022.

Table 5.16

Project Name	AMI Improvement Project
Purpose	To provide a method of remotely collecting meter reads for all meters in the District in real time.
Project Details	An AMI system consisting of approximately 2,000 endpoints and required towers will be installed.
Estimate Cost	$743,640
Scheduled Start Date	2017 (Immediate upon approval of grant funding)
Construction Time	6 months

Sequence of Work (general)

- Prepare RFP for AMI system
- Project Bid Advertisement
- Refine Propagation Studies (by proposed vendor/s)
- Project Award
- Collector installation
- Meter Box Retrofits
- Meter and Endpoint Installation
- Database reconciled and billing software updated
- Added software for tracking water losses developed and commissioned

5.3.5.1 Meter Data Consolidation & Water Loss Management System

Three new meters are recommended as described in more detail in previous sections. The project is summarized in Table 5.16.1 below:

Table 5.16.1

Project Name	AMI Improvement Project
Purpose	To allow all DMA source meters to send data to the Badger meter database and simplify the DMA analysis.
Project Details	Installation of three new magnetic flow meters are proposed, one at the WTP in the pump building, one to replace the meter at the Shady Lane booster station, and a third to replace the meter in the Harvey PRV vault.
Estimate Cost	**$50,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	3 months

5.3.5.2 Pressure Management Project

This project consists of installing 6 PRVs to reduce water loss in the Keys by reducing the system pressure by approximately 50%. It is estimated that by reducing the pressure by 50% the water loss may be reduced by approximately 30%. It should be noted that reducing the pressure to 55 psi would ultimately be completed in a phased approach by which the pressure would first be lowered to 75 psi until the existing service line PRVs are removed, or adjusted, at which point the pressure would be reduced to 55 psi. A map showing the proposed locations of the PRVs is presented in **Figure 3.10.1.**

Table 5.16.2

Project Name	Pressure Management Project
Purpose	To reduce water loss and associated “Boil Water Notices “within the low elevation high pressure areas of the distribution system by installing PRVs.
Project Details	A total installation of 6 PRV stations. Four dedicated to the Keys and two dedicated to Orchard Shores.
Estimate Cost	**$480,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	3 months

5.4 Water Storage and Pump Station System Improvement Projects (Partially Completed)

5.4.0 Booster Pump Station Control System (Applicable to Shady Lane, High Valley, and Cerrito Booster Pump Stations)

Each pump station will have a PLC enclosure which will be used to monitor instruments and control valves and pumps. The PLC will interface with the Ignition SCADA system via radio telemetry. Each pump station will also have a separate VFD drive panel or motor starter panel, depending on the site.

Local Pump Control

The VFD drive or motor starter enclosure will be designed with a main disconnect and motor circuit breakers. These switches can also be used for maintenance for lockout tag out functions. A digital indicator will show tank level and flow meter values on the PLC enclosure door. On-Off-Auto selector switches, run indicator lamps, and runtime meters for pumps will also be located on the enclosure door.

Control Panel Components

The main components mounted to the control panel will include the main circuit breaker, PLC controller, radio telemetry equipment, surge suppressor, uninterruptable power source (UPS), control power circuit breakers, control relays and terminals.

Field Instruments

A pressure transmitter will be used to determine the tank level; this device will measure the hydrostatic pressure from the bottom of the tank to determine the water level and produce a continuous 4-20mA analog signal output relative to a fixed level range. The operator will be able to monitor the live value of the tank level locally and also on the Ignition SCADA system. Each pump station will also have an electromagnetic flow meter to measure the rate of flow through metering and the flow totals will ultimately be used to determine pump performance.

SCADA Tank Level Control

The SCADA system will display the tank level in units of feet and will also allow the operator to configure the control point levels for the pumps to operate, in methods dependent by the site functions described in the “Booster Pump and Tank Site TM”. If pumps are in Auto and in SCADA control, the lead will automatically alternate between the two or three pumps. In the event of pump failure indication, the next pump in sequence will be commanded to start.

Pump Station Flow and Flow Totalization

The SCADA system will display the real-time flow rates in GPM. Daily cumulative and total cumulative gallons will also be displayed on the SCADA system.

Pump Station Alarms: In the event of a pump station alarm, the alarm will be displayed in the SCADA system and an alert call will be made out to the Duty phone and to the others on the alert list according to the SCADA system call out hierarchy.

5.4.1 Shady Lane Pump Station

This recommended project involves the installation of a new booster pump station to facilitate water supply for diurnal flows and to improve fire flow capacities in Zone 3. **Table 5.17** below provides a summary of the project.

2024 Project Update

The pump house at Shady Lane will consist of CMU construction and feature (2) 25 HP multi-stage vertical in-line pumps. The building footprint will measure approximately 16' X 13' and also house two VFD panels, a general PLC panel, power panel, lighting panel, a magnetic flow meter, discharge piping, and fittings. Other site improvements will consist of bypass piping around the tank, site paving, site drainage, upgraded PG&E service, and a retaining wall to hold back debris from the eroding hillside. This booster station is a vital component of the District's water system and allows for moving potable water to other zones and associated storage facilities, especially during the peak summer month water use periods when the WTP staff is dealing with higher than normal backwash rates due to higher algae concentrations. The limitations in treatment capacity coupled with numerous water leaks creates serious health and safety related drinking water issues.

Table 5.17

Project Name	Shady Lane Pump Station Improvement Project
Purpose	To ensure reliable water service and pressures, especially the peak summer usage periods and fire flow capacity to Zone 3 by installing new pumps, control valve, and backup power.
Project Details	This project involves the replacement of outdated and aging booster pumps and associated piping, pump house, and electrical. Two new 20 HP with a VFD will be installed along with a diaphragm type valve, and new transfer switch and plug to accommodate emergency backup power.
Estimate Cost	**$650,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	6 months

Pump Station and Operation

As discussed in **Section 4.3.1**, it is recommended that a minimum of two pumps be installed at the Shady Lane booster pump station such that the combined capacity of the pumps is capable of pumping at a rate of approximately 500 gpm. Under normal conditions (i.e. no fire flows being provided from Shady Lane pump station), pumps would alternate in a lead/lag first-on/first-off manner. The speed of each pump will be controlled via a VFD to avoid hard stops and starts in order to minimize surge pressures while also allowing operators to adjust set points to meet desired fill rates for the tanks.

The pump station would also include a diaphragm type valve on the discharge manifold that would open to relieve high surge pressures back to the tank/suction side of the pump intake. This valve will include an actuator that will allow it to open and feed water back from the upper zone into Zone 1 based on either low tank level or an operator-initiated call to open.

If there is a fire in Zone 3, an estimated demand of approximately 1,000 gpm would be met by a combination of storage in the Konocti tank and up to 500 gpm from the two pumps at the Shady Lane pump station. Level control set points for the Konocti tank controlling the Shady Lane pumps would presumably be unchanged. It is estimated that two 20 HP pumps would be required in the future to meet fire flow demands. A transfer switch to allow for emergency backup power from a portable generator connection will also be installed as part of this project. Also, as part of identifying and controlling the District-wide water losses, it is recommended that a flow meter is included with the aforementioned improvements. Flow metering of all water pumped to Konocti would designate Zone 3 as a District Metered Area. The ability to quantify all water conveyed to Zone 3 is considered critical for identifying real water losses as well as accounting for suspected water theft. An image of the existing tank site is presented below in **Figure 5.17**.

***Figure 5.17**, Shady Lane Pump House (Steel Tank in Background and Footing for Previously Removed Tank in Foreground)*

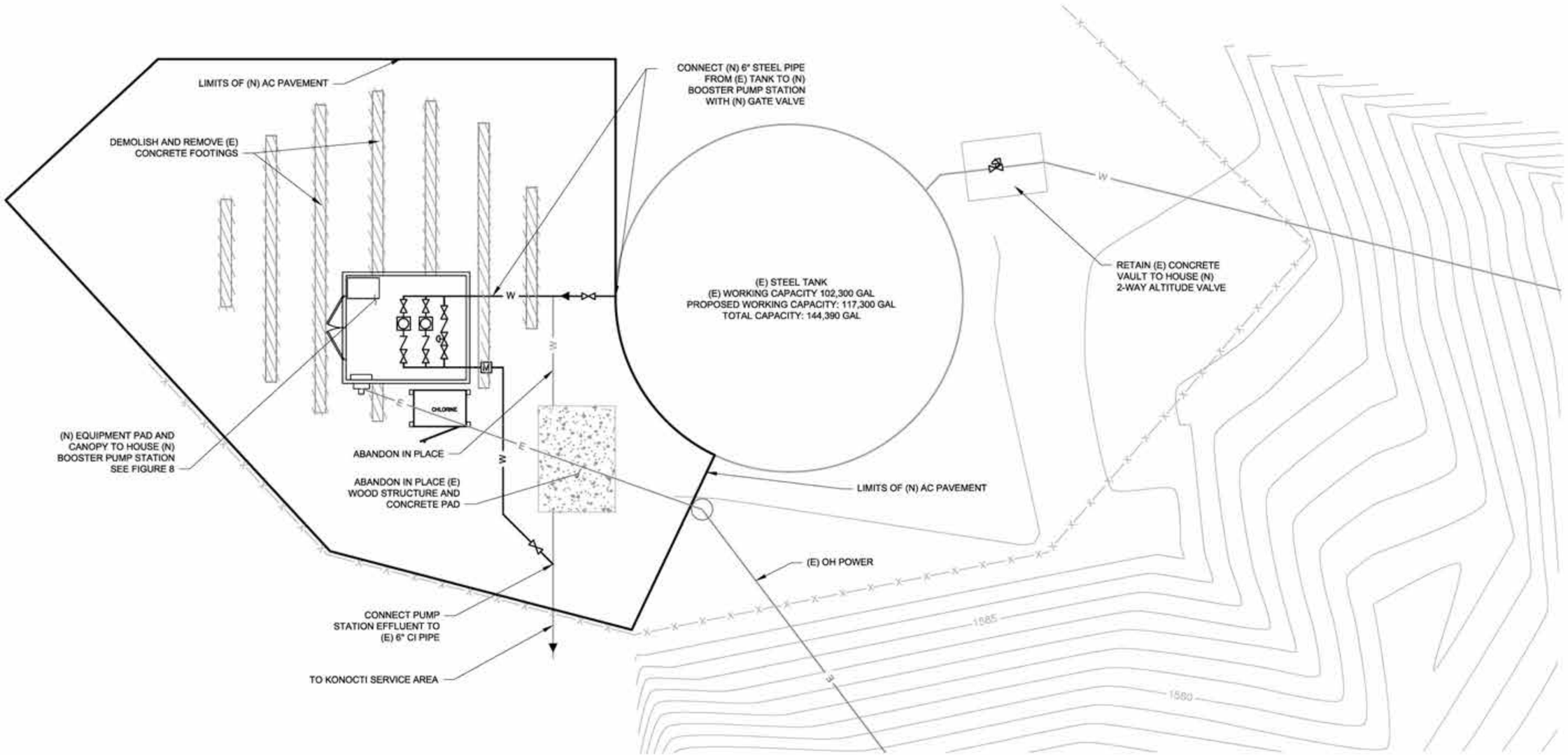


Proposed site improvements to accommodate the new Shady Lane booster pump station are presented below **Figure 5.18**. The proposed booster station planned for the Shady Lane site is presented in **Figure 5.19**.

Sequence of Work (general)

- Trench and install 6” pipeline from tank to new pump station location
- Trench and install 6” pipeline from new pump station location to distribution main

- Pour foundation for prefab pump station
- Install prefab pump station
- Integrate existing telemetry and PLC controls
- Install electrical and control improvements/Tie-in to tank and distribution pipelines
- Test pump station and startup



SITE PLAN

SCALE: 1" = 10'

GATE VALVE	⋈	CHECK VALVE	⋈
MAGNETIC FLOW METER	Ⓜ	SURGE RELIEF VALVE	
ALTITUDE VALVE		(E) FENCE	—X—X—X—
TURBINE PUMP			

0 10' 20'

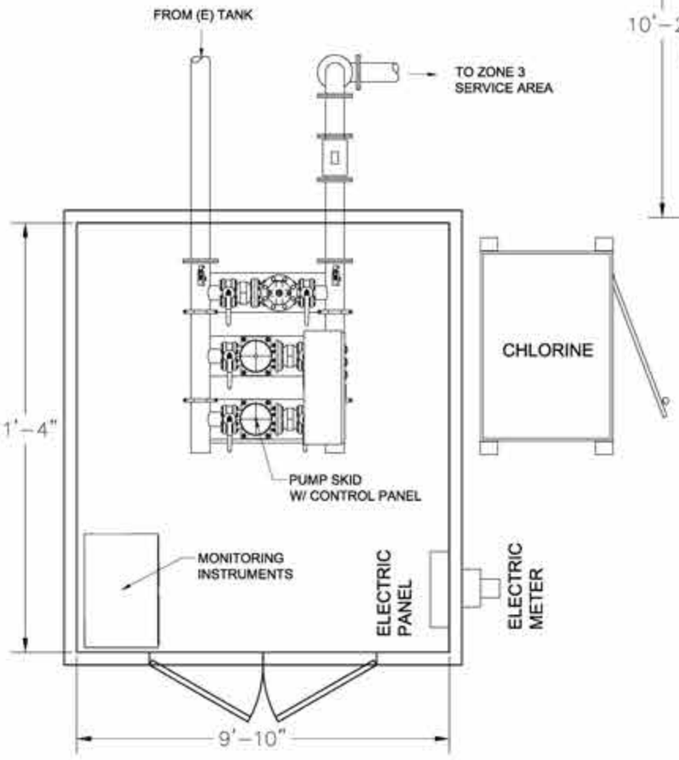
1"=10'

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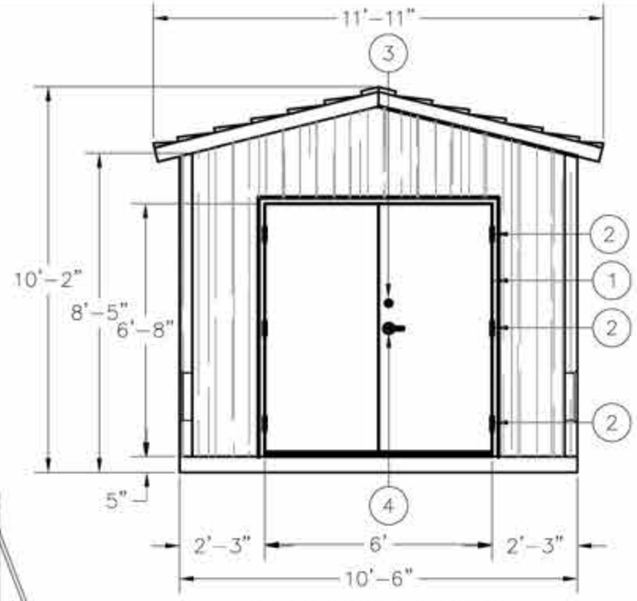
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FIGURE 5.18

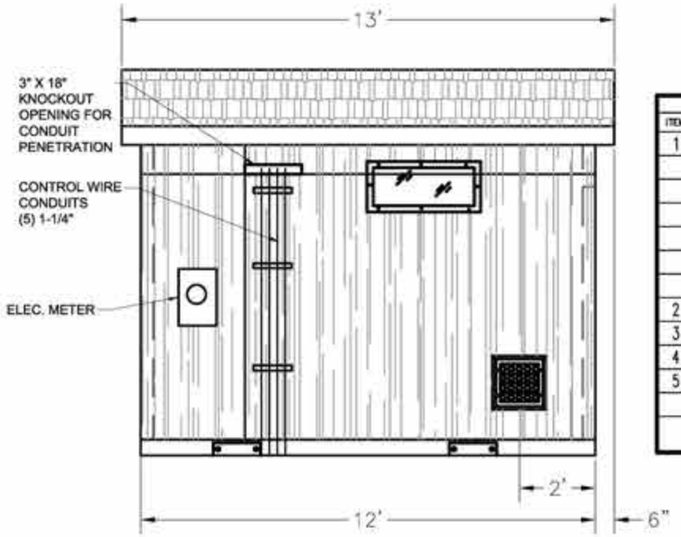
SHADY LANE TANK SITE
IMPROVEMENT PLAN



FLOOR PLAN



FRONT ELEVATION



RH SIDE ELEVATION

		BILL OF MATERIALS
ITEM	QTY	DESCRIPTION
1	1	6068 RH ACTIVE DOOR ASSEMBLY
		PREP FOR DEAD BOLT
		OPENS OUT
		AUTOMATIC DOOR BTM
		6" THRESHOLD
		FLUSH MOUNT BOLT
		ASTRAGAL
2	6	SPRING HINGE 4.5 x 4.5
3	1	SCHALAGE DEAD BOLT LOCK
4	1	CLASS ROOM LEVER
5	5	FLAT BAR 1/2" x 5HR x 4'-2"
		APPROXIMATE WEIGHT

INTERIOR WALL SECTION

REAR ELEVATION

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FIGURE 5.19

SHADY LANE BOOSTER PUMP STATION

5.4.2 High Valley Tank and Pump Station

This recommended project involves the installation of a new booster pump station to facilitate water supply for diurnal flows and to improve fire flow capacities in Zone 2 and a welded steel water storage tank to increase water storage for Zone 1. An image of the existing pump station is presented below in **Figure 5.20. Table 5.18** below provides a summary of the project.

2024 Project Update

The pump house will consist of CMU construction and feature (3) 50 HP multi-stage vertical in-line pumps. The building footprint will measure approximately 34' X 12' and also house three VFD panels, a general PLC panel, power panel, transformer and lighting panel, magnetic flow meter, discharge piping, and fittings. Other site improvements will consist of bypass piping around the tank, pump bypass valving, site paving, site drainage, upgraded PG&E service to 480V, and a retaining wall to hold back debris from the eroding hillside.

Updated Table 5.18

Project Name	High Valley Tank and Pump Station Improvement Project
Purpose	To ensure reliable water service during peak summer months water usage and improve fire flow capacity to Zone 2 by installing new pumps and backup power. To ensure reliable water storage for Zone 1. These improvements will also assist in offsetting the system peak hour capacity issues and impacts due to excessive water leaks and WTP algae and turbidity issues.
Project Details	This project involves the replacement of an outdated and aging booster pump and associated piping and electrical. Three new 50 HP pumps with VFDs will be installed along with a transfer switch and plug for emergency backup power. A new 130,000-gallon welded steel tank will be installed along with associated plumbing and electrical.
Estimate Cost	**$2,090,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	**10 months**

Water Storage Tank

This improvement at the High Valley Tank site will add water storage for meeting fire flows and maximum day water demands. Site grading, piping, and electrical improvements are included as part of this project. The welded steel tank option was chosen over the bolted steel tank as the welded steel tank will save cost in the long run, despite the higher installation cost.

Pump Station and Operation

To provide approximately 1,000 gpm criteria for the hydrants between the Cerrito tank and the High Valley booster, there will need to be additional booster capacity from the High Valley pump station to supplement gravity flows from the Cerrito tank. As such, the existing pump is not adequately sized, and three pumps are recommended to meet these criteria. A triplex booster station is proposed with three 50 horsepower pumps, each able to achieve a minimum flow rate of 167 gpm when operating in parallel. The existing pump station will need to remain in service until the startup of the new triplex booster station.

For typical demands, operation would alternate among the three pumps in a first-on/first-off manner. Due to the very high pressures, the integrity and pressure rating of the existing 6" line between the High Valley site and Cerrito site should be verified prior to increasing the capacity of this pump station. In addition to pressure testing, it is recommended that the district pothole a variety of locations in the lower reaches of the inter-connecting pipes to verify the pressure class and condition of the discharge piping. It was reported that the line leaving the tank is ductile iron pipe in the lower (higher pressure) reaches. Given the relatively high pressures, expected to be in the range of 250 psi, it may be prudent to maintain the existing pump capacity (100 gpm at 244 psi) until such time that the line is either inspected and pressure tested at the proposed operating conditions or replaced where deficient. In the interim, the proposed triplex pump station would operate no more than one pump at a time, alternating in use at a rate of approximately 100 gpm.

The triplex pump station will be equipped with VFD control to allow soft start-stop controls to limit surges and accommodate operator adjustable flow set points as needed to control filling times and water quality in the tank. The pump station would also include a diaphragm type control valve on the discharge manifold that would open to relieve high surge pressures back to the tank/suction side of the pump intake. This valve will include an actuator that will allow it to open and feed water back from the upper zone based on either low tank level or an operator initiated call to open. A transfer switch to allow for emergency backup power from a portable generator connection will also be installed as part of this project. See the Booster Pump Station Control System narrative in **Section 5.16** for more details.

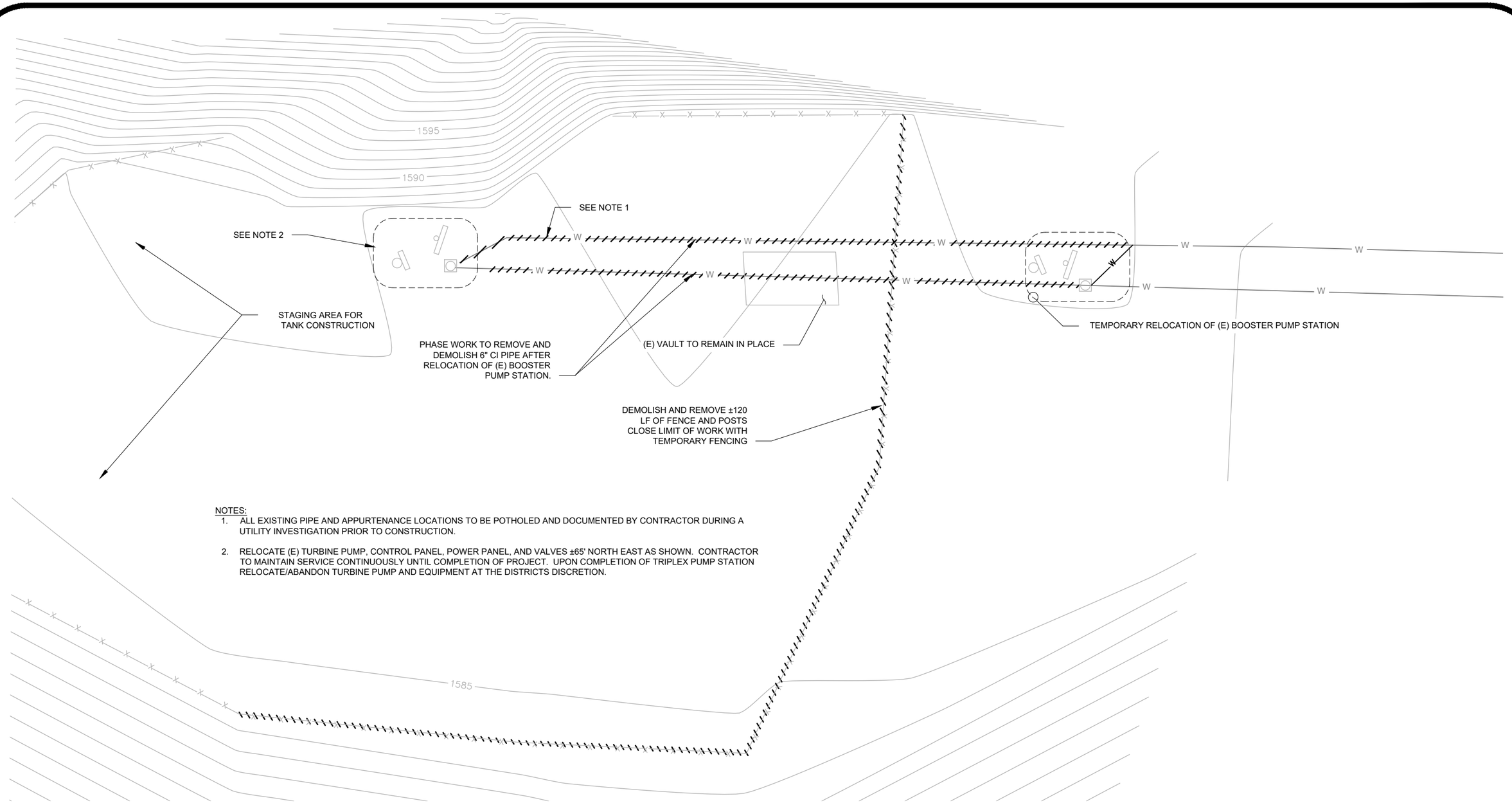
A staging and demolition plan is presented in **Figure 5.8** for the High Valley tank site. The proposed improvement plan for the High Valley site is presented in DEMO **Figure 5.20. Figure 5.21** through **Figure 5.23** presents the proposed triplex pump station for the High Valley site.

***Figure 5.20**, High Valley Booster Pump*



Sequence of Work (general)

- Site grading for Steel Tank
- Improved PG&E services (as required based on detailed design requirements)
- Pour tank foundation
- Install Steel Tank and site piping upgrades
- Pour foundation for prefab pump station
- Install prefab pump station and building
- Relocate existing PLC and telemetry in new building
- Install electrical and control improvements/Tie-in to tank and distribution pipelines
- Test pump station and startup
- SCADA programming at WTP
- Site Paving and Fencing
- Demolition/relocation of existing piping and appurtenances



NOTES:

1. ALL EXISTING PIPE AND APPURTENANCE LOCATIONS TO BE POTHOLED AND DOCUMENTED BY CONTRACTOR DURING A UTILITY INVESTIGATION PRIOR TO CONSTRUCTION.
2. RELOCATE (E) TURBINE PUMP, CONTROL PANEL, POWER PANEL, AND VALVES ±65' NORTH EAST AS SHOWN. CONTRACTOR TO MAINTAIN SERVICE CONTINUOUSLY UNTIL COMPLETION OF PROJECT. UPON COMPLETION OF TRIPLEX PUMP STATION RELOCATE/ABANDON TURBINE PUMP AND EQUIPMENT AT THE DISTRICTS DISCRETION.

DEMOLISH

(E) CONTROL PANEL

(E) VERTICAL TURBINE

(E) POWER PANEL

N

0 40' 80'

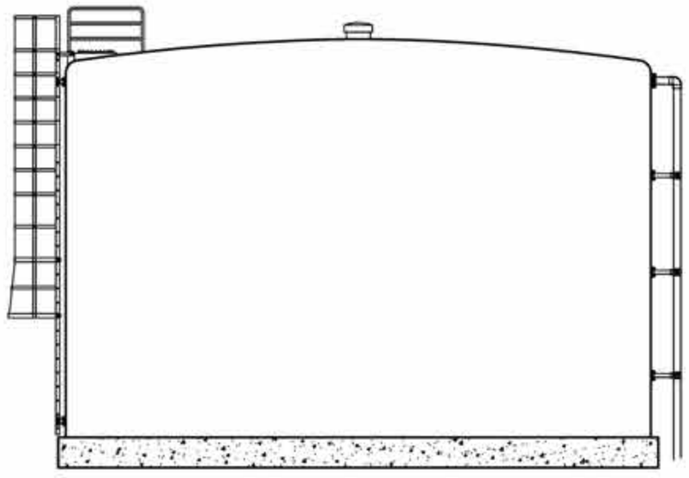
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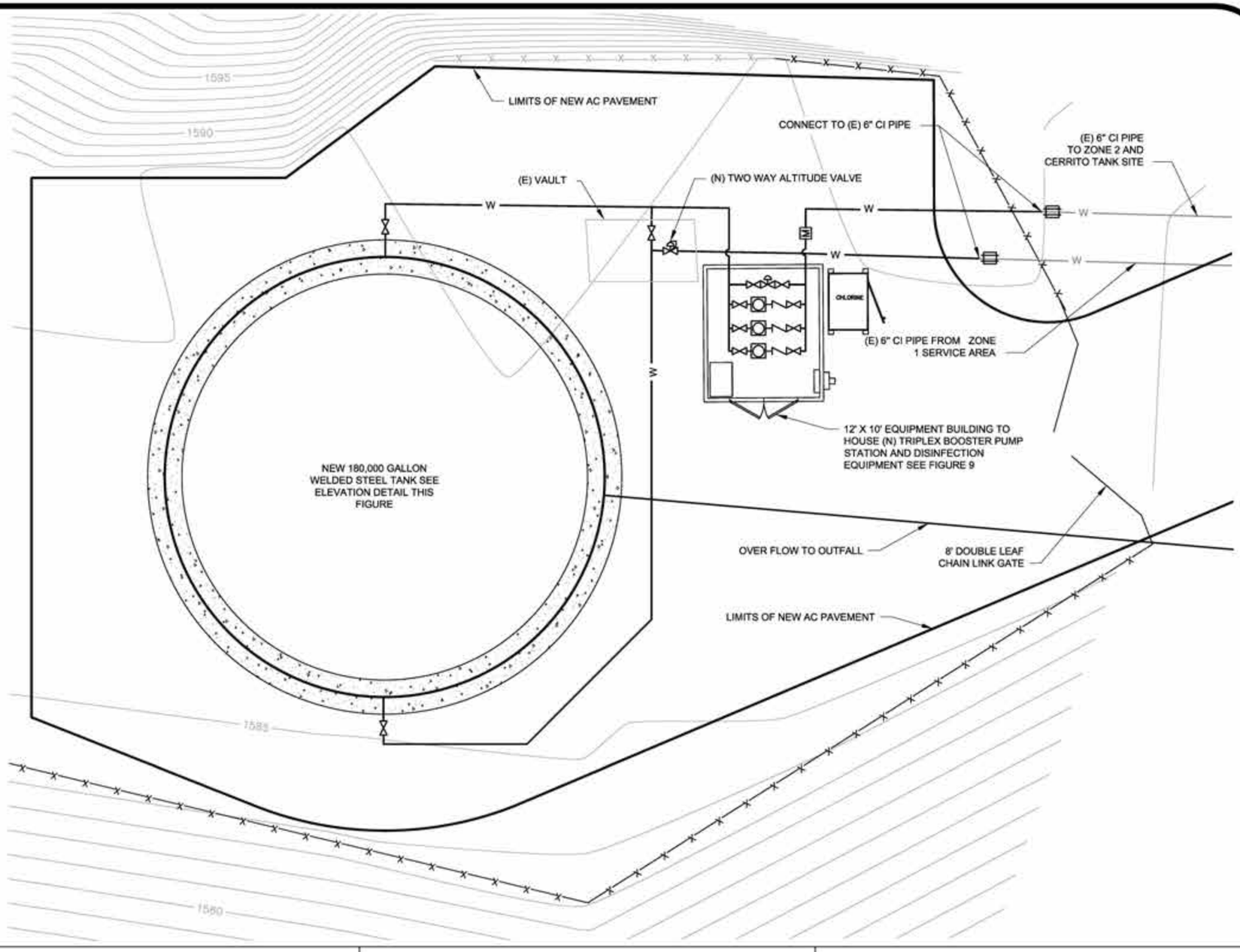
FIGURE 5.21

HIGH VALLEY SITE STAGING AND DEMOLITION PLAN



WELDED STEEL TANK ELEVATION

SCALE: NTS



GATE VALVE
MAGNETIC FLOW METER
ALTITUDE VALVE
TURBINE PUMP
FCA
CHECK VALVE
SURGE RELIEF VALVE
(N) FENCE
(E) FENCE

1"=10' 0 10' 20'

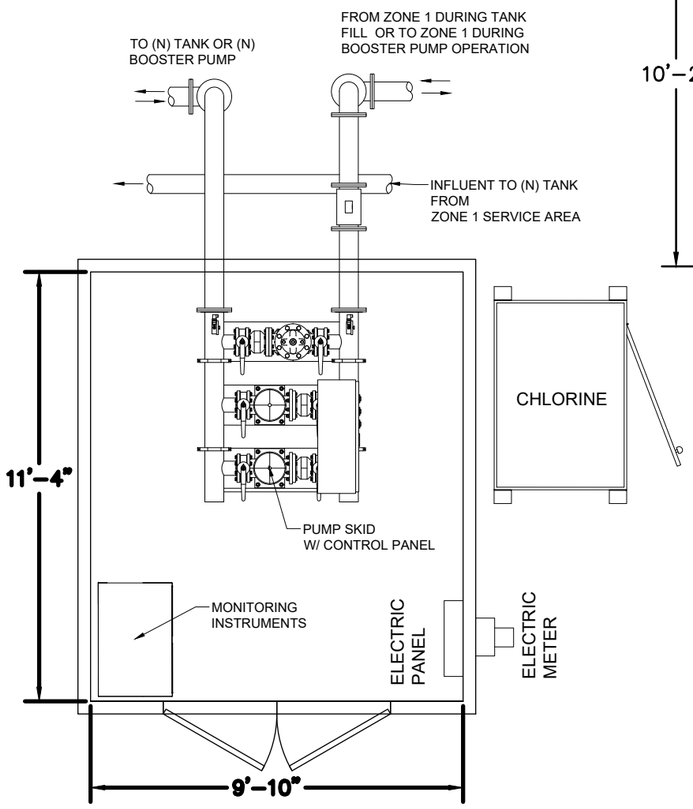
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FIGURE 5.22

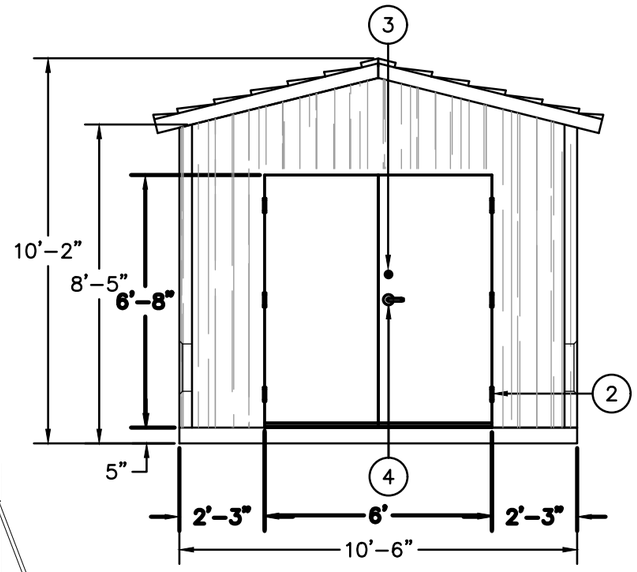
HIGH VALLEY TANK SITE IMPROVEMENT PLAN



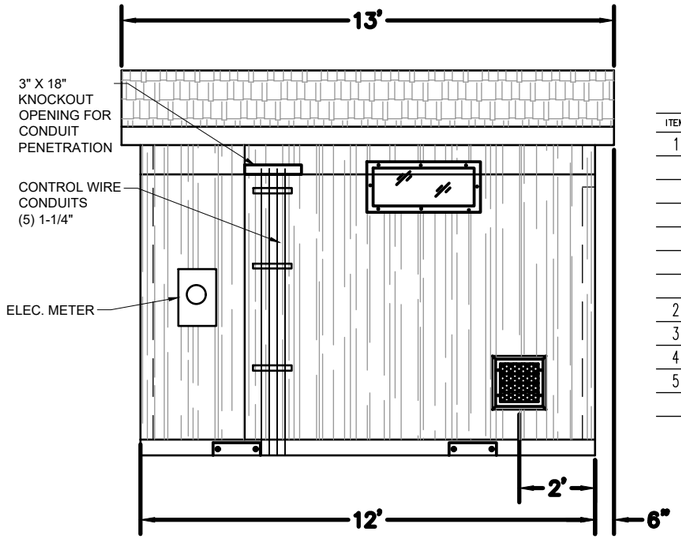
FLOOR PLAN

PUMP STATION PLAN

SCALE: 1/4" = 1'- 0"

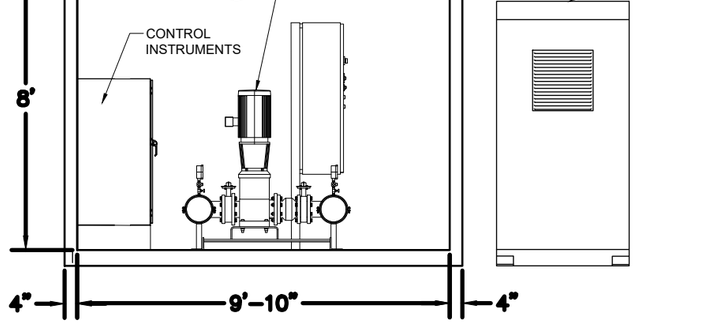


FRONT ELEVATION

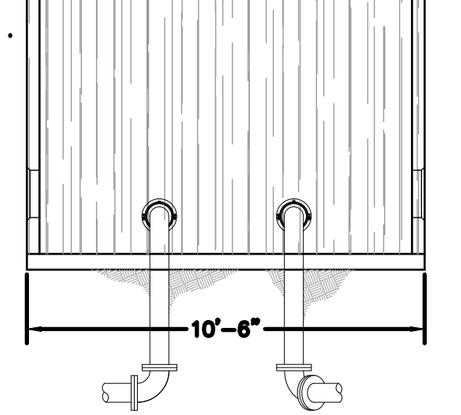


RH SIDE ELEVATION

		BILL OF MATERIALS
ITEM	QTY	DESCRIPTION
1	1	6068 RH ACTIVE DOOR ASSEMBLY
		PREP FOR DEAD BOLT
		OPENS OUT
		AUTOMATIC DOOR BTM
		6' THRESHOLD
		FLUSH MOUNT BOLT
		ASTRAGAL
2	6	SPRING HINGE 4.5 x 4.5
3	1	SCHALAGE DEAD BOLT LOCK
4	1	CLASS ROOM LEVER
5	5	FLAT BAR 1/2" x 5HR x 4'–2"
		APPROXIMATE WEIGHT



INTERIOR WALL SECTION



REAR ELEVATION

KEYNOTES

1. ISOLATION VALVE (TYP.)
2. GLOBE CHECK VALVE (TYP.)
3. 6" MAGNETIC FLOW METER.
4. BOOSTER PUMP CONTROL PANEL.
8. DISINFECTANT STORAGE BUILDING. HOUSES 55 GALLON SODIUM HYDROCHLORIDE SUPPLY WITH METER PUMP AND RESIDUAL ANALYZER.
9. 40 HP VERTICAL TURBINE PUMP. 167 GPM CAPACITY PUMPING AT 563 FEET OF HEAD.
10. SURGE RELIEF VALVE WITH OPERATOR INITIATED BACKFEED CAPABILITY VIA SCADA SYSTEM.
11. PIPE SUPPORT (TYP.)
12. PLC PANEL.
13. RAMP TO STORAGE BUILDING MAX 5% SLOPE. MATCH FINISHED FLOOR ELEVATION.
14. FINISHED GRADE SEE SITE PLAN.

HIGH VALLEY TRIPLEX BOOSTER PUMP STATION
FIGURE 9

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FIGURE 5.23
HIGH VALLEY BOOSTER PUMP STATION

5.4.3 Cerrito Tank and Pump Station (Project Substantially Complete)

This recommended project involves the installation of a new booster pump station to facilitate water supply for diurnal flows and to improve fire flow capacities in Zone 4, and the installation of a new welded steel water tank to increase water storage for Zone 2. An image of the existing tank site is presented in **Figure 5.24** on the following page. **Table 5.19** below provides a summary of the project.

2024 Project Update

This project was partially completed in 2023 as part of the USDA Rural Development funded water system improvement project with the demolition and replacement of the old redwood tank with a new bolted steel tank. The pump house was rehabilitated with two new 20 hp pumps, motor control panel, pneumatic tank instrumentation, magnetic flow meter, and ductile iron piping, fittings, air compressors valves, and new siding on the structure. Since these improvements were completed by change orders, there were limited items within the building that could be rehabilitated. The District recently replaced the service panel, conductors, and conduits on the outside of the building. Pending improvements are listed below in **Table 5.19** of this section.

Table 5.19

Project Name	Cerrito Tank and Pump Station Improvement Project
Purpose	To improve water service and fire flow capacity in Zone 4 by installing new pumps and standby power accommodations. To eliminate the existing deteriorating redwood tank and install a new welded steel tank to increase water storage for Zone 2 and entire system.
Project Details	This project involves the replacement of outdated and aging booster pumps and associated piping and electrical. Three new 15 HP pumps with VFDs will be installed along with a transfer switch and plug for emergency backup power. The existing 100,000-gallon redwood tank will be demolished. A new 100,000-gallon welded steel tank will be installed along with associated piping and electrical.
Estimate Cost	$516,200
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	8 months

Water Storage Tank (Completed)

This proposed project at the Cerrito site will include removing the leaking redwood tank and constructing a water storage tank for improving reliable fire flow capacity and meeting daily water demands. Site grading, piping, and electrical improvements are included as part of this project. The welded steel tank option was chosen over the bolted steel tank as the welded steel tank will save cost in the long run, despite the higher installation cost.

Pump Station Operation and Control (Partially Completed)

To provide fire flow capacity in Zone 4 from the Cerrito booster and hydro tank, it is recommended that a new pump station and hydro-pneumatic tank be installed with a capacity that maximizes the velocity in the existing 6" line feeding the nearest hydrant prior to the change in diameter to 4". Under the proposed

scenario, three pumps each with a capacity of 233 gpm and 15 HP would be used to supply approximately 700 gpm of fire flow, assuming approximately 8 fps maximum velocity in the 6" line at TDH of approximately 50 psi. A prepackaged triplex booster station is proposed. These pumps would supply water to a new hydro-pneumatic tank for Zone 4. VFDs for pump control would not be necessary because the pumps would be controlled by level sensors within the hydro-pneumatic tank. A transfer switch and plug to allow for connecting emergency backup power from a portable generator will also be installed as part of this project. See the Booster Pump Station Control System narrative in **Section 5.16** for more details.

Sequence of Work (general)

- Install Temporary Water Storage Tank
- Demo Redwood Tank
- Site grading for Steel Tank
- Pour tank foundation
- Install Steel Tank and site piping upgrades
- Apply tank coatings
- Pour foundation for prefab pump station and new hydro tank
- Install prefab pump station and building
- Install hydro-pneumatic tank
- Install electrical and control improvements/Tie-in to tank and distribution pipelines
- Site paving and fencing
- Test pump station and startup

***Figure 5.24**, Cerrito Redwood Tank and Pump House*

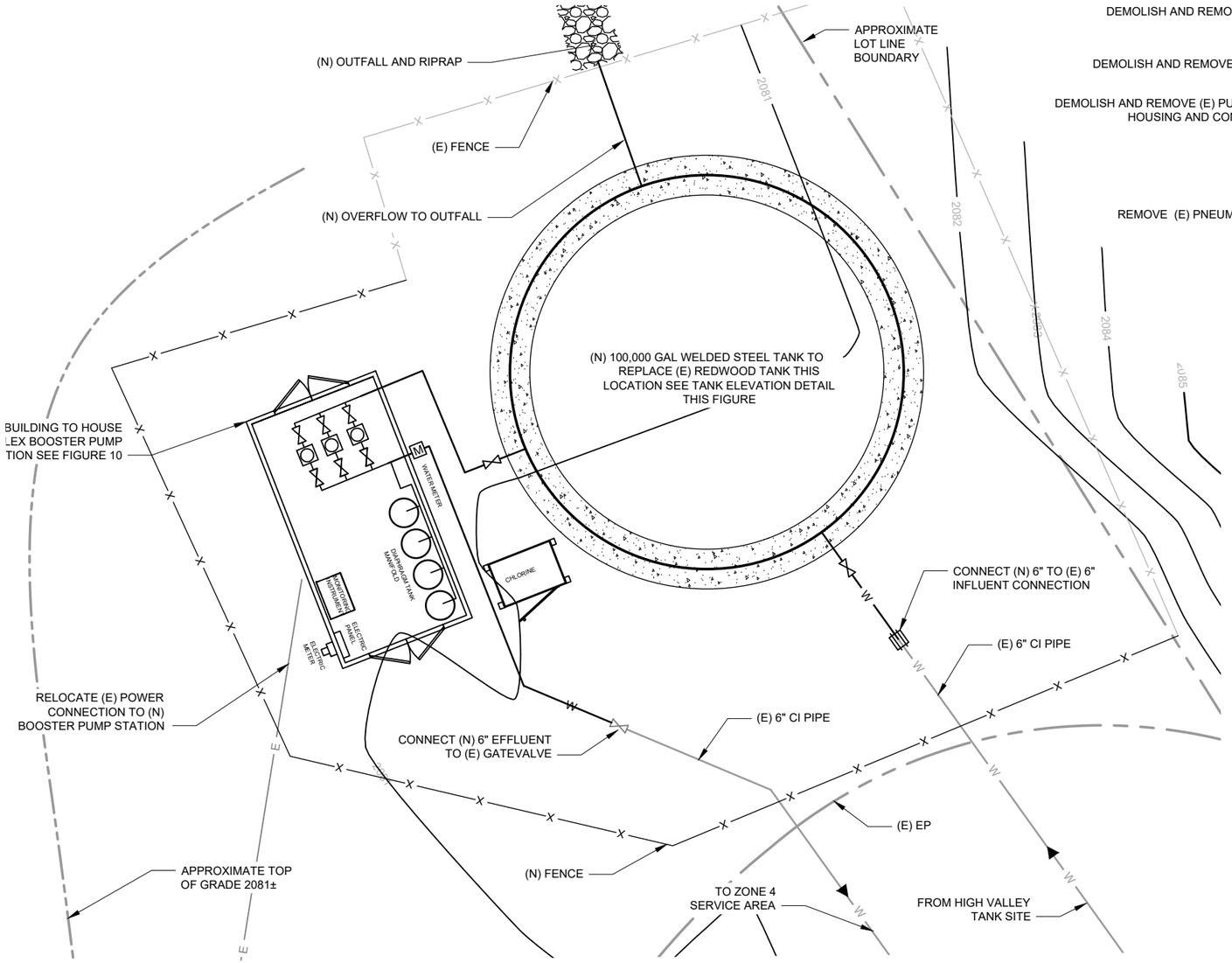


A site improvement plan for the new Cerrito tank is presented on the following page in **Figure 5.25** followed by a detail of the proposed booster pump station in **Figure 5.26**.

2024 Additional Project Improvements

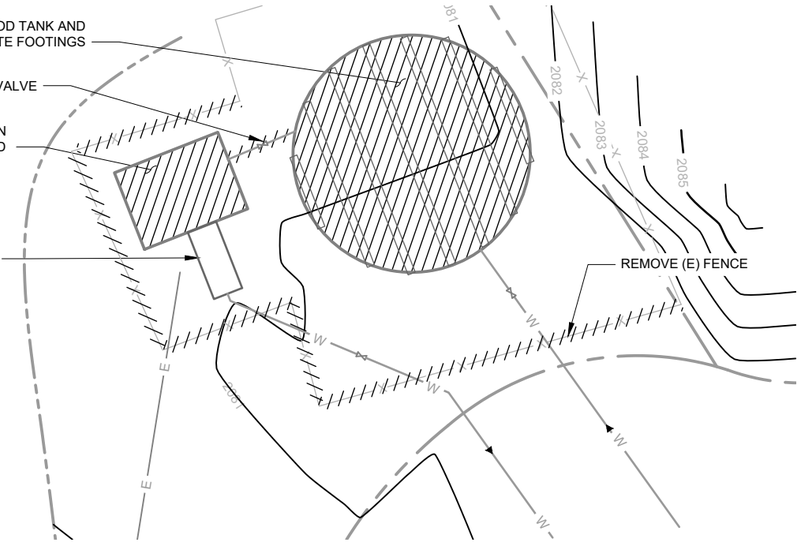
Table 5.19.1

Project Name	Cerrito Tank and Pump Station Improvement Project
Purpose	To improve water quality and the overall integrity of the existing pump station.
Project Details	• Upgrade PG&E Service to 200 amps • Coating of piping inside pump house and suction piping outside of pipe house • Installation of non-slam check valve on pneumatic tank discharge piping • Building paint, insulation, and mini-split installation.
Estimate Cost	**$100,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	**2 months**



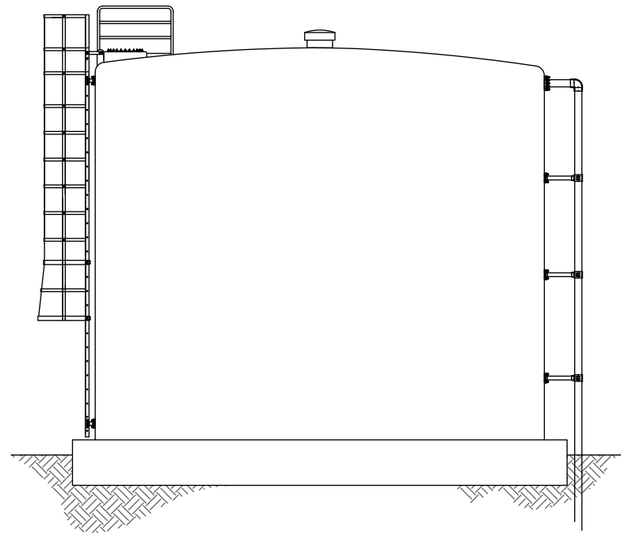
SITE IMPROVEMENT PLAN

SCALE: 1" = 10'



SITE DEMOLITION PLAN

SCALE: 1" = 20'



WELDED STEEL TANK ELEVATION

SCALE: 1" = 10'

(E) FENCE
(N) FENCE
DEMOLISH
CHECK VALVE
MAGNETIC FLOW METER
TURBINE PUMP
GATE VALVE
FCA
CHECK VALVE

N

1"=10' 0 10' 20'

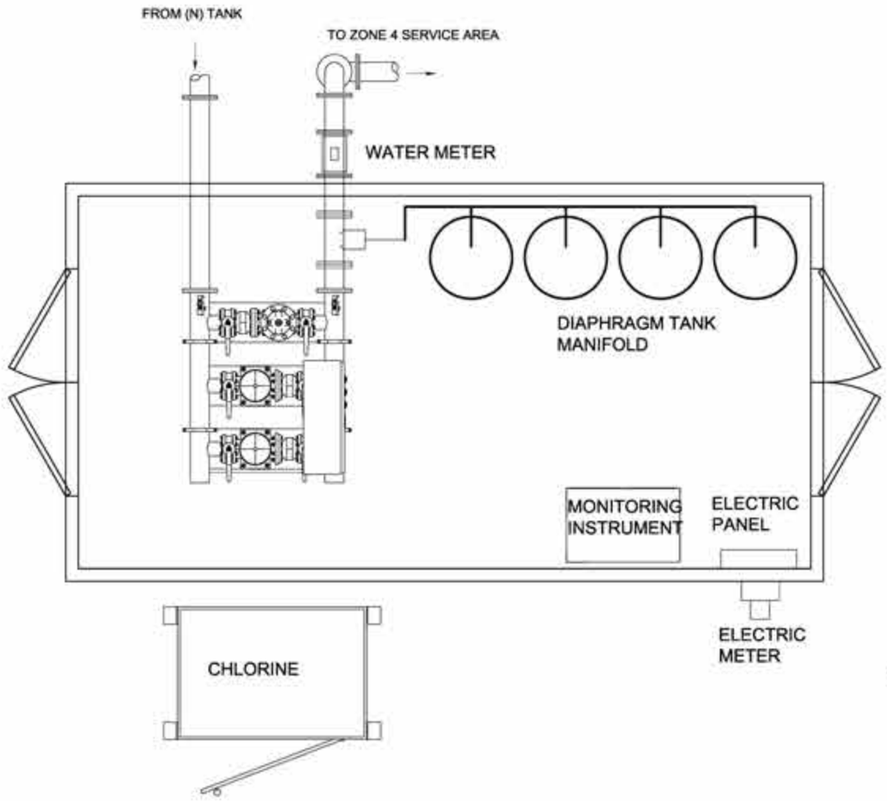
1"=20' 0 20' 40'

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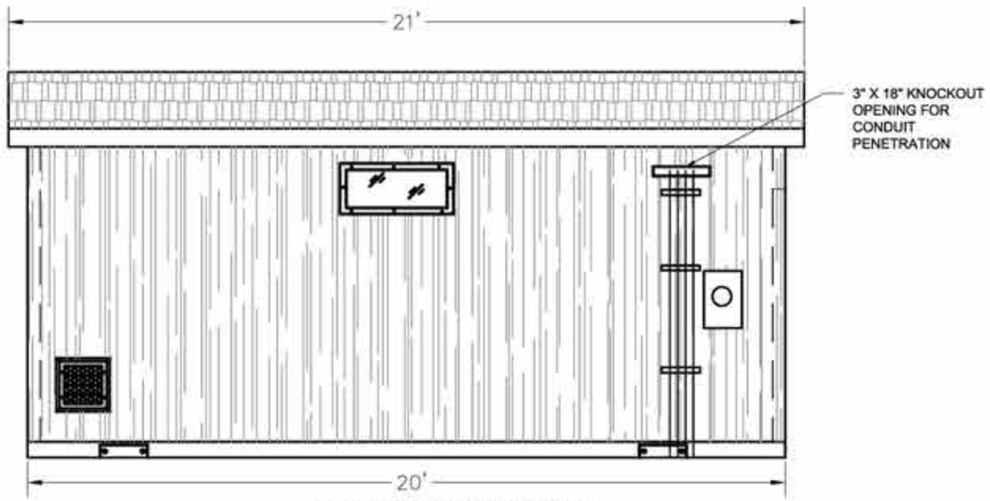
FIGURE 5.25

CERRITO TANK SITE IMPROVEMENT PLAN

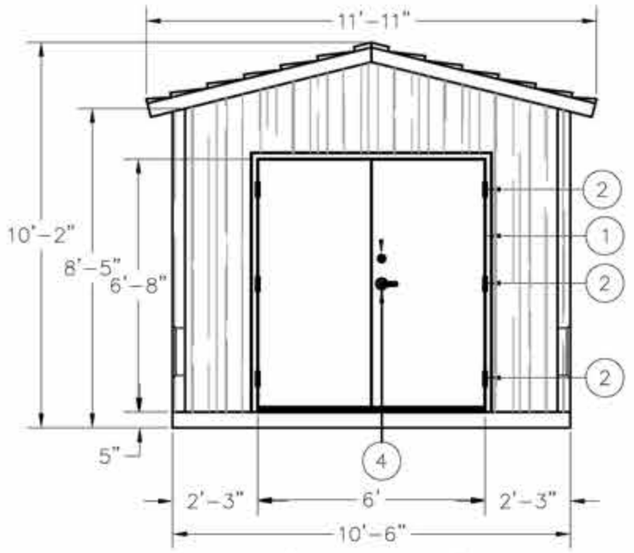


PUMP STATION PLAN

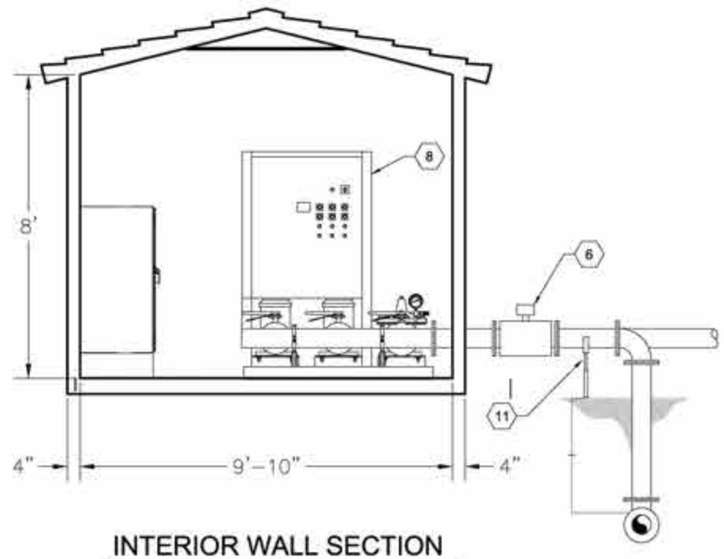
SCALE: 3/16" = 1'- 0"



LH SIDE ELEVATION



FRONT ELEVATION



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FIGURE 5.26

CERRITO BOOSTER PUMP STATION

5.4.4 Harvey Blvd. Tank, PRV, and Pump Station (Project Complete)

This project involves the installation of a new booster pump station to facilitate water supply for diurnal flows and to improve fire flow capacities in Zone 1, and the installation of a new welded steel water tank to increase water storage for Zone 1 and provide storage capacity for CSA-16 (Paradise Cove). **Table 5.20** below provides a summary of the project.

2024 Project Updated
This project was partially completed in 2023 as part of the USDA Rural Development funded water system improvement project.

Table 5.20

Project Name	Harvey Blvd. Tank, PRV, and Pump Station Improvement Project
Purpose	To provide system-wide storage for meeting fire flows, improve service during outages in the western portion of the CLOCWD system and provide reliable water storage for CSA-16 (Paradise Cove)
Project Details	A new 220,000-gallon welded steel tank will be installed along with associated plumbing and electrical. A pump station capable of conveying up to 500 gpm to Zone 1 is also included.
Estimate Cost	$859,400 (Tank Site Improvements)
Scheduled Start Date	2017 (Immediate upon approval of grant funding)
Construction Time	6 months

Pressure Reducing Valve
The proposed PRV located at Harvey Blvd shall be controlled by a combination of pressure-controlled solenoid valves in conjunction with a local PLC that is tied to telemetry that communicates via cellular or radio signals from both the Paradise Cove tank and the CLOCWD WTP SCADA system. The Paradise Cove tank shall include a pressure/level monitoring transducer that monitors tank level as the primary control variable for opening and closing the proposed PRV which consists of a diaphragm type valve (i.e. Cla Valve) capable of opening and closing based on PLC outputs as well as upstream pressure and/or downstream pressures.

During a fire flow event, flows from both the existing Paradise Cove tank and the proposed Harvey Blvd tank will be required to meet desired flow rates (expected combined flow range is 1,000 to 1,200 gpm). When a hydrant is opened within the Paradise Valley service area, the PRV at Harvey Blvd and Highway 20 shall be allowed to open regardless of time of day and initial tank level in the Paradise Valley tank.

The proposed PRV at Harvey is currently being designed by others under contract with Lake County Special Districts.

Harvey Blvd Tank

The site will be fed via gravity from Zone 1 with an altitude valve on the tank inlet to control flows into the tank. A dedicated 8" fill line is proposed that would be constructed in a common trench with a dedicated 8" effluent line from the westerly intersection of Harvey Blvd and Highway 20 to the proposed Harvey tank site. The tank site identified is currently accessed by a rather steep rough graded access road that would be improved through additional grading operations to accommodate a more uniform slope with an estimated maximum grade of 25%. Due to the relatively steep slope, open graded AC paving is proposed along with a gravel or aggregate base shoulder. The steep grade of the proposed access road could prove to be problematic, particularly in winter months when freezing conditions could render it impassable. Efforts to identify other alignments for this site were not successful and other sites that provide the required elevation in the area would result in much higher infrastructure cost. **The District is encouraged to verify that the proposed roadway slope serving the Harvey Blvd tank site is acceptable prior to proceeding.** It is understood that the access road and the pipelines serving the site would be designed by others under a contract with the Lake County Special District. A preliminary layout of the proposed access road for the Harvey tank site is presented in **Figure 5.27** through **Figure 5.29**.

The proposed Harvey tank base elevation is estimated at 1515, approximately 93 feet lower than the static elevation of Zone 1 (1607'). While this will facilitate filling with an altitude valve on the tank inlet, turning the tank over will require a booster pump to push water back into Zone 1. The altitude valve would open on low level and close on high level, the valve would also close during pumping and could be operator controlled. The ability to drain the tank by pumping back to Zone 1 is recommended for both fire and emergency purposes, and, due to the relatively low demands expected in the Paradise Cove service area, for helping to mitigate DBP formation.

***Figure 5.27**, Proposed Site for Harvey Tank*



Given the relatively long distance back to the Zone 1 service area from the Harvey tank, head losses can quickly add up. Therefore, a duplex pump station is recommended with a total capacity 500 gpm (a flow chosen based on keeping velocity in the 6" line along Highway 20 reasonable) at an operating TDH of 120 psi. This will require two pumps capable of providing 250 gpm with 30 HP motors. Given the fireflow modeling results as discussed in **Section 3.1.4**, a duplex pump station at this location is recommended for installation. This will allow the water stored at this location to be used to supply fire flows within the current District service area. A spare pump on the shelf, at a minimum, is recommended. The pump station would also be equipped with a surge relief valve in the event of a power outage while pumping. The proposed site plan and booster pump station planned for the Harvey site is presented on the following pages in **Figure 5.30** and **5.31,** respectively.

Harvey Tank Control Requirements

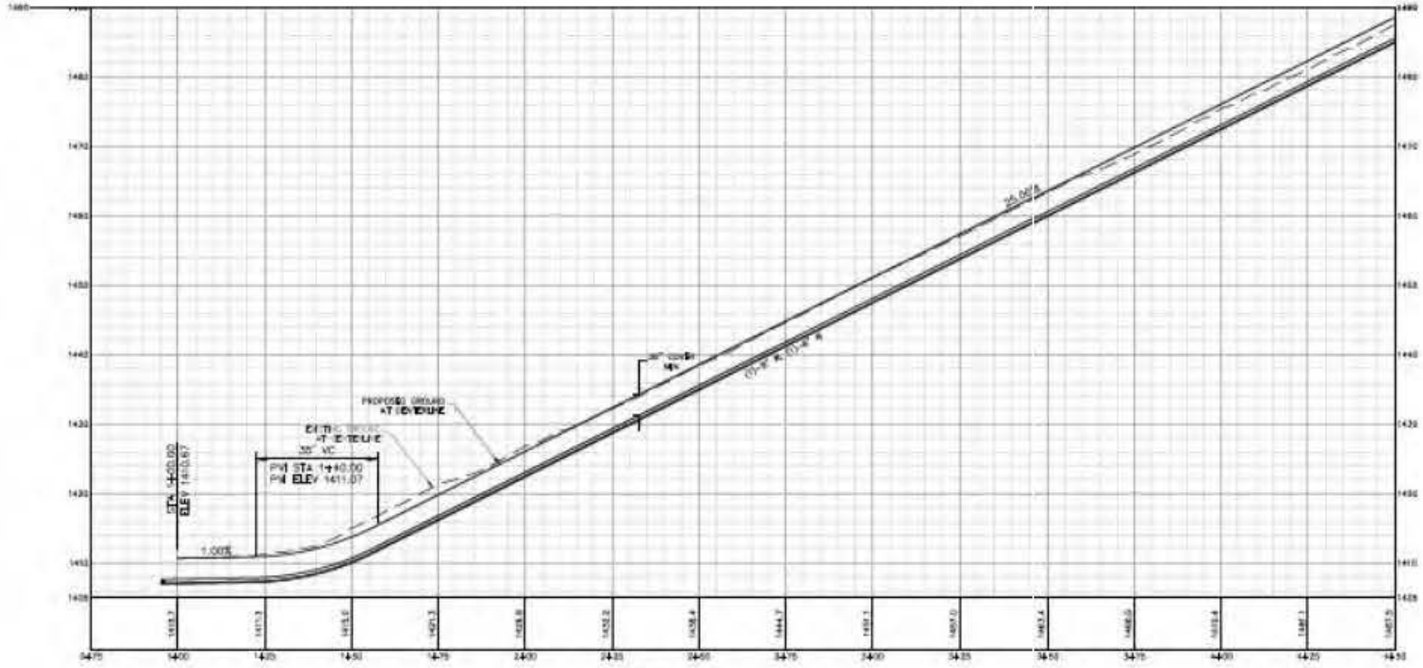
The control features recommended for the proposed Harvey Blvd. control valve should include accommodations for various scenarios including:

- Level control at the tank to prevent overfilling of the Paradise Cove tank
- Pressure sustaining features to keep the pressure near Harvey Blvd above 50 psi
- Flow sustaining to limit water conveyance to the annexation area to under 100 gpm
- Timed fill to synchronize the drawdown-fill schedules between the Paradise Cove and Pluth tanks

The combination of these four control strategies should help facilitate favorable operating performance for varying demands. Additional control and monitoring features are recommended that include flow metering to record annexation area water consumption and track water losses along with appropriate isolation valves and blow-offs for flushing and emergency operations.

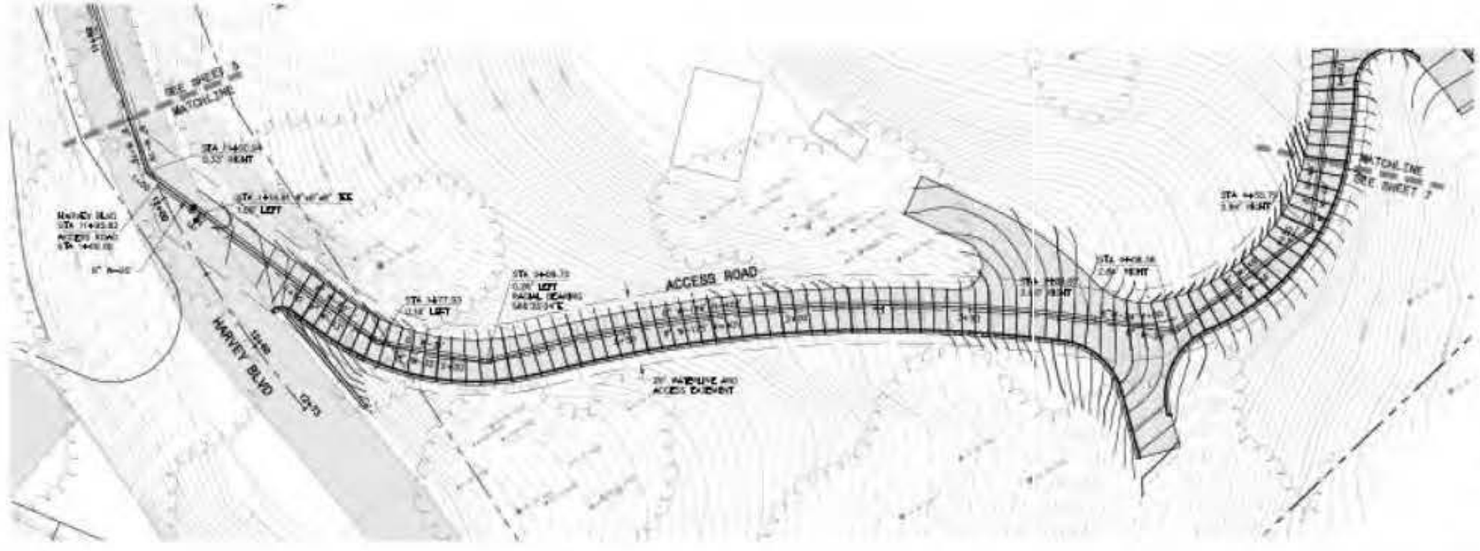
Sequence of Work (general)

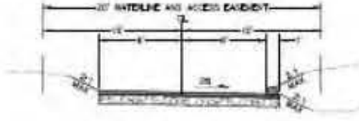
- Rough grading of access road (by others)
- Pipeline installation (by others)
- Initial road construction and drainage improvements (by others)
- New PG&E power (by others)
- Tank site grading and possible recompaction of existing fills (per geotechnical recommendations)
- Site grading for Steel Tank
- Pour tank foundation
- Install Steel Tank and site piping upgrades
- Apply tank coatings
- Pour foundation for prefab pump station
- Install prefab pump station
- Install electrical and control improvements/Tie-in to tank and distribution pipelines
- Test pump station and startup



TANK ACCESS ROAD PROFILE

SCALE
HORZ: 1"=50'
VERT: 1"=10'





ACCESS ROAD
TYPICAL SECTION

NO SCALE



PRELIMINARY
NOT FOR CONSTRUCTION
08/19/2016

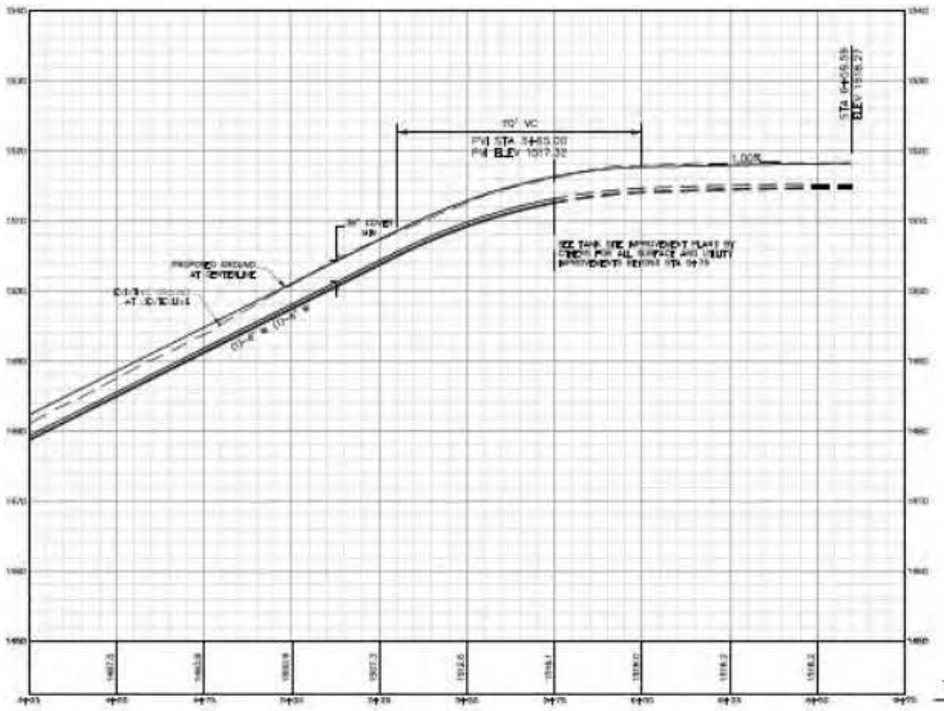
BKF

HARVEY WATERLINE & TANK ACCESS ROAD
Pleasanton Cove to Eastward Court
Livermore, CA

PLAN & PROFILE

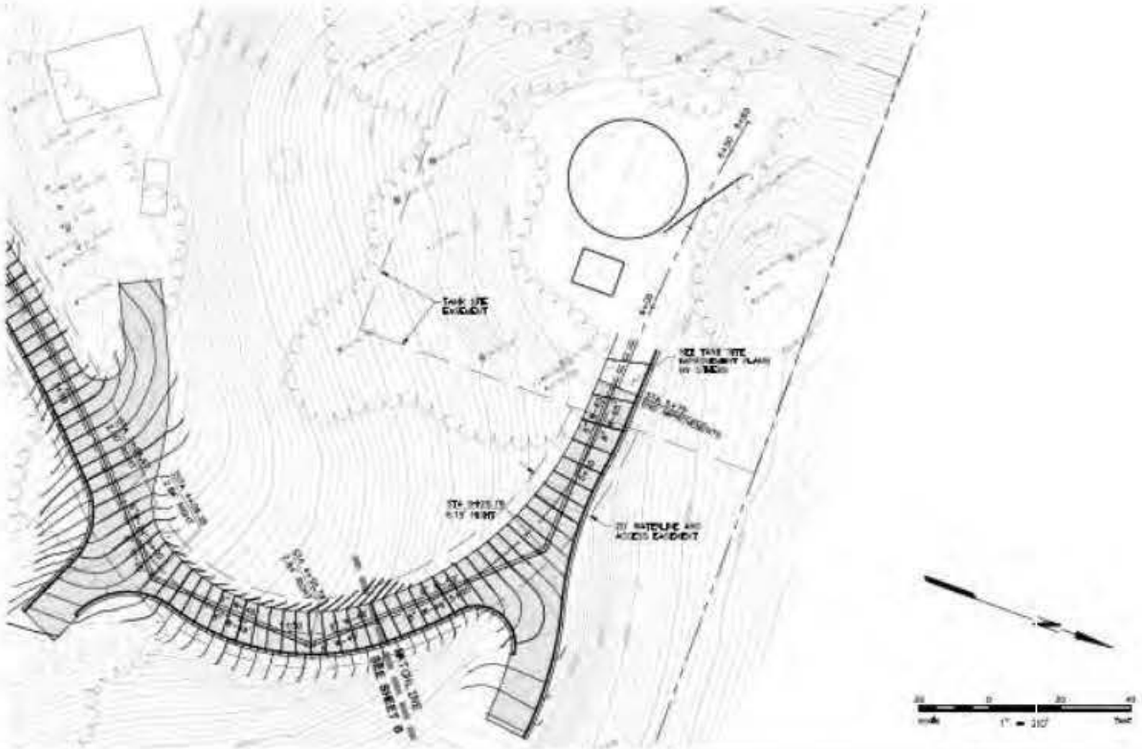
90% SUBMITTAL

6 of 9



TANK ACCESS ROAD PROFILE

SCALE
HORZ: 1"=30'
VERT: 1"=10'



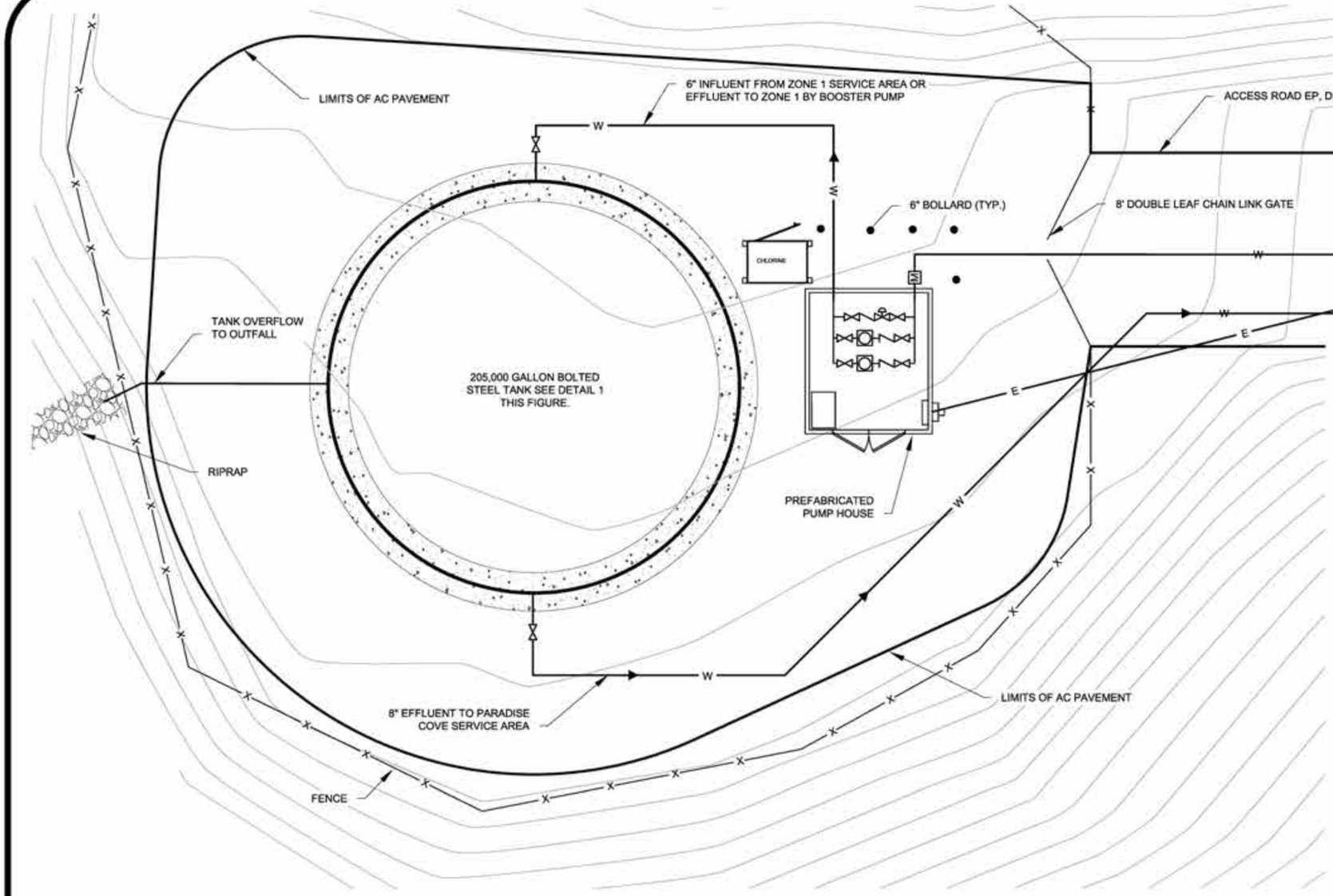
PRELIMINARY
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06/19/2018
DATE
RICHARD T. CRISTINA R.C.E. 37643

BKF ENGINEERS | SURVEYORS | PLANNERS

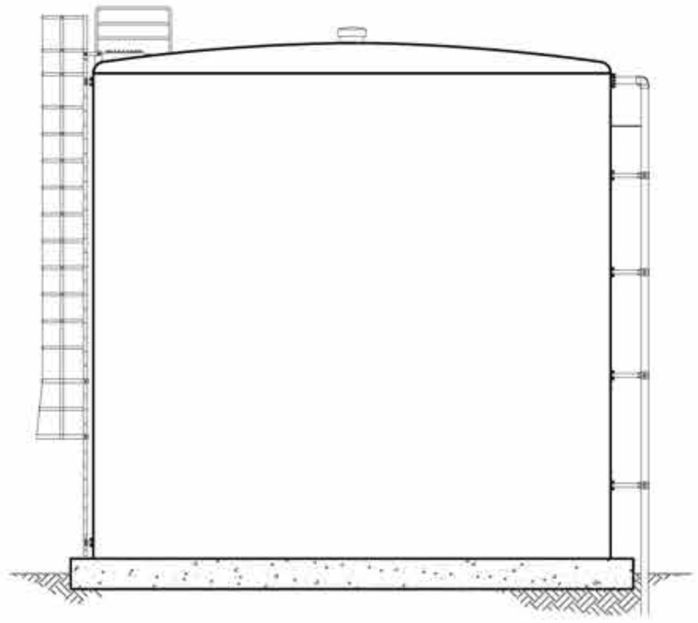
HARVEY WATERLINE & TANK ACCESS ROAD
PARADISE COVE TO CLEARLAKE OAKS
LAKE COUNTY, CA

PLAN & PROFILE

90% SUBMITTAL



SITE PLAN
SCALE: 1" = 10'



WELDED STEEL TANK ELEVATION
SCALE: 1" = 10'

GATE VALVE	⋈	CHECK VALVE	⋈
MAGNETIC FLOW METER	Ⓜ	ALTITUDE VALVE	⋈
TRAFFIC BOLLARD	●	FENCE	—X—X—X—
TURBINE PUMP	⊠	OH POWER	—E—E—E—

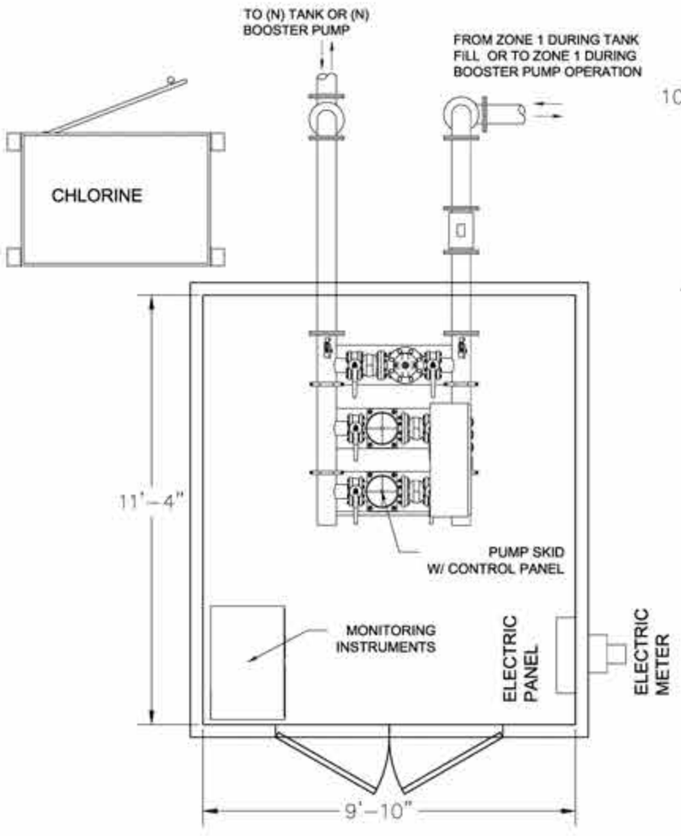
1"=10' 0 10' 20'

1"=20' 0 20' 40'

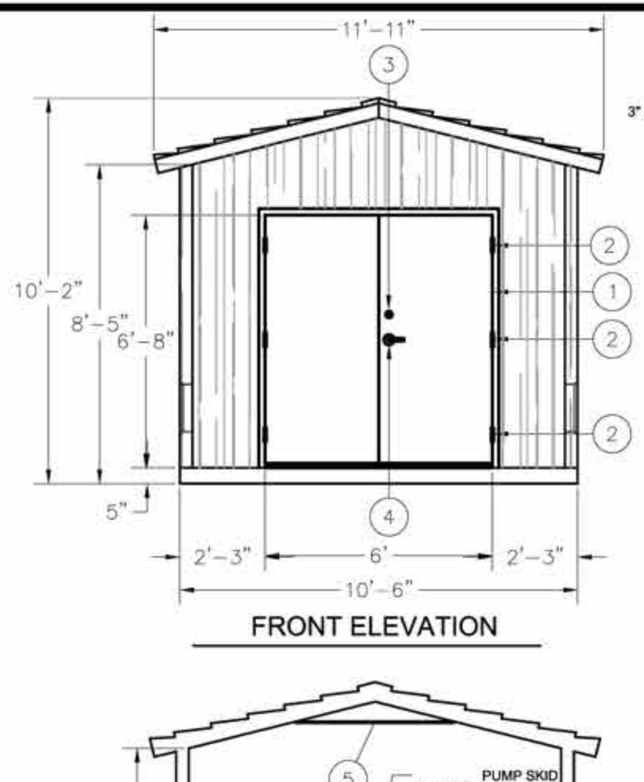
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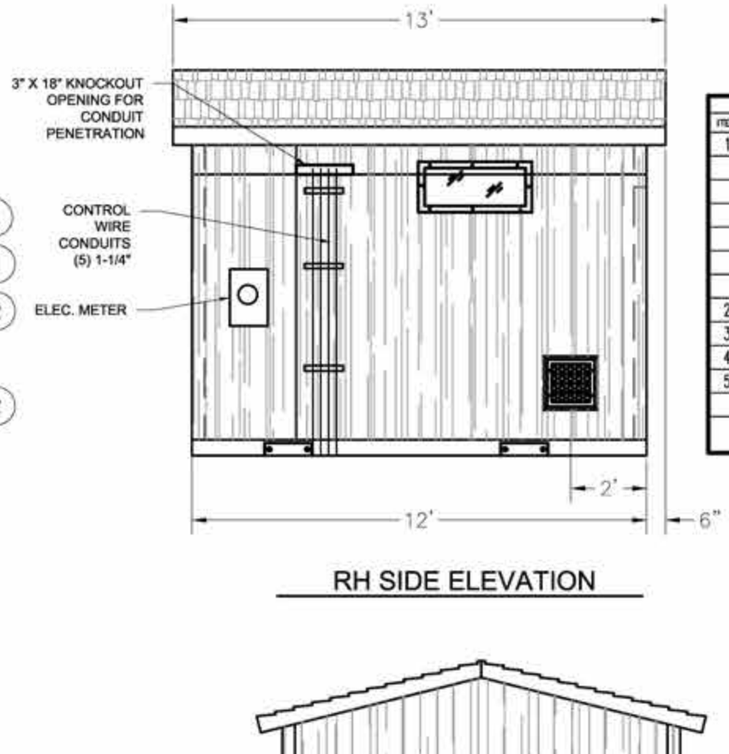
FIGURE 5.30
HARVEY TANK SITE PLAN



FLOOR PLAN

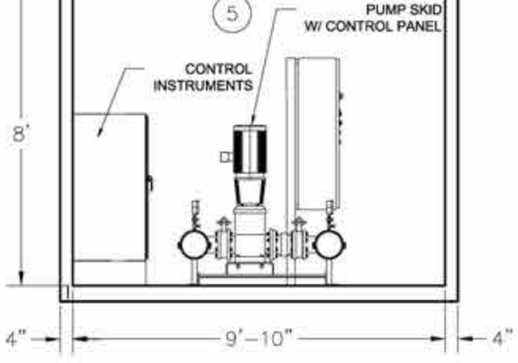


FRONT ELEVATION

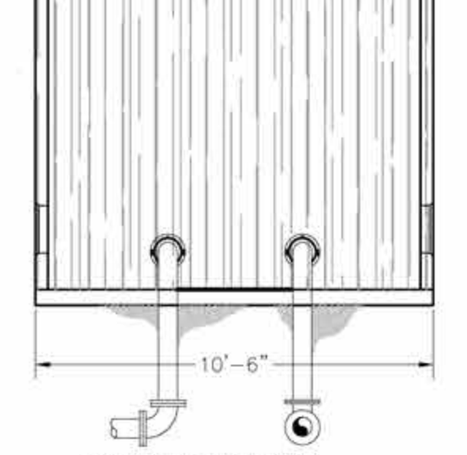


RH SIDE ELEVATION

		BILL OF MATERIALS
ITEM	QTY	DESCRIPTION
1	1	6068 RH ACTIVE DOOR ASSEMBLY
		PREP FOR DEAD BOLT
		OPENS OUT
		AUTOMATIC DOOR BTM
		6" THRESHOLD
		FLUSH MOUNT BOLT
		ASTRAGAL
2	6	SPRING HINGE 4.5 x 4.5
3	1	SCHALAGE DEAD BOLT LOCK
4	1	CLASS ROOM LEVER
5	5	FLAT BAR 1/2" x 5HR x 4'-2"
		APPROXIMATE WEIGHT



INTERIOR WALL SECTION



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PRELIMINARY NOT FOR CONSTRUCTION

FIGURE 5.31

HARVEY BOOSTER PUMP STATION

5.4.5 Pluth Tank

This recommended project involves the demolishment or abandonment of the deteriorating redwood tank at the Pluth tank site and the eventual replacement with a new welded steel tank. **Table 5.21** below provides a summary of the project.

2024 Project Clarification

The old redwood tank was recently taken out of service and has since been abandoned. The level instrumentation and telemetry has been relocated to the adjacent welded steel tank.

Table 5.21

Project Name	Pluth Site Improvement Project
Purpose	To eliminate the existing deteriorating redwood tank and install new welded steel tank to ensure water storage for Zone 1. Due to system-wide water loss from deteriorated water mains during peak use periods along with extremely high algae and turbidity in the raw water impacting the District's ability to meet MDD demands.
Project Details	The existing 100,000-gallon redwood tank will be demolished. A new minimum 165,000-gallon welded steel tank will be installed along with associated plumbing and electrical.
Estimate Cost	$487,400
Scheduled Start Date	**2035**
Construction Time	10 months

The Pluth redwood tank will either be demolished as part of this project or abandoned in place. It is recommended that this take place immediately as the tanking is actively leaking and is restricting the use of the total working volume of the Pluth steel tank. The tank will provide storage for diurnal and fire flow requirements.

Before a new tank can be placed at this site, soil stabilization measures will need to take place. The slope on the north side of the Pluth Tank site is eroding and is in need of re-grading. The slope condition is such that a new tank should not be added until the problem has been mitigated. A geotechnical engineering assessment is recommended.

Because of the addition of the Harvey Tank, new Cerrito Tank, and High Valley Tank, this project is not required to meet water storage demand requirements. As such, new tank construction is not expected to take place in the immediate future. The approximate timeline for this project is to be determined based on future demands and need.

Sequence of Work (general)

- Demo Redwood Tank
- Site grading for Steel Tank
- Pour tank foundation
- Install Steel Tank and site piping upgrades
- Provide appropriate testing methods including film thickness gage and wet sponge
- Install electrical and control improvements/Tie-in to tank and distribution pipelines

5.4.6 Summary of Tank and Booster Pump Improvements

Table 5.22 and **Table 5.23** below present the summary of proposed storage tanks and proposed pumps.

***Table 5.22**, Summary of Proposed Storage Tanks 2024 Update*

	Dimensions					Water Levels (ft)			
Tank	**Dia**	**Height**	**Area**	**Storage**	**Base Elevation[1]**	**Min[2]**	**Max**	**Alarm**	**Active Storage**
Pluth – Steel	55.00	20.25	2,376	359,890	1588.00	1.25	16.00	19.25	262,125
Shady Lane	32.00	24.00	804	144,390	1588.00	0.50	19.00	23.50	111,292
Konocti	30.00	24.00	707	126,900	1791.00	0.50	23.00	23.50	121,600
High Valley – Proposed	38.60	24.00	1,170	215,090	1586.00	0.50	20.50	21.00	179,500
Cerrito	34.16	20.00	916	100,120	2081.00	0.50	15.50	19.50	77,600
Harvey Blvd[3]	34.16	32.00	916	219,380	1515.00	0.50	30.00	30.50	205,700
Total CLOCWD[4]				**1,315,880**					**1,167,400**
Paradise Cove	34.00	16.00	908	108,670	1480.25	1.25	15.00	15.50	101,870

Note:

1. ***Based on a survey by Geo Legal (2016).***
2. ***Estimated for modeling purposes.***
3. ***96,000 gal of the Harvey Blvd Tank is allocated to Paradise Cove. The rest is available as CLOCWD storage.***
4. ***Minus the 96,000-gal allocated to Paradise Cove.***
5. ***Future Tank – not required to meet existing demands.***

***Table 5.23**, Summary of Proposed Pumps 2024 update*

Pump Location	Pump No.	Pump Horsepower	Approx. Pump TDH (ft)	Pump Flow (gpm)
WTP High Service	1	100	290	Unknown
WTP High Service	2	**60**	290	**700**
WTP High Service	3	50	290	610
Shady Lane Proposed	1	25	250	240
Shady Lane Proposed	2	25	250	240
High Valley Proposed	1	50	600	210
High Valley Proposed	2	50	600	210
High Valley Proposed	3	50	600	210
Cerrito	1	20	95	500
Cerrito	2	20	95	500
Harvey	1	7.5	137	100
Harvey	2	7.5	137	100

5.4.7 Storage Corrosion Protection

These recommended projects are intended to rehabilitate the corrosion protection systems of the welded steel storage tanks within the distribution system. Improvements consists of new washouts, new coatings, and maintenance of cathodic protection systems. **Table 5.24** through **5.26** below provides a summary of the project.

Table 5.24

Project Name	Konocti Tank Corrosion Protection
Purpose	Extend the service life of the existing storage tank and protect water quality. External and internal tanks inspections recently conducted indicated potential catastrophic structural failures within various water tanks. Loss of these tanks would result in the inability to reliably meet peak hour and maximum day demands. Without new coatings, failure is considered eminent and will soon require entire tank replacement in lieu of rehabilitation.
Project Details	This project will include installation of impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades including: • Replace the corroded circular hatch with rectangular hatch. • Replace the undersized vent with a larger AWWA mushroom vent. • Install the self-closing gate. • Install 40,000 gallons of temporary storage by use of polyethylene tanks and modified site piping.
Estimated Cost	$350,000
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	1 week

Table 5.25

Project Name	Pluth Lane Tank Corrosion Protection
Purpose	Extend the service life of the existing storage tank and protect water quality. External and internal tank inspections recently conducted indicated potential catastrophic structural failures of this tank over the long run.
Project Details	This project will include installation of impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades including: • Replace center vent with AWWA compliant mushroom vent. • Replace the interior latter.
Estimated Cost	$320,000
Scheduled Start Date	2035
Construction Time	1 week

Table 5.26

Project Name	Shady Lane Corrosion Protection
Purpose	Extend the service life of the existing storage tank and protect water quality. External and internal tanks inspections recently conducted indicated potential catastrophic structural failure is eminent for this tank. It will soon be beyond repair and would then require complete replacement.
Project Details	This project will include installation of sacrificial cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades including: • Replace center vent with AWWA compliant mushroom vent. • Replace the interior ladder. • Replace circular hatch with rectangular hatch. • Install the self-closing gate. • Installation of 6" bypass piping to allow continued service to the Konocti pressure zone during tank rehabilitation.
Estimate Cost	$280,000
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	1 week

Exterior Renovation Sequence of Work

- Exterior pressure wash
- Rusted areas tool cleaned per SSPC standards
- Cleaned areas spot primed with high quality primer
- Full exterior coating with intermediate primer
- Full exterior coating with finish coat
- Provide appropriate testing methods including film thickness gage and wet sponge

Interior Renovation Sequence of Work

- Sand blast complete interior to "near white" finish
- Remove all dust and blast products by high-pressure air, vacuum cleaning or brushing and apply the first coat of paint before any surface develops
- Using epoxy, thinned 10%, stripe paint all weld/lap seams and pitted areas with roller or brush
- Apply one full coat of epoxy at a DFT of 4 to 6 Mils to complete interior of the tank, riser pipe, and all other interior surfaces
- Apply a second full coat of epoxy at a DFT of 5 to 7 Mils to the complete interior of the tank, riser pipe, and all other interior surfaces
- Provide appropriate testing methods including film thickness gage and wet sponge
- Allow surfaces to cure with adequate ventilation
- Disinfect the interior using the spray method, verify quality of work, and seal tank for service

Cathodic Protection Sequence of Work

- Mounting of test station
- Installation of anodes
- Installation of conduit and wire
- Startup and testing in accordance with NACE criteria

5.4.8 Storage THM Removal System

The intent of this recommended project is to reduce THMs from the distribution system. Aeration has been proven to be an effective means of removing THMs from finished drinking water and is accomplished by three methods: bubble aeration, surface aeration, and spray aeration. For this project spray aeration is recommended due to its ability to remove THM species at the equal rates while being most energy efficient. The THM removal systems recommended for the distribution system are identical to the system proposed for the clearwell as described **Section 5.1.6**. **Table 5.27** through **5.30** below provides a summary of the project.

2024 Project Update

Recently modeling efforts and discussions with staff have identified the Konocti tank as a high-priority project for maintaining TTHM compliance relative to the other tank sites. The recommended project approach is to install a power vent and mixer at each tank site, with the exception of the Shady tank, to remove THMs. Only after the performance of the mixer and power vent has been evaluated should installation of spray aeration equipment be considered.

Table 5.27

Project Name	Konocti THM Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	This project will install a mixer and power vent at the Konocti tank site.
Estimate Cost	$200,000
Scheduled Start Date	Immediate upon approval of grant funding
Time to Completion from Start Date	3 months

Table 5.28

Project Name	Harvey THM Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	This project will install a mixer and power vent at the Harvey tank site.
Estimate Cost	$267,000
Scheduled Start Date	2030
Construction Time	3 months

Table 5.29

Project Name	Cerrito THM Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	This project will install a mixer and power vent at the Harvey tank site.
Estimate Cost	$267,000
Scheduled Start Date	2030
Construction Time	3 months

Table 5.30

Project Name	Pluth THM Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	This project will install a mixer and power vent at the Pluth tank site.
Estimate Cost	$267,000
Scheduled Start Date	2035
Construction Time	3 months

Table 5.31

Project Name	High Valley THM Removal Project
Purpose	To remove THMs from the clearwell before entering the distribution system
Project Details	Currently the High Valley tank is nonexistent, the THM removal system should be combined with the tank.
Estimate Cost	$267,000
Scheduled Start Date	2030
Construction Time	3 months

Sequence of work (general)

- Drain clearwell
- Cleaning of interior clearwell floors and walls with pressure waster to remove silt, and any foreign sediment
- Removal of any biofilm using an NSF 60 approved chemical cleaning agent followed by a freshwater rinse to remove any cleaning agent
- Installation of NSF approved pumps and spray nozzles positioned in the tank roof
- Installation of forced air ventilation system on the roof of the tank in accordance with AWWA D100
- Installation of mixer on tank floor
- Upon completion of installation tank disinfected in accordance with AWWA C652
- Furnish 3 phase power to the base of the tank with necessary trenching, conduit, and electrical connections.
- Furnish electrical control boxes, tank sidewall penetrations, and electrical connections within and on the tank
- Electrical and control panel start up and verification of equipment installation
- Tank fill followed by THM sampling to ensure performance

5.5 Operational Improvement Projects

Operation improvements are categorized as both short- and long-term improvements and replacements of system components including, but not limited to: pumps, motors, piping, corrosion/painting, circuitry, piping and fittings, and other appurtenance replacements and or improvements. Typically, the system component improvements are funded through both capital and operational reserves established by the District.

5.5.1 GAC Filter Media Replacement Project

This project will consist of replacing the existing filter media with new granular activated carbon filter media per design specifications. As discussed in **Section 3.5.8**, the GAC filter media's ability to remove Total Organic Carbon (TOC) drops rapidly with use and within 6 to 8 months of filter media replacement, TOC is at pre-replacement levels. **Table 5.31** below provides a summary of the project.

2024 Update

The GAC media has not been replaced recently. In general, the pressure vessels are in good working order, no other improvements, other than media replacement, are recommended.

Table 5.31 Updated

Project Name	GAC Filter Media Replacement Project
Purpose	To replace the old GAC filter media with new media to ensure continued effectiveness of GAC system.
Project Details	Removal and disposal of the existing GAC filter media, cleaning of the filter interiors, and replacement with new filter media.
Estimate Cost	$95,000
Scheduled Start Date	Immediate
Construction Time	<1 month

If the GAC filter is intended to be used exclusively for taste and odor management, further investigation of its efficacy should be conducted. It is recommended that monthly taste and odor testing be conducted upon replacement of the GAC filter media to identify its useful life in removal of compounds creating taste and odors in the treated water supplied by the WTP. If the GAC system intended to be used for reducing excessive levels of DBPs in the treated water, a filter media change-out period of 6 months should be considered. A 6-month change-out schedule would equate to an annual cost of approximately $140,000, which may be cost prohibitive. Other options for DBP removal and reduction are recommended (See proposed projects in **Section 5.5** (Tank Aerators), **Section 5.6** (WTP Piping), and **Section 5.7** (Acid Injection). An image of the GAC contact tanks, and GAC piping is presented in **Figures 5.32** and **Figure 5.33** on the following page.

- **Sequence of Work (general)**
- Filter Shutdown
- Removal, packaging, and disposal of existing GAC media.
- Cleaning the interior of the filter units
- Repair and/or replacement of underdrains, as needed
- Installation of new GAC media
- Filter Startup

***Figure 5.32**, GAC Contact Tanks (2)*



***Figure 5.33**, GAC Contactor Piping (Filter Feed Building is on Right)*



5.5.2 Filter Building HVAC & Insulation Project

In 2013, CLOCWD received a proposal from Aircon, Inc., a Sacramento based design/build contractor. A 4-ton ductless split system was proposed for installation at the Filter Pump-house/Laboratory building. The installation of this unit will provide a conditioned space and lower temperatures in the room to reduce heat related degradation of pumps and VFDs housed at this location and to provide a level of staff comfort while in the workspace. In addition, Title 24 code standards will be met with the application of R-30 insulation in the attic of this building. An image of the filter pump house and is presented below in **Figure 5.34**. **Table 5.32** below provides a summary of the project.

Table 5.32 Updated

Project Name	Pump House HVAC Installation Project
Purpose	To upgrade the WTP pump house to include a functioning HVAC system.
Project Details	This project will add an HVAC system and associated ductwork and electrical to the WTP pump house.
Estimated Cost	$55,500
Scheduled Start Date	2035
Construction Time	1 month

Sequence of work (general)

- Conduct Title 24 Design/Report
- Install 4-ton Ductless Air Handler
- Install 3 Air Handlers
- Install Insulation (Blow-In and Batt as required)

***Figure 5.34**, Filter Feed Pump house/Laboratory*



5.5.3 Institute a Comprehensive Leak Detection Program

A system-wide acoustic leak detection survey was completed as part of this project. Several leaks were discovered and repaired in the process as discussed in **Section 3.6.3**. It is recognized that due to the on-going recurrence of leaks, a regularly scheduled program of annual surveys is recommended. The leaks should be entered into the GIS database for the water system that was developed as part of this project. It is proposed that the next round of surveys be included in funding in order to provide the District with the necessary technical support to get the proposed program implemented. Subsequent survey frequency should be based on the number of recurring leaks based on at least 3 years of leak surveys and related information on water losses. **Table 5.33** below provides a summary of the project.

Table 5.33

Project Name	Acoustic Leak Detection Program
Purpose	To accurately track discovered leaks and develop a business case and program for subsequent surveys throughout the distribution system.
Project Details	Perform system-wide acoustic survey and make associated repairs. Update information in leakage database and subsequent water audit. The initial project should focus on identifying leaks in the Pluth DMA.
Estimate Cost	$50,000
Scheduled Start Date	2030
Construction Time	3 months

5.5.4 Miscellaneous Equipment

The equipment below is recommended for immediate acquisition to enhance staff operations. The equipment needed consists of a Benchtop Charge Analyzer for efficient jar testing and coagulant dosing; as well as a microscope to identify microorganisms and other constituents within raw and treated water.

Project Name	Miscellaneous Equipment
Purpose	Assist staff in operation with additional equipment
Project Details	Benchtop Charge Analyzer (coagulant dosing) Microscope
Estimate Cost	$18,400
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	N/A

5.5.4.1 2024 Miscellaneous Equipment and Instrumentation Update

Staff indicated that the Rosemount pH sensors and analyzers are reaching the end of their life cycle and would prefer to replace them with new Swan analyzers. This consists of replacing all three analyzers for raw sampling, settled, post GAC, and finished effluent. Staff has also indicated that the transmitter for the magnetic flow meters located on the effluent of clarifier no. 2 is reaching the end of its useful life and should be replaced soon. Additionally, low range / high range handheld colorimeters are also desired.

5.5.5 Valve & Actuator Improvements

This project consists of replacing the valves and actuators at the sludge wasting outlets of the upflow clarifiers in addition to the valves and actuators within the filter building for filters no. 2 and 3. Currently both clarifiers feature an independent sludge wasting line, each line features a motor-controlled ball valve. However, the actuators are configured such that both valves are called to open simultaneously, independent controls are not present for each valve. This becomes problematic since the two upflow clarifiers drain at different rates, requiring the unnecessary wasting of clarified effluent from the faster draining clarifier. Furthermore, the actuators are exposed to UV radiation since the vault which houses them is not covered.

Replacement of the existing pneumatic actuators on pressure filters no. 2 and 3 should also be completed with installation of a redundant electric air compressor. The existing air compressor is located in the high service pump room and is currently in good working order; however, installation of a redundant unit will ensure that backwash operations, which are critical to water production during the summer months, are not compromised.

***Table 5.34.1**, Valve and Actuator Improvement*

Project Name	**Valve & Actuator Improvements**
Purpose	Assist staff in operation with additional equipment
Project Details	• Replace sludge valves and actuators and install discrete signal wiring from actuator to PLC for each clarifier. • Retrofit vault with light-duty cover to protect actuators and piping components from UV exposure. • Replace all piston style pneumatic actuators, and butterfly valves for pressure filter no. 2 & 3 backwash manifold piping within the piping gallery of the pressure filter room. • Installation of a redundant 5 HP electric air compressor • SCADA Programming
Estimate Cost	**$100,000**
Scheduled Start Date	**Immediate upon approval of grant funding**
Construction Time	**2 months**

Figure 5.5, Existing Pressure Filter Piston Actuators



5.5.7 SCADA System Upgrades

As discussed in previous sections, the older 300 series SCADA Pack controllers have become obsolete and several must be replaced. Those identified for replacement with the 400 series controllers include two older SCADAPacks within the filter pump building and on in the high service pump room. Improvements within the filter room would consist of replacing the two SCADAPacks with a single Allen-Bradley ControlLogix controller and i/o modules within a new enclosure. The existing SCADAPack within the high service pump room will also be replaced with the latest Allen-Bradley Compactlogix controller and remain within the existing enclosure. The existing Ignition SCADA operator interface will need to be modified to communicate with the new PLCs and an electrician will need to be retained to assist in disconnecting the existing conduit, pull instrument control wiring, install new enclosures, and install conductors and conduit.

Table 5.32 Updated

Project Name	Pump House HVAC Installation Project
Purpose	Replace SCADA Pack remote terminal units with next generation technology.
Project Details	Installation of new hardware and programming.
Estimate Cost	$400,000
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	3 months

5.6 Environmental Impacts

The District has enlisted the service of Analytical Environmental Services (AES), based in Sacramento, CA, to prepare the environmental documentation for the proposed construction projects recommended in this report. AES was originally contracted in 2014 to prepare the necessary environmental documentation for the District Water Preliminary Engineering Report.

Once a final project list is agreed to and approved by CLOCWD, the Environmental Documents can then be prepared in accordance with CEQA and NEPA Guidelines.

2024 Update

A Water Master Plan project Cost and Environmental Analysis Matrix has been prepared and is presented in Section 6 indicating which projects have complete environmental clearance.

SECTION 6 – Phased Project Costs, Affordability, and Recommended Financing Methods

This section presents select projects from Section 5 which have been scheduled into the related planning, design and construction phases. A comprehensive summary of the recommended projects, including costs and environmental coverage, is presented at the end of this section in **Table 6.4**.

Currently the District has accrued a long-term debt service in order to fund a loan from a 2021 USDA Rural Development Infrastructure Grant. As a result of pre-existing loan payments combined with limited revenue to fund additional debt and loan service, the District is requesting that only 100% grant funds be acquired from the SWRCB to fund the recommended high priority projects.

During the course of preparing this 2025 WMP update it became apparent that the overall water system was in a "failing state". Various operating processes found within the system, including the raw water supply/intake, WTP clarification and treatment process, storage and booster pump facilities, and the distribution system pipelines and appurtenances were all in need of various improvements to avoid threats to public health, exceedance of existing MCLs, and other drinking water violations as noted as being critical in Assembly Bill 685, the "Human Rights to Water" (HR2W) legislation, and as described and summarized in the following paragraphs.

Assembly Bill 685, that has been codified in the California Water Code Section 106.3, states "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes". HR2W also goes on to state that the Law "extends to all Californians, including disadvantaged individuals and groups and communities in rural and urban areas."

The District has worked closely with the SWRCB DDW staff to identify system failures. Over the last 12 years various portions and components of the CLOCWD water system have been failing and have created serious operational challenges and deficiencies. Affected critical water system components, include and not limited to source water supply (Clear Lake), WTP algae and turbidity removal processes, water distribution system pipelines, booster pumping, and storage systems. Many of the impacts are inter-related and are driven primarily by high water losses in the distribution system.

Ongoing water quality violations have occurred, and in some cases have been avoided through emergency actions taken by the District staff. The existing system-wide drinking water violations include high trihalomethane (THM) levels resulting from the lack of pre-treatment facilities needed to treat high turbidity concentrations, and at times high pH values, that result in stresses on existing clarifiers and filters. The water system leaks due to high pressures combined with old and deteriorated galvanized pipelines along with older substandard asbestos cement (AC) pipes in the distribution system. This is exacerbated by the lack of existing storage facilities and booster pumps to provide the system flexibility required to both supply and move treated water between system pressure zones. In the past several of the tanks have been removed due to structural failure while many existing tanks are on the brink of failing.

The raw water high turbidities have placed a serious impact on the ability of the clarifiers and other WTP components to produce enough finished water to meet MDD. There have also been over eighty-eight (88)

"Boil Water Notices" that were sent to customers since 2017 within the affected areas. These and other serious drinking water concerns are based on detailed research and evidence as found in the reports and studies completed over the last 12 years. Recent water audits indicate the high water losses are increasing and consistently getting worse over time as the system ages. It is also important to note that system-wide drinking water standards have been compromised, and the key portions of the water system are in jeopardy of catastrophic failures leading to unsafe drinking water for the 2400 District wide customers. Unless the recommended improvements are made the impaired drinking water system will continue to affect customers of the District, which includes homes, schools, daycare, and assisted living facilities. Each identified water infrastructure component deficiency found within this recent study is interrelated.

The system-wide failures and deficiencies were first recognized in the 2014 USDA Rural Development Project Engineering Report. Subsequent reports, including and not limited to the DWR funded 2015/17 Water Master Plan, and more recently the current updated 2025 Water Master Plan funded by the SWRCB Office of Drinking Water, have identified a number of water system drinking water MCL violations. The MCL violations have been caused primarily from those deficiencies as noted within Section 3 and 6 of this 2025 WMP. The District, recognizing the deficiencies, have taken both emergency and planned actions to correct the system failures. However, the lack of adequate internal resources and funding have placed severe limitations on the District's ability to keep up with the required and ongoing improvements that are needed to provide safe and affordable drinking water to its customers.

In October of 2024, the California State Water Resources Control Board DDW adopted "List Criteria for Failing Water Systems". This list includes those water systems that are considered "failing" along with the criteria to identify those systems. The list criteria are broken into the following sections:

A. Primary MCL Violation with an Open Enforcement Action.
B. Secondary MCL Violation with an Open Enforcement Action.
C. E. coli Violation with an Open Enforcement Action.
D. Treatment Technique Violations (in lieu of an MCL).
E. Monitoring & Reporting Violations.
F. Source Capacity and Water Outage Violations.

As determined through the recent system-wide analysis as a part of the updated 2025 Water Master Plan, there have been past violations and the on-going potential for more future drinking water violations that meet at least two of the criteria listed above. It is evident by observation of the data presented herein that the District's water system is failing and unless immediate and appropriate actions are taken through system-wide improvements the system will continue to deteriorate. Information drawn from various studies, reports, and notifications are presented herein that will provide the necessary evidence to establish a "failing water system" under HR2W. The following recommended projects (Phase 1A and 1B) are all considered a "High Priority" and if completed they will greatly improve the overall water system operation and reduce the potential for future water system violations. **Table 6.1**, as shown on the following page, provides the information and justifications to indicate that the CLOCWD's water facilities are in a failing condition and will continue to get worse over the coming months and years.

Table 6.1 Determination of Failing Water System for the CLOCWD – State of California AB 685 (HR2W)

Specific Water System General Facility Cmponents Evaluated	Reference Section in 2025 WMP	Water System Deficiency and Drinking Water Violation or High Potential for Violation	Criteria Categories and Corresponding Violation Numbers		Related Violations	Other Justifications for Grant Funding and Project Necessity
			MCL Violations and/or High Potential Violations	Source Capacity & Water Outage Violations and/or High Potential		
Water Distribution System (Pipelines)	Phase 1A Sec. 6.1.1	Since 2016 CLOCWD has had over 388 water distribution system leaks and associated system pressure loses, including 88 "Boil Water Notices" and leading to over 50% water loss. Water losses between 2014 and 2023 increased by 38%	O1A (Secondary MCL Violation)	C295	C277 and C279	The water leaks (loses) along w/ a combination high algae/turbidity concentarions in the WTP raw water during peak demand periods have led to potentially serious water production shortages. Every leak repair creates a serious health threat due to the potential for an E.coli violation. The water main breaks also create serious localized water pressure loss.
Water Distribution System (PRVs)	Phase 1A Sec. 6.1.1	Since 2016 CLOCWD has had over 388 water distribution system leaks and associated system pressure loses, including 88 "Boil Water Notices" and leading to over 50% water loss.		C277	C295	The PRVs will allow creatinon of a new presure zone and reduce pressures between 30 and 50 percent in the Keys area. Anticipated water loss is expected to be reduced approximately 25% in this area resulting in lower leakage rates, water usage and costs in curred for production at the WTP.
THM Removal	Phase 1A Sec. 6.1.2	(2) THM violations since 2012 with (6) potential violations since 2015 w/in the 5 mg/l of the MCL of 80 mg/l	O1 (Primary Violation SDWIS Code 2950)			Due to the relatively long pipeline lengths within the CLOCWD water system high THMs occur near the far ends of the system. This is exacerbated during the warmer summer months it creates the need for additonal chlorine a purcusor to THMs, along w/ other organic substances in water.
Shady Lane Pump Station Improvements	Phase 1A Sec. 6.1.3	There is currently a lack of reliability and redundancy needed to meet MDD. Pumps are critical to meet high demands that are exacerbated by significant water loss.		C295 (High Potential)	C277 and C279	High system demands coupled with 50% water loses w/in various water system zones have required to need to add booster pumps to avoid water outages. WMP water modeling also indicates the need to install booster pump(s). This in addition to production volume limitations at the WTP has led to potential and serious water shortages.
High Valley Tank	Phase 1A Sec. 6.1.5	There is currently a lack of reliability and redundancy needed to meet MDD. Storage is critical to meet high demands that are exacerbated by significant water loss.		C295 (High Potential)	C277 and C279	Based on system-wide modeling, the High Valley tank is required to meet SDWA requirements by maintaining finished water delivery and this coupled with marginal finish water production at the WTP makes this a critical improvement project. (Also refer to WMP modeling.)
Shady Lane and Pluth Tank Rehabilitation	Phase 1A Sec. 6.1.6	Structural failure of tanks is eminent without recoating. Loss of storage will make it impossible to meet peak hour and max day demands.		C295 (High Potential)	C277 and C279	This project is required to extend the service life of critical infratsructure, to provide required water for MDD and to protect drinking water quality. Serious structural anomallies have been identified in recent tank inspections
Konocti Tank Rehabilitation & THM Removal System	Phase 1A Sec. 6.1.7	This tank is needed to meet peak hour and MDD. High demands are exacerbated by significant water loss. (2) THM violations since 2015 with (6) potential violations since 2015 w/in the 5 mg/l of the MCL of 80 mg/l	O1 (Primary Violation SDWIS Code 2950)	C295 (High Potential)	C277 and C279	This project is required to extend the service life of critical infratsructure, to provide required water for MDD and to protect drinking water quality. Serious structural anomallies have been identified in recent tank inspections

Table 6.1 Continued

Specific Water System General Facility Cmponents Evaluated	Reference Section in 2025 WMP	Water System Deficiency and Drinking Water Violation or High Potential for Violation	Criteria Categories and Corresponding Violation Numbers		Related Violations	Other Justifications for Grant Funding and Project Necessity
			MCL Violations and/or High Potential Violations	Source Capacity & Water Outage Violations and/or High Potential		
WTP EQ Tank	Phase 1A Sec. 6.1.8	Existing EQ tanks are temporary "Baker Tanks" that must be replaced with permanent redundant tanks to allow for consecutive backwashes, particularly during high demand/high algae periods.		C277 (High Potential)	C279	The current WTP production limitations are related to high raw water turbidities from algae in the raw water coupled with 50% water loses due to system leaks. These conditions increase the importance of this improvement.This improvement willalso improve finished water production rates.
WTP DAF or SAF Pilot Plant	Phase 1B Sec. 6.2.1	Lack of reliability and redundancy to meet MDD. Needed to improve current WTP capacity and avoid production shotages.		C277 (High Potential)	C279	The current WTP production limitations are related to high raw water turbidity due to algae along with 50% water loses due to system leaks. These conditions can be improved by pretreatment. This improvement will increase finished water production rates. Water shortages along with request to customers to limit the use of potable water water water have occurred.
SCADA System Upgrades	Phase 1B Sec. 6.2.2	Needed due to obsolete PLCs. Critical for the operators ability to monitor and control the WTP, pump stations, and other water systems facilities/components.		C277, C295, and C279 (High Potential)		The current SCADA system is obsolete and doesn't provide for the the monitoring and control capabilities required for properly maintaing and operating the CLOCWD water system.
Meter Data Consolidation & Water Loss Management	Phase 1B Sec. 6.2.3	Needed to allow staff to isolate water leaks, minimize system losses and lost revenue. Since 2016 there have been over 388 water distribution system leaks and associated system pressure loses, including 88 "Boil Water Notices" leading to over 50% water loss		C295	C277 and 279	This project includes both meter data consolidation and a water loss management system that will provide critical data and recommendations for pinpointing water leaks both now and in the future,
Leak Detection Program	Phase 1B Sec. 6.2.4	Provide important mechanism for staff to isolate water leaks, minimize system losses and reduce lost revenue. Since 2016 there have been over 388 water distribution system leaks and associated system pressure loses, including 88 "Boil Water Notices" leading to over 50% water loss		C295	C277 and 279	Leak detection recommended immediately in the Pluth zone due to approximately 50% higher water loss in this part of the system based on recent DMA water loss analysis and tank drawdown tests.
X-Connection Control and X-Connection Hazard Assessment	Phase 1B Sec. 6.2.5	Adhere to the California Cross Connection Control Policy handbook and SWRCB DDW Policies and Regulations				Requirement from the SWRCB DDW
Ozone Ejector Improvements	Phase 1B Sec. 6.2.6	To assure the production of safe drinking water by significantly increasing the disinfection capacity, reduce THMs, and improve treated water quality.		**C277** (High Potential)		Ozone generation oxidizes oragnic matter within the membranes of viruses and bacteria. It also oxidizes certain materials into solid particles so they can be properly filtered through the District's acivated carbon and pressure filters.Ozone ejector will also provide cost-effective reliability to the WTP process..

Note: Criteria categories and corresponding violation numbers correlate to the October "2024 SWRCB Failing Water Systems - List Criteria". "Related Violations" are cross-over and interconnected based on Water System General Facility Components.

Phase 1A Immediate (High Priority) Projects:
Phase 1A consists of immediate projects, ready for construction, which are intended to be funded by State Water Resources Control Board Division of Financial Assistance (DFA) Drinking Water State Revolving Funds (SRF) or other future funding sources if available. These high priority projects are either at a 90% or 100% construction phase (Plans & Specifications), with either complete or pending environmental coverage. This Phase also includes the preparation and approval of a Construction Grant Application with the SWRCB DFA SRF Program. SWRCB Grant funding for the Phase 1A "High Priority" projects is a critical and necessary financial component for providing safe and reliable drinking water and eliminating current system-wide drinking water health and safety issues. The District has recently made progress on eliminating system-wide deficiencies that can lead to drinking water health and safety issues by actively pursuing funding from Federal, State, and local sources. The current District customers are identified as an extremely disadvantaged community and have recently absorbed a large debt service to fund the loan portion of the USDA Rural Development funded project. As a result, the District cannot afford to acquire additional debt service for the Immediate/Priority Projects as noted above. The **Phase 1A** high priority projects total estimated cost is **$15.6 M** including soft costs and contingency**.** ($11,976,522 for Phase 1A Pipelines and $3,660,800 for other Phase 1A projects)

Phase 1B Immediate (High Priority) Projects
Phase 1B project improvements are considered a high priority, however construction contract documents for these projects have yet to be produced and environmental coverage is either complete or pending. This Phase also includes the preparation and approval of a Construction Grant Application with the SWRCB DFA SRF Program. The **Phase 1B** high priority projects cost is estimated at **$13.2M** including soft costs and contingency.

Phase 2, High Priority Future Projects (5-year)
Phase 2 projects consist of priority improvements which exist only at a conceptual or planning level and are outlined and analyzed as a part of the WMP update. These projects have yet to be designed and feature only partial environmental coverage. Funding mechanisms for these projects have not yet been identified. This Phase of proposed system-wide improvements will require the preparation of a future Construction Grant Application with the SWRCB DFA SRF Program. The total Phase 2 Project Costs are estimated at **$9.8M.**

6.1 Phase 1A (Immediate – High Priority Projects)

As previously described, the Phase 1 projects are focused on improvement projects that have in the past, or are anticipated to have in the future, a high likelihood of creating serious drinking water violations. Past and potential future TTHM violations can be attributed to high flow rates due to leaks in the system combined with poor source water quality. The inability to properly treat the water resulting from high leak rates and to remove high turbidities from the algae laden raw water are just two of the serious problems facing the District's current system. Other important and recommended projects include the replacement of a significant portion of the small-diameter galvanized iron pipes in the Keys and Pressure Zone 1,which have been prone to frequent failures as noted in the original WMP.

6.1.1 Pipeline Replacement, and Pressure Management Project

This project includes pipelines along the west side of 1st Street through 6th Street, Schindler Street, Island Drive, Garden Court, and Center Way. Additionally, Phase 1 addresses the replacement of small-diameter AC pipes in the Keys area that continue to fail under high pressure. These include pipelines along Island Drive, Shoreview Drive, Island Circle, Blue Heron Court, Oak Knoll Avenue, Short Street, and Highway 20. These replacements are prioritized to avoid serious water quality issues, loss of localized system pressures, and the potential threat of E. coli contamination.

Over the last eight (8) years most of the more than 88 Boil Water Notices that have been issued by the CLOCWD are a direct result of pipeline failures within the Keys area. During MDD periods in the summer the water main breaks stress the WTP production capacity at times when production capacity is already running at maximum levels. This requires operators to man the WTP 24/7 due to source water containing high concentrations of algae concurrent with the high system demands during the summer. As referenced in the SWRCB Division of Drinking Water 2023 Unsafe Water Notification Guidance Report, guidelines were prepared to avoid possible impacts due to contamination of public and private drinking water systems in California. The introduction of the Guidance Report illustrates the intent as it relates to the CLOCWD system:

> *"This document provides guidance . . . . in managing situations involving unsafe water notifications. These notifications are used in circumstances where there is a known or potential risk of contamination in a water supply that poses an immediate threat to public health. This guidance document will address situations where a "Boil Water Notice," "Do Not Drink," or a "Do Not Use" notification may be required."*

The 2023 Unsafe Water Notification Guidance Report implies that repeated Boil Water Notices indicate a threat to public health. These drinking water protection measures are found within the California Health and Safety Code sections 116450 and 116451, and sections 64430, 64463, 64463.1, 64463.4, and 64465 of the Title 22 of the California Code of Regulations. Pipeline improvements are required to reduce the occurrence of main breaks and provide safe drinking water.

Ongoing water leaks have had, and will continue to have, an impact on the water system's ability to meet peak summertime demands and this, coupled with the current lack of flexibility to move/transport treated water to various pressure zones, including the lack of water storage and booster pumping, has created a serious risk and potential drinking water issue resulting in a lack of consumer confidence.

Project Name	Immediate Pipeline Replacement and Pressure Management Project
Purpose/Need	To avoid serious drinking water violations and avoid future potential public water system contamination, replacement of old and deteriorated asbestos cement and galvanized iron piping along with reducing excessive system pressures and minimizing the amount of water loss is recommended. Replacing old and deteriorated water mains will reduce water losses which are currently at 40-50% of total system production.
Construction Cost Estimate:	$10,085,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	As shown in Table 6.1 above, the old and deteriorating water distribution system has created poor drinking water conditions for the District customers. This includes the loss of pressure and the high potential for contamination. There have also been over 88 “Boil Water Notices” sent to affected customers during the leak repair events which have resulted in a threat to public health from drinking water contamination, inadequate production and supply, and loss of consumer confidence.
Construction Contract Documents:	40% Complete
Environmental Coverage:	Partially Complete
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	8 months

6.1.2 Paradise Tank Pipeline Rehabilitation Project (THM Removal)

Project Name	Paradise Tank Pipeline Rehabilitation Project
Purpose/Need (See Section 2.1.2 for historic TTHM record violations)	To adhere to the SDWA by maintaining TTHM concentrations below the primary drinking water standard MCL. The current piping configuration does not fully utilize the existing THM removal equipment within the Paradise Tank. The proposed modifications would direct all of the flow entering the Paradise Cove community through the THM removal process prior to entering the system, effectively lowering the THM concentration below the MCL.
Construction Cost Estimate:	$60,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	Needed to improve system reliability and eliminate the existing and future threat of high TTHM concentrations and improve the consumer confidence.
Construction Contract Documents:	70% Complete
Environmental Coverage:	Pending
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.1.3 Shady Lane Pump Station Improvements

Project Name	Shady Lane Pump Station
Purpose/Need	To satisfy DDW requirements and ensure reliable water service to the Konocti pressure zone by installing a new CMU pump house complete with pumps, control valves, and backup power.
Construction Cost Estimate:	$650,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	Needed for reliability and redundancy and to meet MDD, especially relating to significant water loss due to leaks and through impacts to drinking water production due to high raw water turbidity from Clear Lake's algae laden raw water putting a strain on the overall water system
Construction Contract Documents:	70% Complete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.1.4 High Valley Tank

Project Name	High Valley Tank
Purpose/Need	To adhere to the SDWA by maintaining water delivery capabilities sufficient to meet peak hour demand by flow equalization.
Construction Cost Estimate:	$820,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	This tank is needed for reliability and redundancy to meet MDD, especially relating to significant water loss due to leaks and through impacts to WTP drinking water production due to high raw water turbidity from Clear Lake algae that is putting a strain on the overall water system
Construction Contract Documents:	70% Complete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.1.5 Shady Lane Tank Rehabilitation

Project Name	Shady Lane Tank Rehabilitation
Purpose/Need Shady Lane Tank Continued	The existing Shady Lane tank is in dire need of internal and external recoating in order to adhere to the SDWA by maintaining water delivery capabilities sufficient to meet peak hour demand by flow equalization. Failure to rehabilitate this tank will result in the inability to provide peak hour flow equalization to the main pressure zone(s) within the Keys and inhibit the conveyance of water to the Konocti pressure tank.
Construction Cost Estimate:	$280,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	Recoating is needed to extend the service life of the existing storage tank, protect water quality and to maintain system pressures. External and internal tank inspections recently conducted indicated potential catastrophic structural failures within various water tanks.
Construction Contract Documents:	60% Complete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.1.6 Konocti Tank Rehabilitation and THM Removal System

Project Name	Konocti Tank Rehabilitation and THM Removal System
Purpose/Need	This project is needed to adhere to the SDWA by maintaining TTHM concentrations below the primary drinking water standard. Historically, the MCL has been exceeded, or nearly, exceeded on multiple locations at the Mesa Stubbs sample point requiring installation of a THM removal system at the Konocti tank. Since installation of a THM removal system requires taking the tank out of service this project would also include recoating the tank interior to adhere to the SDWA by maintaining water delivery capabilities sufficient to meet peak hour demand by flow equalization. Failure to rehabilitate this tank will result in the inability to provide any flow equalization for maintaining system pressures and flows in the Konocti pressure zone.
Construction Cost Estimate:	$550,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	This project is needed to improve system reliability and eliminate the existing and future threat of high TTHM concentrations and improve consumer confidence. The project will extend the service life of the existing storage tank and protect water quality. External and internal tanks inspections recently conducted indicated potential catastrophic structural failures within various water tanks.
Construction Contract Documents:	50% Complete

Table 6.16 Continued

Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.1.7 WTP Dissolved Air Floatation Pilot Plant (or SAF)

There have been a number of compliance letters written by the SWRCB DDW in regards to serious potential of cyanobacteria contamination, along with the high turbidity and organic loadings affecting WTP production, including secondary effects from high amounts of algae (organics) being discharged (backwash water) to the District's WWTP facilities impacting the DO levels during its treatment processes.

Project Name	DAF / SAF Pilot Plant
Purpose/Need	To maximize the source capacity and increase treated water production at the WTP through the pretreatment of the raw water and to reduce the organic loading on the existing upflow clarifiers.
Construction Cost Estimate:	$200,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	The high turbidity levels are due to high concentrations of algae in the raw water and they have significantly reduced the production of drinking water thus requiring long and more periodic backwash events. Removal of algae will also potentially reduce the risk of algae producing cyanotoxins and TTHMs in the distribution system.
Construction Contract Documents:	Incomplete
Environmental Coverage:	Pending
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.2 Phase 1B (Immediate High-Priority Projects)

6.2.1 High Valley Pump Station

Project Name	High Valley Pump Station
Purpose/Need	To satisfy DDW requirements and ensure reliable water service to the Cerrito pressure zone by installing a new CMU pump house complete with pumps, control valve, and backup power.
Construction Cost Estimate:	$600,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	This project is needed for system reliability and redundancy and to meet MDD. The pump station is needed to bolster supply resulting from significant water loss due to leaks. The pumping capacity is needed to provide additional supply due to limitations on drinking water production resulting from high raw water turbidity and algae that is putting a strain on the overall water system .
Construction Contract Documents:	70% Complete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

MC Engineering staff have prepared a 60% design of the proposed High Valley Pump Station based on the flow criteria identified in this Water Master Plan. The Clearlake Oaks County Water District Staff have reviewed this design and have directed MC Engineering to reduce the design flow of the proposed High Valley Pump Station to the flowrate of the existing booster pump. The proposed pump station will be redesigned to accommodate these criteria. The engineer's estimate for the High Valley Pump Station has been decreased for the smaller building and equipment.

The design criteria for the proposed High Valley Pump Station is dominated by fire flow to the Cerrito pressure zone. This Water Master Plan Update assumes four hours of fire flow at 1,000 gpm. This criteria was developed based on typical local fire flow requirements in various urban areas of California. The Clearlake Oaks County Water District Staff have determined that it is not practical to provide full urban fire flow to the isolated rural community served by the High Valley Booster Station due to excessive infrastructure and energy requirements along with conveyance pipeline limitations. Instead, the District intends to work with the Northshore Fire Protection District to establish criteria for a reduced water supply available in a fire in accordance with Section B103.1 of the 2022 California Fire Code and The National Fire Protection Agency Standard 1142 on Water Supplies for Suburban and Rural Fire Fighting.

6.2.2 WTP Equalization Tank

Project Name	WTP Backwash Equalization Tank
Purpose/Need	To increase source capacity and water production rates at the WTP by allowing backwash operations to occur at any time as needed by operators. The existing backwash tanks and associated piping are temporary and have reached the end of their life expectancy. They will need to be replaced to maintain the existing plant production capacity.
Construction Cost Estimate:	$586,200
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	Needed for reliability and redundancy to meet MDD. The MDD is abnormally high as a direct result of significant water losses due to distribution system leaks and compounded by high raw water turbidities from algae in the raw water that is putting a strain on the finished water production capacity.
Construction Contract Documents:	65% Complete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.2.3 SCADA System Upgrades

Project Name	SCADA System Upgrades
Purpose/Need	Maintain existing supervisory control and data acquisition systems by replacing obsolete remote terminal units with next generation hardware. This will provide the required system reliability.
Construction Cost Estimate:	$400,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	These improvements are critical to the on-going operations of the system. New PLCs are needed to maintain control of the WTP, especially during the MDD in the summer months when the WTP processes are fully strained. The inability to acquire new PLCs could result in complete failure of the WTP and distribution system pump stations.
Construction Contract Documents:	Incomplete
Environmental Coverage:	NA
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.2.4 Meter Data Consolidation & Water Loss Management System

Project Name	DMA System Upgrades
Purpose/Need	To implement a system wide metering system which tracks all DMA flow data on a single platform to better quantify and identify water loss.
Construction Cost Estimate:	$50,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	These improvements, if implemented, will help in identifying system-wide water leaks. When quickly repaired the improved DMA analytics will prevent impacts on the availability and reliability of drinking water while reducing impacts at the WTP.
Construction Contract Documents:	Incomplete
Environmental Coverage:	NA
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.2.5 Cross Connection Control and Cross Connection Hazard Assessment

Project Name	Cross Connection Control and Cross Connection Hazard Assessment
Purpose/Need	Prepare a cross-connection hazard assessment and develop standards for installation of backflow protection devices at select connections that pose a threat to the District's distribution system. This project is intended to supplement the recently completed 2025 Cross Connection Control Plan. Includes identifying service connections where backflow prevention devices are required and preparing updated construction drawing details.
Cost Estimate:	$50,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	Continuation of the current cross-connection control programs, which originally included the installation of 780 backflow devices, is required by the SWRCB Office of Drinking Water. The future project will comply with the California Cross Connection Control Policy Handbook by preparing a cross-connection hazard assessment and specifying requirements for additional backflow devices at select locations.
Construction Contract Documents:	Incomplete
Environmental Coverage:	NA
Scheduled Start Date:	Immediate upon approval of grant funding
Project Duration:	18 months

6.2.6 Leak Detection Program Project

The estimated system-wide cost for a leak survey is summarized below in **Table 6.20**.

Project Name	Leak Detection Program Project
Purpose/Need	Perform system-wide acoustic survey and make associated repairs to prevent future water shortages. Update information in leakage database and subsequent water audit. The initial project should focus on identifying leaks in the Pluth DMA.
Construction Cost Estimate:	$50,000
Proposed Funding:	SRF Grant
Grant Eligibility and Necessity	A successful leak detection program is the cornerstone of reducing water loss in the distribution system and will allow the CLOCWD to proactively repair failing lines, resulting in reductions in boil water notices, lower plant production, and reduced threats due to TTHMs and other issues.
Construction Contract Documents:	NA
Environmental Coverage:	NA
Scheduled Start Date:	Immediate upon approval of grant funding
Project Duration:	3 months

6.2.7 Ozone Injector Improvements

Project Name	Ozone Injector Improvements
Purpose/Need	To ensure the production of safe drinking water by significantly increasing the disinfection capacity of the ozone contact tower at the WTP to enhance the production capacity and water quality of finished water.
Construction Cost Estimate:	$40,000
Proposed Funding:	SRF Grant
Construction Contract Documents:	Incomplete
Environmental Coverage:	Completed
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	2 months

6.2.8 Pluth Rehabilitation Project

The purpose of this project is to extend the service life of the existing storage tank and protect water quality. This project will include installation of impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades including replacement of the interior ladder and mushroom vent.

Project Name	Pluth Rehabilitation Project
Purpose/Need	The purpose of this project is to extend the service life of the existing storage tank and protect water quality and reduce possible catastrophic tank failures. This project will include installation of impressed current cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades including replacement of the interior ladder and mushroom vent.
Estimate Cost	$320,000
Proposed Funding:	SRF Grant
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date	Immediate upon approval of grant funding
Construction Time	2 months

6.2.9 Phase 1B Pipeline Replacements

Phase 1B pipeline replacement costs include the same assumptions outlined in **Section 6.1.1** and serve to address the same pipeline deficiencies described in Phase 1. Projects include continued replacement of AC mains primarily within the Keys and Orchard Shores including Island Drive, Oak Knoll, Spinnaker Court, and Bass Lane, Orchard Shores Drive, Apple Lane, Lemon Circle, Plum Circle, Grape Circle, and Peach Circle.

Project Name	Phase 2 Pipeline Replacement Project
Purpose/Need	To adhere to the SDWA by minimizing the number of water outages and boil water notices, and water outages, issued by the District by replacing aging asbestos cement and galvanized iron piping.
Construction Cost Estimate:	$5,250,000
Proposed Funding:	SRF Grant
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date:	Immediate upon approval of grant funding
Construction Time:	8 months

6.2.10 Highway 20 Pipeline and Foothill Ave.

Project Name	Highway 20 Pipeline Project
Purpose/Need	As described in Section 4.3.1 of the water master plan, a 4" line currently restricts flow to the keys and to the Pluth Tank. Removing and replacing the 4" pipeline or the addition of a larger capacity pipe would provide adequate peak flows and decrease water loss by reducing the pressure in the Keys.
Estimate Cost	$1,950,270
Proposed Funding:	SRF Grant
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date	Immediate upon approval of grant funding.
Construction Time	12 months

6.3 Phase 2 (5-year Projects)

Phase 2 projects consist of high priority improvements which exist only at the conceptual and planning level, these projects have not been designed yet and feature only partial environmental coverage. Funding mechanisms for these projects have not yet been identified.

6.3.1 Phase 2 Pipeline Replacement Project

Phase 2 pipeline replacement costs include the same assumptions outlined in **Section 6.1.1**. Phase 2 Projects include continued replacement of AC mains and the interconnection of pipelines which aim to increase water quality by reducing the number of dead end mains by creating additional loops within the system, this includes connecting Spring Drive and Henderson Drive by installation of a pipeline on Put Drive (which also replaces a portion of the small diameter galvanized iron pipeline on Put Drive), installation of a pipeline on Lakeview Drive to interconnect (and partially replace) the piping between Hillside Lane and Konocti Drive, installation of piping on Mesa Drive to connect the two dead end recently created by failure of the roadway (landslide). Other pipeline improvements in Phase 2 include replacement of the aging and undersized AC pipelines on Sulphur Bank Road which ultimately service the Elem community as well as the WWTP.

Project Name	Phase 2 Pipeline Replacement Project
Purpose/Need	To adhere to the SDWA by minimizing the number of boil water notices, minimizing potential public health threats, and preventing water outages, through replacing aging asbestos cement and galvanized iron piping.
Construction Cost Estimate:	$6,014,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date:	2030
Construction Time:	8 months

6.3.2 Phase 2 Backflow Prevention Project

Project Name	Phase 2 Backflow Prevention Project
Purpose/Need	Install additional backflow prevention devices as determined by the cross-connection hazard assessment. The number of installations is to be determined. The Teams recommend budgeting up to 100 installations for planning purposes.
Construction Cost Estimate:	$95,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date:	2030
Construction Time:	8 months

6.3.3 Cerrito Tank and Pump Station Improvement Project

Project Name	Cerrito Tank and Pump Station Improvement Project
Purpose/Need	To improve water quality and avoid future THM violations by installation of THM removal equipment within the Cerrito tank and upgrading the appurtenances of the existing pump house. • Upgrade PG&E Service to 200 amps • Coating of piping inside pump house and suction piping outside of pipe house • Installation of non-slam check valve on pneumatic tank discharge piping • Building insulation and mini-split install.
Estimate Cost	$367,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Completed
Scheduled Start Date	2030
Construction Time	2 months

6.3.4 Harvey THM Removal Project

Project Name	Harvey THM Removal Project
Purpose	To improve water quality and avoid future THM violations by installing THM removal equipment within the proposed Harvey Tank. Work would include installation of (1) power vent (1) mixer and (1) control panel.
Estimate Cost	$267,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date	2030
Construction Time	2 months

6.3.5 High Valley THM Removal Project

Project Name	High Valley THM Removal Project
Purpose/Need	To improve water quality and avoid future THM violations by installing THM removal equipment within the proposed High Valley Tank. Work would include installation of (1) power vent (1) mixer and (1) control panel.
Estimate Cost	$267,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date	2030
Construction Time	2 months

6.3.6 Dissolved Air Floatation Pretreatment

Project Name	DAF / SAF Project
Purpose/Need	The purpose maximizes the source capacity of the WTP by reducing the organic loading on the upflow clarifiers by installation of a Dissolved Air Floatation or Suspended Air Floatation pretreatment unit. This proposed process will reduce the backwash run times and provide more treated water during peak periods.
Estimate Cost	$2,300,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	Pending
Scheduled Start Date	2030
Construction Time	2 months

6.3.7 WTP Valve and Actuator Rehabilitation Project

Project Name	WTP Valve and Actuator Rehabilitation Project
Purpose/Need	The purpose of this project is to replace the aging motorized actuators with the sludge discharge lines on each clarifier and replace the existing piston style pneumatic actuators on pressure filter no. 2 and 3 including the butterfly valves. Since the operation of the pressure filters relies on a single 5 hp air compressor, installation of an additional backup unit is also highly recommended.
Estimate Cost	$100,000
Proposed Funding:	TBD
Construction Contract Documents:	None
Environmental Coverage:	NA
Scheduled Start Date	2030
Construction Time	3 months

6.4 Phase 1A, 1B, and 2 Project Costs Overview

Table 6.4 provides an overview of project costs for each phase assuming a 30% soft cost and 10% contingency.

Table 6.4- Water Master Plan Project Cost Summary

PROJECT PHASES		Project Descriptions/Titles	Construction Cost	Soft Costs (30%)	Sub Total (w/Soft Costs)	Contingency (10%)	TOTAL PROJECT COSTS	TOTAL PROJECT COSTS BY PHASE
PHASE 1A	1A Pipelines	1st St. through 6th St. Lake and Schindler St.,	$3,538,110	$1,061,433	$4,599,543	$459,954	$5,059,497	$11,976,522
		Orchard Shore Drive, Walnut Circle, Chestnut Circle, Sulphur Bank	$1,458,540	$437,562	$1,896,102	$189,610	$2,085,712	
		Shoreview Dr., Blue Heron Ct., Center Way, Island Cl (West), & Short St.,	$2,658,540	$797,562	$3,456,102	$345,610	$3,801,712	
		PRV Valves (4)	$720,000	$216,000	$936,000	$93,600	$1,029,600	
	1A Other Projects	Paradise Tank Pipeline Rehab Project (THM	$60,000	$18,000	$78,000	$7,800	$85,800	$3,660,800
		Shady Lane Pump Station Improvements	$650,000	$195,000	$845,000	$84,500	$929,500	
		High Valley Tank	$820,000	$246,000	$1,066,000	$106,600	$1,172,600	
		Shady Lane Tank Rehabilitation	$280,000	$84,000	$364,000	$36,400	$400,400	
		Konocti Tank Rehabilitation (THM Removal)	$550,000	$165,000	$715,000	$71,500	$786,500	
		WTP Dissolved Air Floatation Pilot Plant	$200,000	$60,000	$260,000	$26,000	$286,000	
PHASE 1B		High Valley Pump Station	$600,000	$180,000	$780,000	$78,000	$858,000	$13,247,752
		WTP EQ Tank	$586,200	$175,860	$762,060	$76,206	$838,266	
		SCADA System Upgrades	$400,000	$120,000	$520,000	$52,000	$572,000	
		Meter Data Acquisistion & Water Loss Mangmt System	$50,000	$25,000	$75,000	$5,000	$55,000	
		Cross Connection Control and Cross Connection Hazard Assessment	$50,000	$30,000	$80,000	$5,000	$55,000	
		Leak Detecion Program Project	$50,000	$12,000	$62,000	$5,000	$55,000	
		Ozone Injector Improvements	$40,000	$15,000	$55,000	$5,500	$60,500	
		Pluth Rehabilitation	$320,000	$96,000	$416,000	$41,600	$457,600	
		Phase 1B Pipelines- Island Drive, Oak Knoll, Spinnaker Ct, Bass Lane, Orchard Shores Drive, Apple Lane, Lemon Circle, Plum Circle, Grape Circle, Peach Circle	$5,250,000	$1,575,000	$6,825,000	$682,500	$7,507,500	
		Highway 20 Pipeline and Foothill Ave.	$1,950,270	$585,081	$2,535,351	$253,535	$2,788,886	
		Phase 1A and 1B Subtotals:	**$20,231,660**	**$6,094,498**	**$26,326,158**	**$2,625,916**	**$28,885,074**	**$28,885,074**
		Phase 1A and 1B Soft Costs to Date:		$875,003				$875,003
		Costs to Complete		**$5,219,495**				**$28,010,071**
PHASE 2		Phase 2 Pipeline Replacements	$6,014,000	$1,804,200	$7,818,200	$781,820	$8,600,020	$13,456,300
		Phase 2 Backflow Prevention Project	$95,000	$28,500	$123,500	$12,350	$135,850	
		Cerrito Tank and Pump Station Improvements	$367,000	$110,100	$477,100	$47,710	$524,810	
		Harvey THM Removal System	$267,000	$80,100	$347,100	$34,710	$381,810	
		High Valley THM Removal Project	$267,000	$80,100	$347,100	$34,710	$381,810	
		DAF Pretreatment	$2,300,000	$690,000	$2,990,000	$299,000	$3,289,000	
		WTP Valve and Actuator	$100,000	$30,000	$130,000	$13,000	$143,000	
		Total Construction Costs	**$29,641,660**					
		Costs (Planning, Design, CM, and Admin.)	**$14,916,996**					
		Sub-Total w/ Soft Costs	**$44,558,656**					
		10% Contingency	**$4,455,866**					
		TOTAL PHASES 1A, 1B, AND 2	**$49,014,522**					

6.5 Project Affordability and Financing

This Section of the report summarizes the current opportunities to enable the District to complete the important and critical water system improvements and to limit the short and long-term liabilities as they relate to safe and affordable drinking water. Since the current water system is "failing" and will continue to deteriorate, including the quality of the raw water for Clear Lake, the District will immediately need to pursue the next steps, including the completion of design for the highly recommended Phase 1A and 1B projects.

In 2020, the District acquired a 30% grant and a matching loan of approximately $5,600,000 from the United States Department of Agriculture Rural Development (USDA RD), to provide the required funding to plan, design, and construct some of the recommended water treatment and distribution system improvements (pipeline replacements), including both the installation of over 2,100 new water meters/meter retrofits and the installation of over 750 backflow prevention devices to affected customers within the Keys area of the District. The USDA RD loan portion was financed and absorbed through the District rates. The USDA loan has an approximate debt service of $132,000/year which equates to approximately $5-6/mo. per District customer. This new debt service has 37 years remaining to be fully paid off and has created an economic burden on the current rate payers of the CLOCWD, who are classified as a "extremely disadvantaged" community under SWRCB regulations and policies. The District cannot at this time afford additional debt service. The current "failing" water system is requesting 100% grant funding from the SWRCB DW SRF DFA program to complete portions of the environmental, design and ultimately construction of the Phase 1A and B projects. If approved, this important SWRCB DFA grant funding will reduce a large burden and limit the District's liabilities relating to the current failing water system and associated distribution, treatment, TTHM removal facilities, and pumping and storage improvements and other miscellaneous system components.

The District was recently successful in acquiring emergency funding from the DWR Small Community Drought Relief Program (Agreement No. 4600014460). This funding in the amount of approximately $678,504 included the construction of an emergency water intake pipeline from the WTP extending approximately 1,300 LF along the Clear Lake bottom along with a specialized fish screen attached at the end of a10-inch dia. HDPE line. The project also included improvements to the WTP control room (electrical and controls), a new VFD and a 75 HP portable pump (850-950 GPM). It was only to be constructed as a temporary facility, but it recently has benefited the WTP operators during the summer months when the algae concentration is extremely high near the original raw water intake structure near the shoreline.

Table 6.5 on the following page is a detailed list of all of the requested projects to be funded through the SWRCB DFA Program, the level of completion for each project, and status of environmental coverage/approvals (NEPA and CEQA). Upon approval of our 2025 WMP, including the approval for funding of the recommended critical and "high priority' projects, a SWRCB DW SRF DFA construction grant application will be prepared that will include a phased project approach (Phase 1A and Phase 1B), to allow those high priority projects that have completed both the design and construction (Phase 1A) to proceed ahead of those that may still may require additional environmental and design work (Phase 1B).

Table 6.5- Water Master Plan Project Cost, Funding, and Environmental Matrix Summary

PHASE	PRIORITIZED PROJECTS	PROJECT REFERENCES DESRIPTIONS (1)				PLANS AND SPECS	ENVIR. NEPA/CEQA COVERAGE		REQUESTING SWRCB SRF DFA GRANT FUNDING	
	Project Descriptions / Titles	Original DWR Water Master Plan (2017)	Updated Water Master Plan (2025)	Source Capacity Study (2023)	DWR Water Facilities PER (2015)	P & S % Complete (3)	Environmental CEQA/Nepa Coverage (2)			
		Sections (Excerpts)	Sections (Excerpts)	Sections (Excerpts)	Sections (Excerpts)		Yes	No	Yes	No
PHASE 1A	Phase 1A Pipelines- 1st St. through 6th St. Lake and Schindler St.,	Sect.6.3.1	Sect. 6.1.1		Project (Item 4) Table 16	70%	X		X	
	Phase 1A Pipelines- Orchard Shore Drive, Walnut Circle, Chestnut Circle, Sulphur Bank	Sect. 6.3.1	Sect. 6.1.1		Project (Item 4) Table 17	60%	X		X	
	Phase 1A Pipelines- Shoreview Dr., Blue Heron Ct., Center Way, Island Cl (West), & Short St.,	Sect.6.3.1	Sect. 6.1.1		Project (Item 4) Table 18	60%	X		X	
	PRV Valves (4)		Sect. 6.1.1			50%	X		X	
	Paradise Tank Pipeline Rehab Project (THM)		Sect. 6.1.2			70%	X		X	
	Shady Lane Pump Station Improvements	Sect. 6.4.1	Sect. 6.1.3		Project (Item 5) Table 16	70%	X		X	
	High Valley Tank	Sect. 6.4.2	Sect. 6.1.4		Project (Item 3) Table 16	70%	X		X	
	Shady Lane Tank Rehabilitation	Sect. 6.4.6	Sect. 6.1.5		Project (Item 3) Table 16	60%	X		X	
	Konocti Tank Rehabilitation (THM Removal)	Sect. 6.4.6	Sect. 6.1.6			50%	X		X	
	WTP Dissolved Air Floatation Pilot Plant		Sect. 6.1.7	X		0%		X	X	
PHASE 1B	High Valley Pump Station	Sect. 6.4.2	Sect. 6.2.1		Project (Item 5) Table 16	70%	X		X	
	WTP EQ Tank	Sect.6.2.5	Sect. 6.2.2	X	Project (Item 1) Table 16	65%	X		X	
	SCADA System Upgrades		Sect. 6.2.3	X	Project (Item 6) Table 16	0%	X		X	
	Meter Data Consolidation & Water Loss Mangmt System	Sect.6.3.4	Sect. 6.2.4	X Sect. 7.1.1	Project (Item 6) Table 16	0%	X		X	
	Cross Connection Control Plan and Cross Connection Hazard Assessment	Sect. 6.3.3 Sect. 6.5.3	Sect. 6.2.5	Sect. 7.1.5a		20%	X		X	
	Leak Detection Program Project	Sect. 6.5.1	Sect. 6.2.6	X	Project (Item 6) Table 16	0%	X		X	
	Ozone Injector Improvements	Sect.6.2.1	Sect. 6.2.7	X	Sect. 6.1.2	0%	X		X	
	Pluth Tank Rehabilitation		Sect. 6.2.8			50%	X		X	
	Phase 1B Pipelines- Island Drive, Oak Knoll, Spinnaker Ct, Bass Lane, Orchard Shores Drive, Apple Lane, Lemon Circle, Plum Circle, Grape Circle, Peach Circle		Sect. 6.2.9			5%	X		X	
	Phase 1B Pipelines- Highway 20 and Foothill Ave.	Sect. 6.3.1	Sect 6.2.10		Project (Item 4) Table 19	95%	X		X	

Notes: **(1)** Completed Reports by SWRCB and USDA meeting guidelines and outlies per grant and loan programs

(**2**) Specific projects impacts and mitigations detailed as per NEPA and CEQA guidelines, including NODs

(3) Percent complete is as of September 2025. Phase 1A projects (not including the WTP DAF Pilot Plant and including the Pluth Tank, High Valley Pump Station, and WTP EQ Tank) P&S % complete to be progressed 90% under current TA Grant

Appendix B

Biological Resources Assessment

BIOLOGICAL RESOURCES ASSESSMENT



Clearlake Oaks County Water District

Water Infrastructure and Rehabilitation Project

Lake County, CA |January 2026

BIOLOGICAL RESOURCES ASSESSMENT

Clearlake Oaks County Water District

Water Infrastructure and Rehabilitation Project

Lake County, CA | January 2026

Prepared For:

Clearlake Oaks Water District
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Table of Contents

Section 1 | Introduction 3
1.1 Purpose of Assessment 3
1.2 Project Location 3
1.3 Project Description 3
1.3.1 Equalization Tank Improvements 7
1.3.2 High Valley Tank and Booster Station 7
1.3.3 Shady Lane Tank and Booster Station 7
1.3.4 Paradise Tank THM Reduction Piping 10
1.3.5 Highway 20 Water Line 10
1.3.6 High Priority Water Mains 10
1.3.7 Pressure Reducing Valves (PRV) 11
Section 2 | Regulatory Setting 12
2.1.1 Special-Status Species Regulations 12
2.1.2 Water Resource Protection 13
Section 3 | Methods 15
3.1 Preliminary Data Gathering and Research 15
3.2 Field Surveys 15
3.3 Mapping and Other Analyses 15
Section 4 | Results 17
4.1 Environmental Setting 17
4.2 Vegetation Communities and Wildlife 17
4.3 Critical Habitat and Special-status Habitat 18
4.4 Habitat Plans, Fisheries, and Wildlife Corridors 18
4.5 Listed Species And Other Special-Status Species 19
4.5.1 Reported Occurrences of Listed Species and Other Special-status Species 19
4.5.2 Listed Species or Special-status Species Observed During Field Survey 21
4.5.3 Potential for Listed Species or Special-status Species to Occur in the Proposed Project improvement Areas 22
4.6 Potentially-Jurisdictional Water Resources 22
Section 5 | Impact Analyses And Mitigation Measures 24
5.1 Potential Direct / Indirect Adverse Effects Upon Special-status Species 24
5.1.1 Recommended Mitigation Measures 25
5.2 Potential Impacts to SEnSitive Natural Communities 25
5.2.1 Recommended Mitigation Measures 25
5.3 Potential Impacts to Jurisdictional Aquatic Resources 26
5.3.1 Recommended Mitigation Measures 26
5.4 Potential Impacts to Wildlife Movement, Corridors, etc. 26
5.4.1 Recommended Mitigation Measures 27
5.5 Potential Conflicts with Ordinances, Habitat Conservation Plans, etc. 27
5.5.1 Recommended Mitigation Measures 27

Section 6 | References 28
Section 7 | Qualifications of Surveyors and Authors 29

List of Figures

Figure 1: Regional Location 4
Figure 2: Site and Vicinity 5
Figure 3: Aerial Overview 6
Figure 4: High Valley Tank Site Improvement Plan 8
Figure 5: Shady Lane Tank Site Improvement Plan 9
Figure 6: National Wetland Inventory 23

List of Attachments

Attachment A Database Queries
Attachment B Site Photos

Section 1 | Introduction

1.1 PURPOSE OF ASSESSMENT

This assessment provides information about the biological resources within the Proposed Project improvement areas, the regulatory environment affecting such resources, any potential Project-related impacts upon these resources, and finally, to identify mitigation measures and other recommendations to reduce the significance of these impacts.

1.2 PROJECT LOCATION

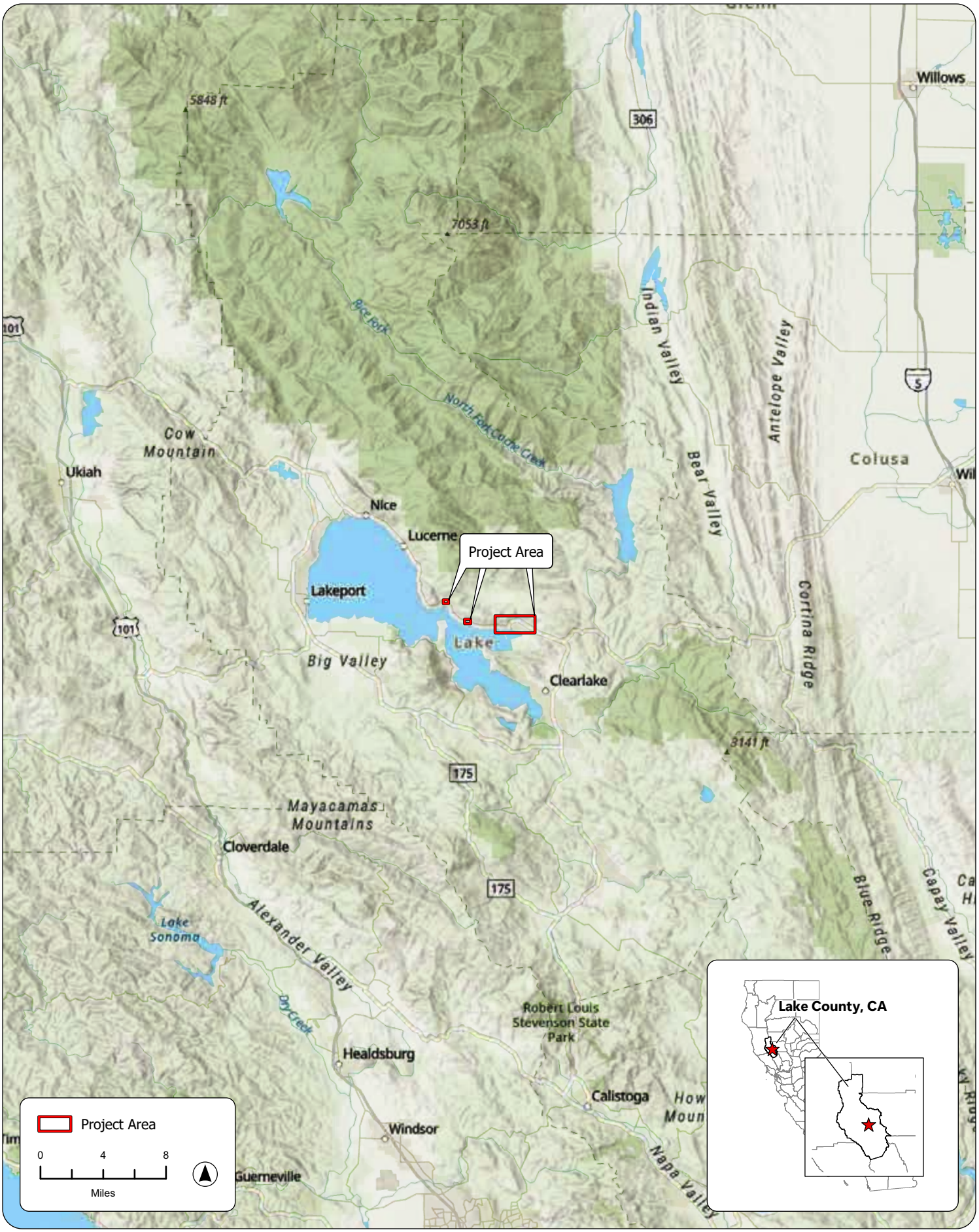
The Clearlake Oaks County Water District (CLOCWD or District) Water Infrastructure and Rehabilitation Project (Proposed Project) involves improvements to various components of the water distribution system, including the water treatment plant (WTP), located at 12952 CA-20, Clearlake Oaks, CA 95423 and within the distribution pipelines, storage tanks, and associated pump stations in and around the community of Clearlake Oaks in Lake County, California adjacent to Clear Lake. The improvement areas are located in Sections 30-33 of Township 14 North, Range 7 West and Sections 21, 29-34, and 36 of Township 14 North, Range 8 West as depicted on the Mount Diablo Principal Meridian U.S. Geological Survey (USGS) 7.5' Clearlake Oaks quadrangle map and Section 21 of Township 14 North, Range 8 West as depicted on the Mount Diablo Principal Meridian USGS 7.5' Lucerne quadrangle map. **Figure 1** and **Figure 2** show the location of the various improvements included within the Proposed Project.

1.3 PROJECT DESCRIPTION

The District proposes to upgrade or replace existing water infrastructure; the components of the Proposed Project are described in detail within the Amended Water Master Plan and Engineering Report and shown on **Figure 3**. The majority of the Proposed Project would take place within existing components and will not require new ground disturbance. The following components of the Proposed Project require ground disturbance and are analyzed in this assessment:

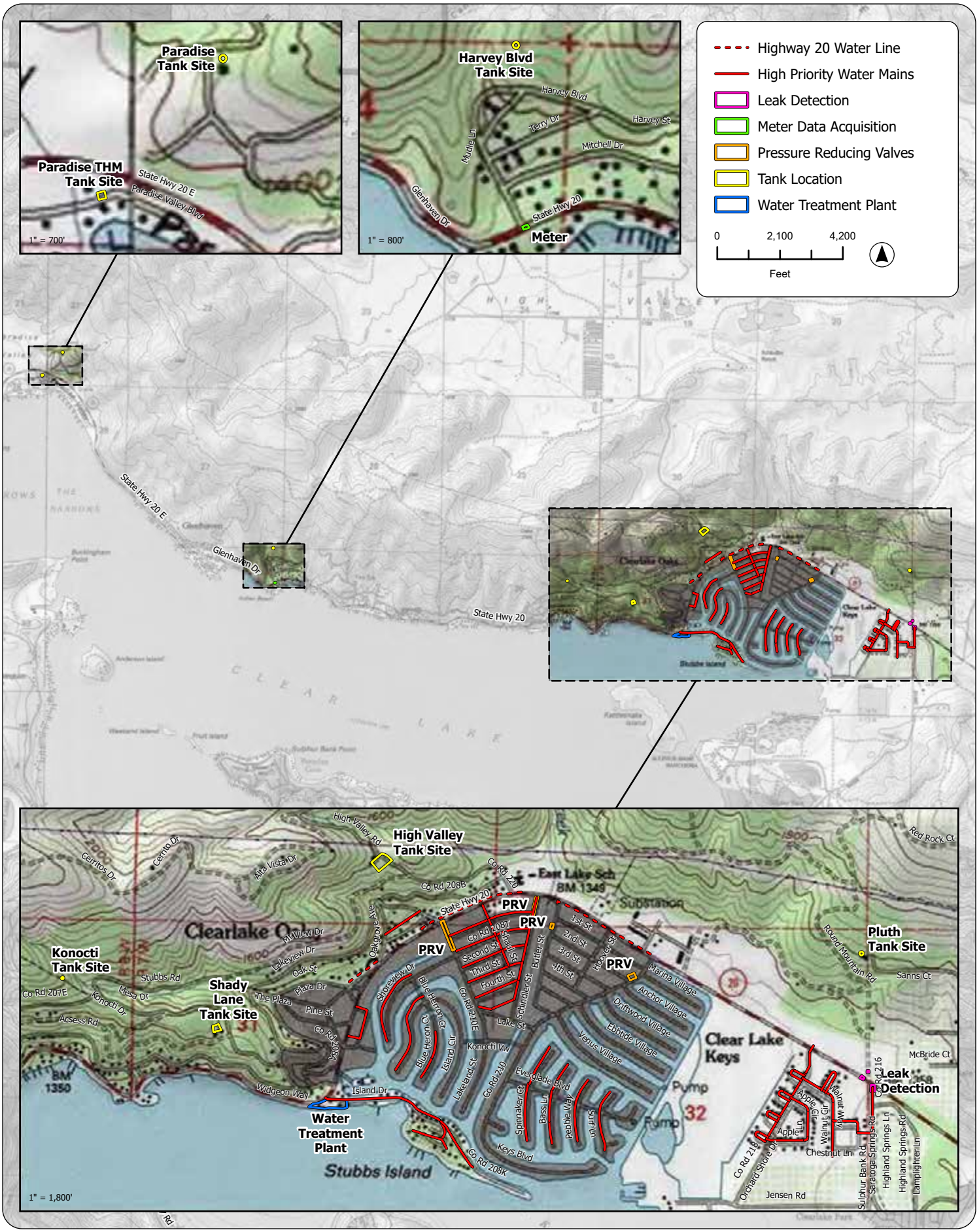
- Equalization Tank Improvements
- High Valley Tank and Booster Station
- Paradise Tank THM Reduction Piping
- Highway 20 Water Line
- High Priority Water Mains and
- Pressure Reducing Valves.

Construction of the Proposed Project would last approximately 18 months, with a tentative start date of May 1, 2027. Some of the work would be completed simultaneously, but the majority of the construction would be staggered.



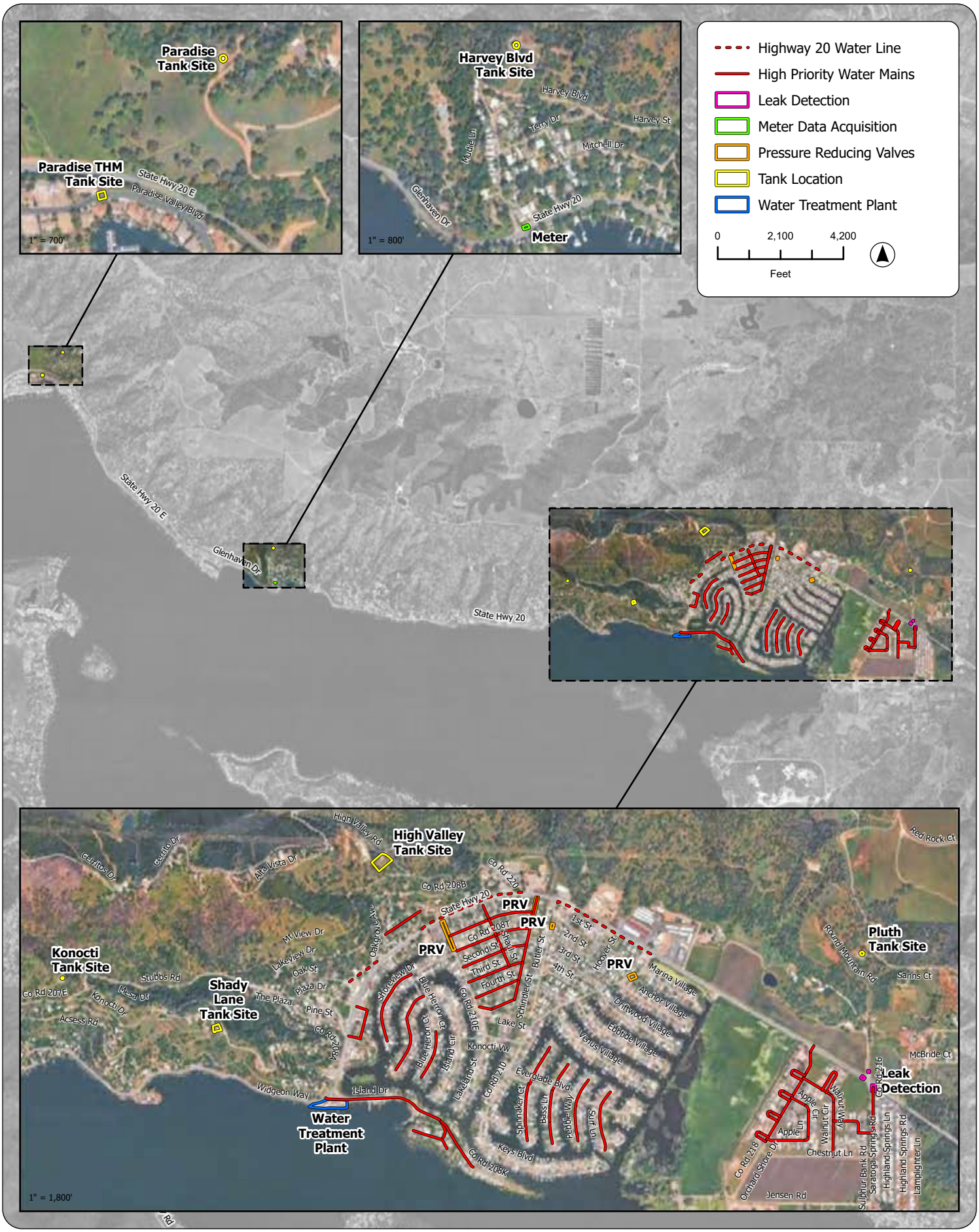
SOURCE: ESRI, 2026; Acorn Environmental, 1/21/2026

Figure 1
Regional Location



SOURCE: "Lucerene, CA" & "Clearlake Oaks, CA" USGS 7.5 Minute Topographic Quadrangles, T14N R7W & T14N R8W, Sections 21, 29, 30, 31, 32, 33, 34, Mt. Diablo Baseline & Meridian; ESRI, 2026; Acorn Environmental, 1/21/2026

Figure 2
Site and Vicinity



SOURCE: ESRI, 2026; Google Earth Aerial Photograph, 5/2024; Acorn Environmental, 1/21/2026

Figure 3
Aerial Overview

1.3.1 Equalization Tank Improvements

The existing temporary backwash tanks and associated piping on the east side of the WTP needs to be replaced because the tanks have reached the end of their life expectancy. Additionally, the replacement is needed to increase source capacity and water production rates at the WTP by allowing backwash operations to occur at any time when needed by operators. This improvement would allow staff to control the rate of discharge into the sanitary sewer thereby minimizing related disruptions to downstream sewer pump stations, the collection system pipelines, and the wastewater treatment plant (WWTP) especially during rainfall events when the wastewater treatment infrastructure is additionally stressed by stormwater inflow and infiltration. Improvements include:

- Relocation of the existing temporary holding containers;
- Installation of piping for backwash flows and tank drainages; and
- Installation of two new 30,000-gallon, open-top, bolted steel tanks and application of tank coatings on the east side of the WTP.

There would be approximately 2,000 square feet of ground disturbance up to 36 inches deep for the two tanks, and 140 feet of yard piping in previously disturbed areas. For a detailed description of this proposed project see Sections 5.2.5 and 6.2.2 of the Amended WMP.

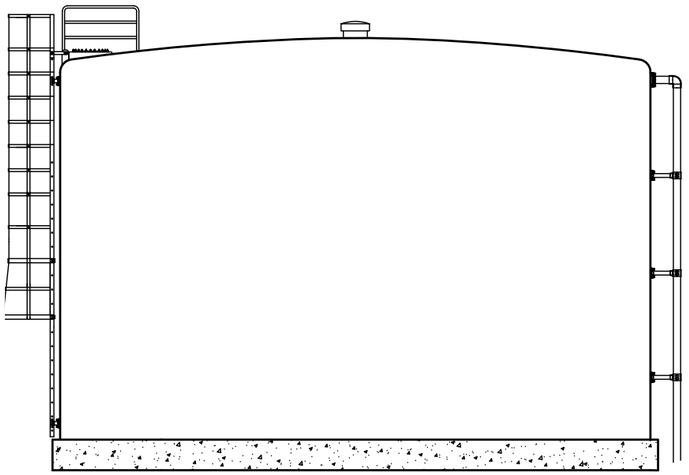
1.3.2 High Valley Tank and Booster Station

The District currently owns and operates an existing 20 hp booster pump within the High Valley Tank Site. The site previously contained two water storage tanks which have since been removed due to structural deficiencies, leaving behind an empty, graded lot. The Proposed Project includes the construction of a 180,000-gallon steel tank, new booster pump station and pump station bypass control valve as shown on **Figure 4**. The installation of a new booster pump station is needed to facilitate water supply for diurnal flows and to improve fire flow capacities and the installation of a welded steel water storage tank is needed to increase water storage. After the relocation of the pump station the 6 inch pipe would be removed, along with 120 linear feet of fence and posts. The building footprint would measure approximately 34 feet by 12 feet and also house three VFD panels, a general PLC panel, power panel, transformer and lighting panel, magnetic flow meter, discharge piping, and fittings.

Other site improvements would consist of bypass piping around the tank, pump bypass valving, site paving, site drainage, upgraded PG&E service to 480V, and a retaining wall to hold back debris from the eroding hillside. The bypass piping would require up to 54 inches of excavation below finished grade. The paved area would be approximately 6,000 square feet with minimal cut of the east side of the property and fill on the west side of the property. The retaining wall would be located along the eastern side of the property and be approximately 10 feet tall. For a detailed description of this proposed project see Sections 5.4.2 and 6.1.4 of the Amended WMP.

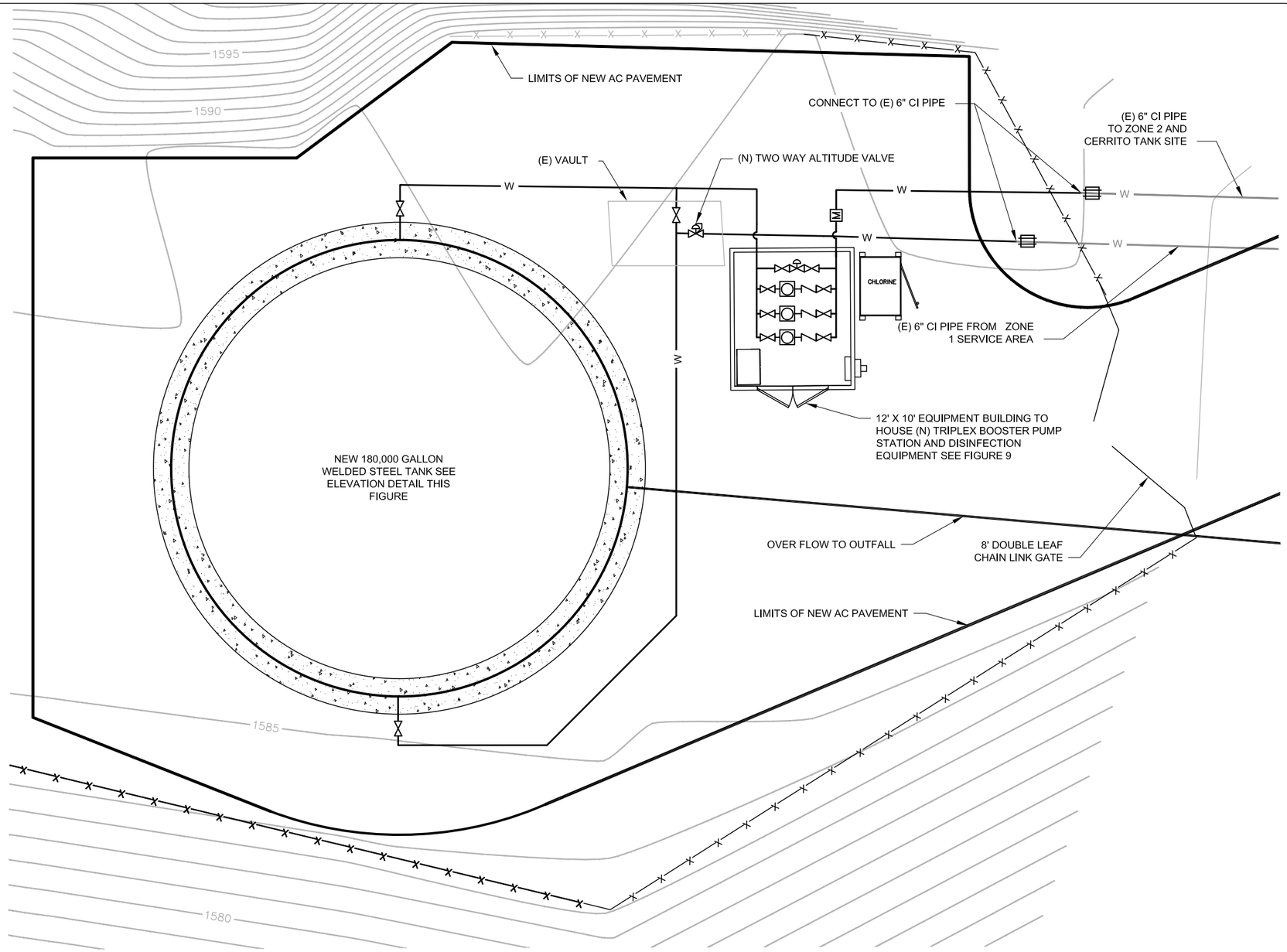
1.3.3 Shady Lane Tank and Booster Station

The District currently owns and operates an existing 102,204-gallon steel tank within the Shady Lane Tank Site. The Proposed Project includes construction of outdated and aging booster pumps and associated piping, pump house, electrical work, equipment pad, and a portable generator. The existing pump would be removed and replaced with two more efficient 20 hp pumps and includes the replacement of the magnetic flow meter as shown on **Figure 5**. In addition, the Proposed Project includes upgrades to the



WELDED STEEL TANK ELEVATION

SCALE: NTS



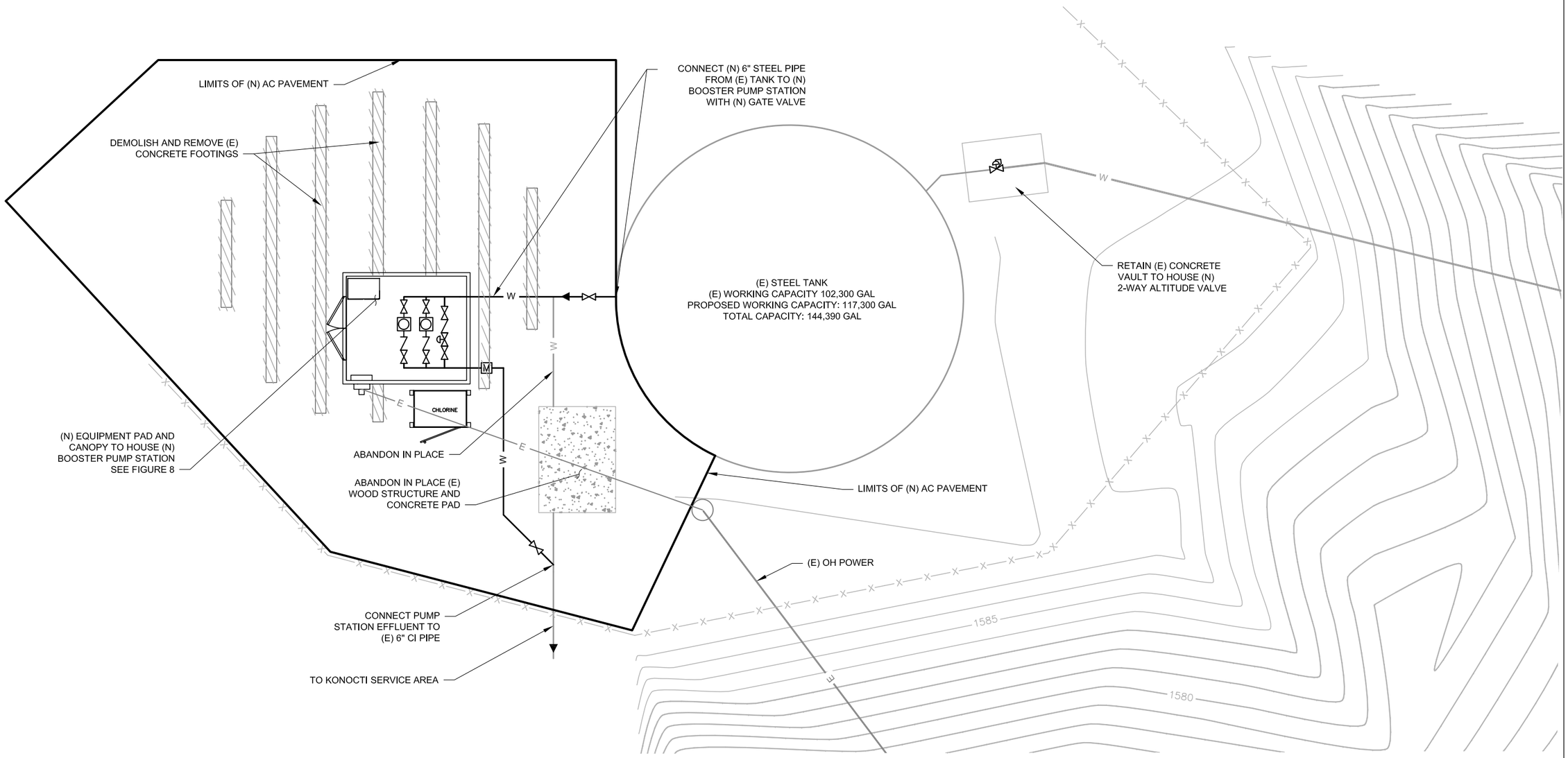
GATE VALVE
MAGNETIC FLOW METER
ALTITUDE VALVE
TURBINE PUMP
FCA
CHECK VALVE
SURGE RELIEF VALVE
(N) FENCE
(E) FENCE

1"=10' 0 10' 20'

1"=40' 0 40' 80'

SOURCE: MC Engineering, 9/2025; Acorn Environmental, 1/21/2026

Figure 4
High Valley Tank Site Improvement Plan



SITE PLAN

SCALE: 1" = 10'

SOURCE: MC Engineering, 9/2025; Acorn Environmental, 1/21/2026

Figure 5
Shady Lane Tank Site Improvement Plan

exterior and interior of the tank. These upgrades are needed to extend the service life of critical infrastructure, to provide water for MDD and to protect drinking water quality.

The project would include installation of sacrificial a cathodic protection system, recoating interior and exterior tank surfaces along with renovation and/or repair/replacement of corroded appurtenances and upgrades that include the following:

- Replace center vent with AWWA compliant mushroom vent;
- Replace the interior ladder;
- Replace the circular hatch with a rectangular hatch;
- Install a self-closing gate; and
- Installation of 6 inch bypass piping to allow continued service to the Konocti pressure zone during tank rehabilitation.

For a detailed description of this proposed project see Sections 5.4.1, 5.4.7, 6.1.3, and 6.1.5 of the Amended WMP

1.3.4 Paradise Tank THM Reduction Piping

The Proposed Project consists of hydraulicly separating the west side of the Paradise Cove community from the east side such that all flows entering the west side are downstream of the THM removal equipment within the Paradise tank. These improvements consist of rehabilitating an existing 6-inch pipeline between the Paradise Valley Boulevard and the Paradise Tank and modifying piping connections. Off of Paradise Valley Boulevard (labeled as Paradise THM Tank Site on Figure 3) disturbance will include trenching up to 20 feet by 4 feet and would be excavated up to 4 feet to install the necessary components. The Paradise tank site would have two open trenches approximately 30 feet by 2 feet and 20 feet by 4 feet would be excavated up to 4 feet deep to install the necessary components. For a detailed description of this proposed project see Sections 5.3.1.1 and 6.1.2 of the Amended WMP.

1.3.5 Highway 20 Water Line

The Proposed Project includes removing and replacing the 4 inch pipeline with the addition of a larger capacity pipe to provide adequate peak flows and decrease water loss be reducing the pressure in the Keys. Currently, a 4 inch line restricts flow to the Keys and to the Pluth Tanks. Open trenching would be used for all pipeline replacements with a maximum depth of 4.5 feet and width of 4 feet. For a detailed description of this proposed project see Sections 4.3.1, 5.3.1, and 6.2.10 of the Amended WMP.

1.3.6 High Priority Water Mains

The Proposed Project includes deficient, leaking, and undersized water mains because they pose health and safety issues and risks relating to potential drinking water contamination. The high priority water mains are located under the following streets:

- 1st Street through 6th Street
- Lake Street and Schindler Street
- Orchard Shore Drive
- Sulphur Bank
- Shoreview Drive
- Blue Heron Court
- Short Street
- Island Drive
- Oak Knoll
- Orchard Shores Drive
- Apple Lane
- Lemon Circle

- Walnut Circle
- Chestnut Circle
- Peach Circle
- Center Way
- Island Circle (West)
- Hickory Lane
- Spinnaker Court
- Bass Lane
- Surf Lane
- Plum Circle
- Grape Circle
- Pebble Way

The pipeline replacements consist of construction and installation of 6-, 8-, 10-, and 12-inch mains to be constructed with C900 PVC-DR 14 pipe, air relief valves, hydrants, and possible PRV's. The project would also include the construction of either single or double ¾-inch or 1-inch house services, which would have the following services installed during construction: service saddle, polyethylene pipe, valves and meter boxes. All pipeline replacements would be open trenches with a maximum depth of 4.5 feet and maximum width of 4 feet. For a detailed description of this proposed project see Sections 5.3.1 and 6.1.1 of the Amended WMP.

1.3.7 Pressure Reducing Valves (PRV)

The Proposed Project includes installation of six PRV's (four for the Keys and two for Orchard Shores) with the intent of lowering system pressures as a way of reducing water loss as shown in **Figure 3**. In order to demonstrate the potential loss reduction, one PRV would be installed initially, and the results would be verified before proceeding with the additional PRV installations. In addition, when the supply pressure is reduced, it will limit fire flow capacity and resulting residual pressures. Due to this reduction, bypass valves would be included to avoid the limit to fire flow capacity and residual pressures, and the availability of lake water. The installation would include approximately 8 to 10 feet by 7 to 9 feet of excavation, with a depth of 6 feet at each of the six locations. For a detailed description of this proposed project see Section 4.3.4.1 of the Amended WMP

Section 2 | Regulatory Setting

The following section summarizes some applicable regulations of biological resources on real property in California.

2.1.1 Special-Status Species Regulations

The United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service implement the Federal Endangered Species Act of 1973 (FESA) (16 USC §1531 et seq.). Threatened and endangered species on the federal list (50 CFR §17.11, 17.12) are protected from "take" (direct or indirect harm), unless a FESA Section 10 Permit is granted or a FESA Section 7 Biological Opinion with incidental take provisions is rendered. Pursuant to the requirements of FESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the Proposed Project improvement areas and determine whether the proposed project will have a potentially significant impact upon such species. Under FESA, habitat loss is considered to be an impact to the species. In addition, the agency is required to determine whether the project is likely to jeopardize the continued existence of any species proposed to be listed under FESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 USC §1536[3], [4]). Therefore, project-related impacts to these species or their habitats would be considered significant and would require mitigation. Species that are candidates for listing are not protected under FESA; however, USFWS advises that a candidate species could be elevated to listed status at any time, and therefore, applicants should regard these species with special consideration.

The California Endangered Species Act of 1970 (CESA) (California Fish and Game Code §2050 et seq., and CCR Title 14, §670.2, 670.51) prohibits "take" (defined as hunt, pursue, catch, capture, or kill) of species listed under CESA. A CESA permit must be obtained if a project will result in take of listed species, either during construction or over the life of the project. Section 2081 establishes an incidental take permit program for state-listed species. Under CESA, California Department of Fish and Wildlife (CDFW) has the responsibility for maintaining a list of threatened and endangered species designated under state law (CFG Code 2070). CDFW also maintains lists of species of special concern, which serve as "watch lists." Pursuant to requirements of CESA, an agency reviewing proposed projects within its jurisdiction must determine whether any state-listed species may be present in the Proposed Project improvement areas and determine whether the proposed project will have a potentially significant impact upon such species. Project-related impacts to species on the CESA list would be considered significant and would require mitigation.

California Fish and Game Code Sections 4700, 5050, and 5515 designates certain mammal, amphibian, and reptile species "fully protected", making it unlawful to take, possess, or destroy these species except under issuance of a specific permit. The California Native Plant Protection Act of 1977 (CFG Code §1900 et seq.) requires CDFW to establish criteria for determining if a species or variety of native plant is endangered or rare. Section 19131 of the code requires that landowners notify CDFW at least 10 days prior to initiating activities that will destroy a listed plant to allow the salvage of plant material.

Many bird species, especially those that are breeding, migratory, or of limited distribution, are protected under federal and state regulations. Under the Migratory Bird Treaty Act of 1918 (16 USC §703-711),

migratory bird species and their nests and eggs that are on the federal list (50 CFR §10.13) are protected from injury or death, and project-related disturbances must be reduced or eliminated during the nesting cycle. California Fish and Game Code (§3503, 3503.5, and 3800) prohibits the possession, incidental take, or needless destruction of any bird nests or eggs. Fish and Game Code §3511 designates certain bird species "fully protected", making it unlawful to take, possess, or destroy these species except under issuance of a specific permit. The Bald and Golden Eagle Protection Act (16 USC §668) specifically protects bald and golden eagles from harm or trade in parts of these species.

California Environmental Quality Act (CEQA) (Public Resources Code §15380) defines "rare" in a broader sense than the definitions of threatened, endangered, or fully protected. Under the CEQA definition, CDFW can request additional consideration of species not otherwise protected. CEQA requires that the impacts of a project upon environmental resources must be analyzed and assessed using criteria determined by the lead agency. Sensitive species that would qualify for listing but are not currently listed may be afforded protection under CEQA. The CEQA Guidelines (§15065) require that a substantial reduction in numbers of a rare or endangered species be considered a significant effect. CEQA Guidelines (§15380) provide for assessment of unlisted species as rare or endangered under CEQA if the species can be shown to meet the criteria for listing. Plant species on the California Native Plant Society (CNPS) Lists 1A, 1B, or 2 are typically considered rare under CEQA. California "Species of Special Concern" is a category conferred by CDFW on those species that are indicators of regional habitat changes or are considered potential future protected species. While they do not have statutory protection, Species of Special Concern are typically considered rare under CEQA and thereby warrant specific protection measures.

2.1.2 Water Resource Protection

Real property that contains water resources are subject to various federal and state regulations and activities occurring in these water resources may require permits, licenses, variances, or similar authorization from federal, state and local agencies, as described next.

The Federal Water Pollution Control Act Amendments of 1972 (as amended), commonly known as the Clean Water Act (CWA), established the basic structure for regulating discharges of pollutants into "waters of the United States". Waters of the US includes essentially all surface waters, all interstate waters and their tributaries, all impoundments of these waters, and all wetlands adjacent to these waters. CWA Section 404 requires approval prior to dredging or discharging fill material into any waters of the US, especially wetlands. The permitting program is designed to minimize impacts to waters of the US, and when impacts cannot be avoided, requires compensatory mitigation. The US Army Corps of Engineers (USACE) is responsible for administering Section 404 regulations. Substantial impacts to jurisdictional wetlands may require an Individual Permit. Small-scale projects may require only a Nationwide Permit, which typically has an expedited process compared to the Individual Permit process. Mitigation of wetland impacts is required as a condition of the CWA Section 404 Permit and may include on-site preservation, restoration, enhancement and/or off-site restoration or enhancement. The characteristics of the restored or enhanced wetlands must be equal to or better than those of the affected wetlands to achieve no net loss of wetlands.

Under CWA Section 401, every applicant for a federal permit or license for any activity which may result in a discharge to a water body must obtain State Water Quality Certification that the proposed activity will comply with State water quality standards. The California State Water Resources Control Board is responsible for administering CWA Section 401 regulations.

Section 10 of the Rivers and Harbors Act of 1899 requires approval from USACE prior to the commencement of any work in or over navigable Waters of the US, or which affects the course, location, condition or capacity of such waters. Navigable waters of the United States are defined as waters that have been used in the past, are now used, or are susceptible to use, as a means to transport interstate or foreign commerce up to the head of navigation. Rivers and Harbors Act Section 10 permits are required for construction activities in these waters.

California Fish and Game Code (§1601 - 1607) protects fishery resources by regulating "any activity that may substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake." The limit of CDFW jurisdiction is subject to the judgment of the Department; currently, this jurisdiction is interpreted to be the "stream zone," defined as "that portion of the stream channel that restricts lateral movement of water" and delineated at "the top of the bank or the outer edge of any riparian vegetation, whichever is more landward." CDFW reviews the proposed actions and, if necessary, submits to the applicant a proposal for measures to protect affected fish and wildlife resources. The final proposal that is mutually agreed upon by the CDFW and the applicant is the Lake or Streambed Alteration Agreement.

For construction projects that disturb one or more acres of soil, the landowner or developer must obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 2009-0009-DWQ).

Section 3 | Methods

3.1 PRELIMINARY DATA GATHERING AND RESEARCH

Prior to conducting the field survey, the following information sources were reviewed:

- Previous biological resource studies pertaining to the Proposed Project improvement areas or vicinity
- United States Geologic Service (USGS) 7.5 degree-minute topographic quadrangles of the Proposed Project improvement areas and vicinity
- Aerial photography of the Proposed Project improvement areas
- CNDDB, electronically updated monthly by subscription
- A query of the California Native Plant Society's database *Inventory of Rare and Endangered Plants of California* (online edition)
- USFWS National Wetlands Inventory (NWI) mapper
- USFWS species list (IPaC Trust Resources Report)

3.2 FIELD SURVEYS

Consulting biologist Dr. Geo Graening conducted a biological field assessment on December 29, 2025, and collected data on wildlife and plant species present, as well as habitat types and jurisdictional waters. Variable-intensity pedestrian surveys were performed. Fauna and flora observed were recorded in a field notebook and identified to the lowest possible taxon. Survey efforts emphasized the search for special-status species that had documented occurrences in the CNDDB within the vicinity of the Proposed Project improvement areas. Habitat types occurring in the Proposed Project improvement areas were mapped on aerial photographs and information on habitat conditions and the suitability of habitats to support listed species was also recorded. The Proposed Project improvement areas were also assessed for the presence of potentially-jurisdictional water features, including riparian zones, isolated wetlands and vernal pools, and other biologically-sensitive aquatic habitats.

3.3 MAPPING AND OTHER ANALYSES

Locations of species' occurrences and habitat boundaries within the Proposed Project improvement areas were recorded on color aerial photographs and then digitized to produce the habitat maps. The boundaries of potentially jurisdictional water resources within the Proposed Project improvement areas were identified and measured in the field and similarly digitized to calculate acreage and to produce informal delineation maps. Geographic analyses were performed using geographical information system software (ArcGIS 10, ESRI, Inc.). Vegetation communities (assemblages of plant species growing in an area of similar biological and environmental factors), were classified by Vegetation Series (distinctive associations of plants, described by dominant species and particular environmental setting) using the CNPS Vegetation Classification system (Sawyer and Keeler-Wolf, 1995). Wetlands and other aquatic habitats were classified using USFWS National Wetlands Inventory Classification System for Wetland and Deepwater Habitats, or "Cowardin class" (Cowardin et al., 1979).

Informal wetland delineation methods consisted of an abbreviated, visual assessment of the three requisite wetland parameters (hydrophytic vegetation, hydric soils, hydrologic regime) defined in the U.S. Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987).

Section 4 | Results

4.1 ENVIRONMENTAL SETTING

The Proposed Project improvement areas are within the Inner North Coast Range geographic subregion, which is contained within the Northwestern California geographic subdivision, which occurs within the California Floristic Province (Baldwin et al., 2012). This region has a Mediterranean-type climate, and the Proposed Project improvement areas are in a thermal belt. The Proposed Project improvement areas and vicinity are in Climate Zone 2b "Warmer-Summer Intermountain Climate," characterized by milder summers and longer and colder winters than in the Central Valley (Sunset, 2025). The topography of the Proposed Project improvement areas is variable and consists of a relatively flat plain sloping towards the shore of Clear Lake and several terraced hill slopes that contain the water tanks. The elevation ranges from approximately 1,320 feet above mean sea level at lake level to up to 1,800 feet for the tank sites. The land uses of the Proposed Project improvement areas are industrial, commercial, rural residential, urban residential, agricultural, and recreation.

4.2 VEGETATION COMMUNITIES AND WILDLIFE

The Proposed Project improvement areas are entirely ruderal or developed in nature and described individually below. No natural habitats are located within the Proposed Project improvement areas.

Equalization Tank Improvements
Areas within the fenced WTP compound are devoid of vegetation.

High Valley Tank and Booster Station
The fenced tank compound has been graded flat and armored with gravel. There is some vegetated cover of non-native annual grasses and weedy forbs, and there is a clump of invasive giant reed in the front driveway.

Shady Lane Tank and Booster Station
The area west of the existing tank has been graded flat and armored with gravel. Concrete footings are located in the gravel area.

Paradise Tank THM Reduction Piping
These areas include roadway, which is paved with asphalt, or inside the fenced tank compound, which has been graded flat and armored with gravel. There is some vegetated cover of non-native annual grasses and weedy forbs.

Highway 20 Water Line
These areas include roadway, which is paved with asphalt, or in the road shoulder, which consists of imported gravel road base or bare ground. There is some vegetated cover of non-native annual grasses and weedy forbs.

High Priority Water Mains and Pressure Reducing Valves.
These areas include roadway, which is paved with asphalt or concrete. These areas are devoid of vegetation except for weeds which grow through pavement cracks. Adjacent to these project areas are sidewalks and residential lawns and other landscaping.

The urbanized and industrial nature of the water facilities discourages most wildlife occupation, but urbanized animals do occur, killdeer (*Charadrius vociferus*), American crow (*Corvus brachyrhynchos*), and common songbirds, as well as ants and fence lizard (*Sceloporus occidentalis*).

4.3 CRITICAL HABITAT AND SPECIAL-STATUS HABITAT

No critical habitat for any federally-listed species occurs within the Proposed Project improvement areas. The CNDDB reported no special-status habitats within the Proposed Project improvement areas. During the biological field survey, no special-status habitats were detected within Proposed Project improvement areas. However, there are special-status habitats in the vicinity: Clear Lake and its adjacent marshes, channels, and keys.

4.4 HABITAT PLANS, FISHERIES, AND WILDLIFE CORRIDORS

Wildlife movement corridors link remaining areas of functional wildlife habitat that are separated primarily by human disturbance, but natural barriers such as rugged terrain and abrupt changes in vegetation cover are also possible. Wilderness and open lands have been fragmented by urbanization, which can disrupt migratory species and separate interbreeding populations. Corridors allow migratory movements and act as links between these separated populations.

No wildlife corridors or fishery resources exist within the Proposed Project improvement areas. However, wildlife corridors exist nearby in the marshlands of Clear Lake, and Clear Lake contains important fishery resources. The Proposed Project improvement areas are not located within any adopted Habitat Conservation Plan or Natural Community Conservation Plan.

4.5 LISTED SPECIES AND OTHER SPECIAL-STATUS SPECIES

For the purposes of this assessment, "special status" is defined to be species that are of management concern to state or federal natural resource agencies, and include those species that are:

- Listed as endangered, threatened, proposed, or candidate for listing under the Federal Endangered Species Act;
- Listed as endangered, threatened, rare, or proposed for listing, under the California Endangered Species Act of 1970;
- Designated as endangered or rare, pursuant to California Fish and Game Code (§1901);
- Designated as fully protected, pursuant to California Fish and Game Code (§3511, §4700, or §5050);
- Designated as a species of special concern by CDFW;
- Plants considered to be rare, threatened or endangered in California by the California Native Plant Society (CNPS); this consists of species on Lists 1A, 1B, and 2 of the CNPS Ranking System; or
- Plants listed as rare under the California Native Plant Protection Act.

4.5.1 Reported Occurrences of Listed Species and Other Special-status Species

A list of special-status plant and animal species that have occurred within the Proposed Project improvement areas and vicinity was compiled based upon the following:

- Any previous and readily-available biological resource studies pertaining to the Proposed Project improvement areas;
- Informal consultation with USFWS by generating an electronic Species List (Information for Planning and Conservation website at https://ecos.fws.gov/ipac/); and
- A spatial query of the CNDDB
- A query of the California Native Plant Society's database Inventory of Rare and Endangered Plants of California (online edition).

The CNDDB was queried and any reported occurrences of special-status species were plotted in relation to the Proposed Project improvement areas boundary using GIS software. The CNDDB reported no special-status species occurrences specifically within the Proposed Project improvement areas, but it did report the following species occurrences in the vicinity:

Eel-grass pondweed (*Potamogeton zosteriformis*)

The location accuracy = 5 miles. The CNDDB species occurrence details are: "*CLEAR LAKE NEAR WYGALS RESORT AT SOUTH END OF LAKE. EXACT LOCATION UNKNOWN. MAPPED BY CNDDB IN GENERAL VICINITY OF SOUTH END OF CLEAR LAKE. SHALLOW WATER. ONLY SOURCE OF INFORMATION FOR THIS SITE IS 1945 COLLECTION BY BAKER. NEEDS FIELDWORK*."

Townsend's big-eared bat (*Corynorhinus townsendii*)

The location accuracy = 1 mile. The CNDDB species occurrence details are: "*1 MI NE OF SULPHUR*

BANK MINE, ABOUT 10 MI SE LUCERNE. EXACT LOCATION UNKNOWN. MAPPED TO PROVIDED LOCALITY OF 1 MI NE OF SULPHUR BANK MINE, 10 MI SE OF LUCERN. 1945:1 BAT COLLECTED ON 2 DEC (MVZ #104356). 1948: 4 BATS COLLECTED ON 30 SEP & 1 OCT (MVZ #112178-112181). 1949: 2 BATS COLLECTED ON 19 MAR & 3 BATS COLLECTED ON 15 APR (MVZ #112908-112912). LISTED AS KNOWN MATERNITY ROOST IN 1986 REPORT."

Pallid bat (*Antrozous pallidus*)

The location accuracy = 1 mile. The CNDDB species occurrence details are: "1 MI NE OF SULPHUR BANK MINE; 10 MI SE LUCERNE. MAPPED ACCORDING TO LAT/LONG COORDINATES GIVEN IN MANIS, WITH UNCERTAINTY OF 1251.8136 M. 1 MALE SPECIMEN COLLECTED BY SETH B. BENSON ON 2 DEC 1945, MVZ #104357.

Osprey (*Pandion haliaetus*)

The location accuracy = 1/5 mile. The CNDDB species occurrence details are: "*0.6 MILE SOUTH OF HIGHWAY 20, 1.25 MILES DIRECTLY EAST OF RATTLESNAKE ISLAND, EAST SIDE OF CLEAR LAKE. MAPPED ACCCORDING TO LOCATION ON PROVIDED MAP. HABITAT AT CLEAR LAKE: SALIX, QUERCUS, AND OTHER HARDWOOD SPECIES. NEST STRUCTURES USUALLY DEAD. SURROUNDING LAND USE IS ORCHARDS, VINEYARDS, RESIDENTIAL, WATER RECREATION & FISHING. 1 NEST OCCUPIED AT THIS LOCATION DURING JULY OF 1992 AND 1993. CLEAR LAKE SURVEY OBSERVED 24 ADULTS & 11 JUVENILES DURING JULY 1992, AND 42 ADULTS & 17 JUVENILES DURING JULY 1993. POSSIBLE THREATS: LOSS OF SUITABLE NESTING LOCATIONS & AG CHEMICALS*."

Konocti manzanita (*Arctostaphylos manzanita ssp. elegans*)

The location accuracy = 1 mile. The CNDDB species occurrence details are: "*SULPHUR BANKS. EXACT LOCATION UNKNOWN. MAPPED AS BEST GUESS BY CNDDB IN GENERAL VICINITY OF SULPHUR BANKS, SULPHUR BANK RIDGE, SULPHUR BANK MINE, AND SULPHUR BANK RANCHERIA. ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1902 BOWMAN COLLECTION. NEEDS FIELDWORK*."

Watershield (*Brasenia schreberi*)

The location accuracy = 1 mile. The CNDDB species occurrence details are: "*SULPHUR BANKS. EXACT LOCATION UNKNOWN. MAPPED AS BEST GUESS BY CNDDB AROUND SULPHUR BANKS BASED ON A 1901 BOWMAN COLLECTION. ONLY SOURCE OF INFORMATION FOR THIS SITE IS A 1901 BOWMAN COLLECTION. NEEDS FIELDWORK*."

Clear Lake hitch (*Lavinia exilicauda chi*)

The location accuracy = non-specific area. The CNDDB species occurrence details are: "*CLEAR LAKE. COLLECTED 9 APR 1961 BY UCB ZOOLOGY 138 CLASS (CAS #72868) AND 8 APR 1962 BY P.R. NEEDHAM, & D.W. SEEGRIST & PARTY (CAS #24033) PARATYPE*."

Brownish dubiraphian riffle beetle (*Dubiraphia brunnescens*)

The location accuracy = non-specific area. The CNDDB species occurrence details are: "*CLEAR LAKE. COLLECTED FROM ROCKY POINT AND NICE, CLEAR LAKE. SHEPARD STATED IT IS ONLY*

KNOWN FROM THE NE SHORE OF CLEAR LAKE, BUT ROCKY PT IS NW. FURTHER, THERE IS ANOTHER ROCKY POINT FAR SE. MAPPED TO ENTIRE LAKE UNTIL BETTER LOCATION GIVEN. INHABITS EXPOSED, WAVE WASHED WILLOW ROOTS. 2 SPECIMENS AT THE CALIFORNIA STATE COLLECTION OF ARTHROPODS (CDFA), COLLECTED BY H. CHANDLER 3 JUL 1946. 2 SPECIMENS COLLECTED 24 JUL 1969. POPULATION HIGH IN 1988 AND STABLE OVER SEVERAL YEARS OF MONITORING."

Clear Lake tule perch (*Hysterocarpus traskii lagunae*)

The location accuracy = non-specific area. The CNDDB species occurrence details are: "*CLEAR LAKE. MAPPED ACROSS THE EXTENT OF THE LAKE. FOUND IN 1873, 1894, 1946, 1948, 1953, 1959, 1961, 1962, 1963, 1964, 1965, 1968, 1969, 1972, 1973, 1976, 1977, 1978, 1979 & 2012. ALSO, A SET OF ELECTROFISHING SURVEYS IN 2014-2015 FOUND H. T. LAGUNAE MADE UP 7% OF THE COUNT OF FISH CAUGHT. HABITAT HAS BEEN IMPACTED BY INTRODUCED FISHES, HISTORIC MINING, RESIDENTIAL DEVELOPMENT, AND AGRICULTURAL RUNOFF.*"

Western ridged mussel (*Gonidea angulata*)

The location accuracy = non-specific area. The CNDDB species occurrence details are: "*CLEAR LAKE. MULTIPLE HISTORICAL COLLECTIONS GIVE LOCALITY ONLY AS "CLEAR LAKE;" 1947 SPECIMEN FROM HORSESHOE BEND ON SE SHORE. 2009 RESURVEY SITE JKH09-009 FROM "ABOUT 2 MI S OF LUCERNE, CA 20 AT MILE MARKER 23.62." COLLECTED PRIOR TO 1909, PRIOR TO APR 1918, AND ON UNKNOWN DATE. 9 COLLECTED ON 29 JUL 1947. LOCALITY LISTED IN INGRAM (1948). NONE FOUND ON 19 JUL 2009.*"

A USFWS species list was generated online using the USFWS' IPaC Trust Resource Report System (see Appendix A). This list is generated using a regional and/or watershed approach and does not necessarily indicate that the Proposed Project improvement areas provide suitable habitat. The following listed species should be considered in the impact assessment:

- California Condor (*Gymnogyps californianus*) Experimental Population, Non-Essential
- Northern Spotted Owl (*Strix occidentalis caurina*) Threatened
- Northwestern Pond Turtle (*Actinemys marmorata*) Proposed Threatened
- Clear Lake Hitch (*Lavinia exilicauda chi*) Proposed Threatened
- Monarch Butterfly (*Danaus plexippus*) Candidate
- Burke's Goldfields (*Lasthenia burkei*) Endangered

Migratory birds should also be considered in the impact assessment.

4.5.2 Listed Species or Special-status Species Observed During Field Survey

During the field survey, no special-status species were detected within the Proposed Project improvement areas or the immediate vicinity.

4.5.3 Potential for Listed Species or Special-status Species to Occur in the Proposed Project improvement Areas

Plants

No special-status plants are expected to occur within the Proposed Project improvement areas because the requisite habitats are not present. Konocti manzanita (Arctostaphylos manzanita ssp. elegans), is a conspicuous shrub that requires volcanic soils, and there are no manzanita plants at all in the Proposed Project improvement areas. Watershield (Brasenia schreberi) and eel-grass pondweed (Potamogeton zosteriformis) are found in freshwater marshes and swamps, and Burke's goldfields (Lasthenia burkei) require vernal pools and wet meadows. The Proposed Project improvement areas are devoid of water resources such as marshes or standing water. Mendocino tarplant (Hemizonia congesta ssp. elegans) requires clay / serpentine soils that do not occur in the Proposed Project improvement areas.

Birds And Bats

The CNDDB reports the following special-status species in the vicinity: osprey (*Pandion haliaetus*), northern spotted owl (*Strix occidentalis caurina*), pallid bat (*Antrozous pallidus*), and Townsend's big-eared bat (*Corynorhinus townsendii*). Trees adjacent to the Proposed Project improvement areas could serve as bat roosting habitat. Northern spotted owl requires mature forest habitat, and has no potential to occur in, or near, the Proposed Project improvement areas.

Aquatic Species

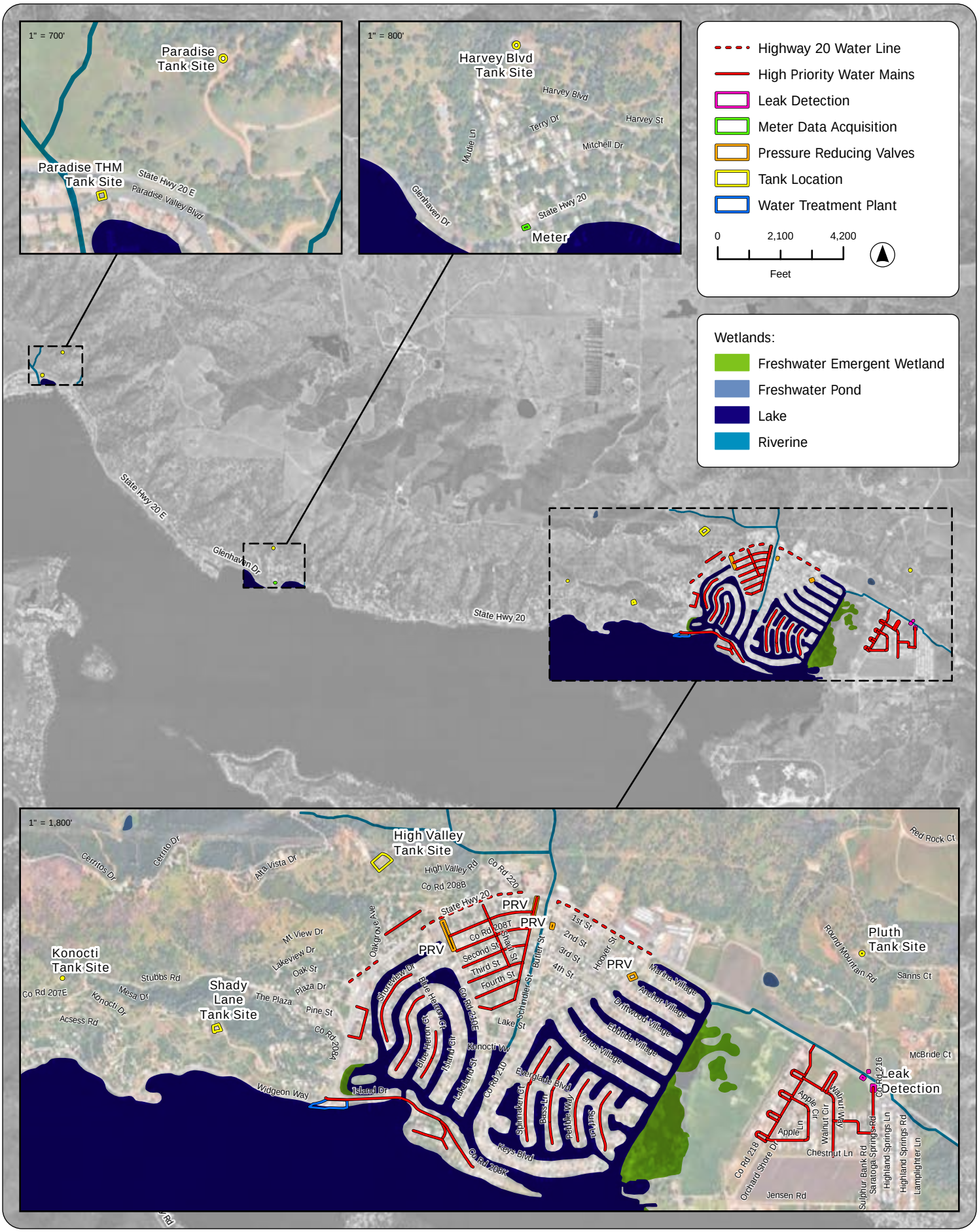
Special-status species occur in Clear Lake and its adjacent marshes; the species reported closest to the Proposed Project improvement areas are Clear Lake hitch, Sacramento perch (*Archoplites interruptus*), Clear Lake prickly sculpin (*Cottus asper*), Clear Lake tule perch (*Hysterocarpus traskii lagunae*), and northwestern pond turtle (*Actinemys marmorata*). However, the Proposed Project improvement areas contain no water resources and will not directly interact with Clear Lake or its tributary waters. It is possible, but improbable, that northwestern pond turtles could migrate from aquatic habitats onto surface streets or fenced compounds.

Other Species

The Proposed Project improvement areas do not contain grasslands, so there is no nectar foraging habitat for Monarch butterfly (*Danaus plexippus*). The biological survey did not detect any host plants, such as milkweeds (*Asclepias* spp.). The Proposed Project improvement areas do not contain overwintering habitat and are not near an overwintering population.

4.6 POTENTIALLY-JURISDICTIONAL WATER RESOURCES

The USFWS National Wetland Inventory reported no water features specifically within the Proposed Project improvement areas, but there are water resources very nearby (**Figure 6**): the shoreline of Clear Lake and the keys of Clearlake Keys; and streams near the tank sites. Field surveys confirmed that the Proposed Project improvement areas do not contain any channels or wetlands.



SOURCE: USFS, 5/7/2025; ESRI, 2026; Google Earth Aerial Photograph, 5/2024; Acorn Environmental, 1/21/2026

Figure 6
National Wetland Inventory

Section 5 | Impact Analyses And Mitigation Measures

This section establishes the impact criteria, then analyzes potential Project-related impacts upon the known biological resources within the Proposed Project improvement areas and then suggests mitigation measures to reduce these impacts to a less-than-significant level.

The significance of impacts to biological resources depends upon the proximity and quality of vegetation communities and wildlife habitats, the presence or absence of special-status species, and the effectiveness of measures implemented to protect these resources from Project-related impacts. As defined by CEQA, the Project would be considered to have a significant adverse impact on biological resources if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a special-status species in local or regional plans, policies, or regulations, or by USFWS or CDFW
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by USFWS or CDFW
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- Conflict with any county or municipal policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved governmental habitat conservation plan.

5.1 POTENTIAL DIRECT / INDIRECT ADVERSE EFFECTS UPON SPECIAL-STATUS SPECIES

Will the project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Implementation of the proposed project will not impact biological resources, either directly or indirectly through habitat modification. The Project Areas are urbanized and devoid of natural habitats. Many of the project areas consist primarily of roads, buildings, graveled pads, and bare ground that is maintained free of weeds. Where vegetation is present, it is either landscaping or patches of European annual grasses and weedy forbs. Thus, special-status species will not be impacted by habitat loss caused by project implementation. Project implementation will not directly impact any known population of special-status

species, as determined by database queries and biological field surveys. No special-status species have a moderate or high potential to occur. Vegetation that is present is ornamental or ruderal and does not contain potential habitat for special-status plant species. The industrial nature of the facilities discourages most wildlife occupation.

The exceptions are the tank sites (High Valley Tank site, Shady Lane Tank site, and the Paradise Tank site). These tank sites are surrounded by trees and natural habitats and are in less urbanized settings. There is a greater potential bird nesting and bat roosting in adjacent trees. Noise, vibration, and other construction-related disturbance, could indirectly impact nesting birds or roosting bats in trees near the Proposed Project improvement areas, which is considered a potentially significant impact. Mitigation Measure BIO-1 below recommends a pre-construction survey for nesting birds and roosting bats and avoidance measures if found. This mitigation would reduce this impact to a less-than-significant level through avoidance measures.

5.1.1 Recommended Mitigation Measures

Mitigation Measure BIO-1: Roosting Bats and Nesting Birds

At the High Valley Tank site, Shady Lane Tank site, and the Paradise Tank site, a pre-construction survey for roosting bat shall be conducted by a qualified biologist within 500 feet of improvements. If construction activities occur during the nesting bird season (typically February through August), a pre-construction survey for the presence of special-status bird species or any nesting bird species should be conducted by a qualified biologist within 500 feet of improvements. If active nests or roosting bats are identified in these areas, CDFW and/or USFWS shall be consulted to develop measures to avoid “take” prior to the initiation of any construction activities. Avoidance measures may include establishment of a buffer zone using construction fencing or postponement of construction activities until a qualified biologist has determined that the nest/roost are no longer active.

5.2 POTENTIAL IMPACTS TO SENSITIVE NATURAL COMMUNITIES

Will the project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

The Proposed Project improvement areas do not contain any riparian habitat, aquatic resources, or other sensitive natural habitat. There will be no impacts to sensitive natural communities from project implementation.

5.2.1 Recommended Mitigation Measures

None required.

5.3 POTENTIAL IMPACTS TO JURISDICTIONAL AQUATIC RESOURCES

Will the project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

There are no aquatic resources within the Proposed Project improvement areas. There will be no direct impacts to aquatic resources from project implementation. Indirect impacts could occur during project construction by the potential accidental release of pollutants (sediment, petroleum products, concrete waste, etc.) into downgradient aquatic resources, which is considered a potentially significant impact. Mitigation Measure BIO-2 consists of erosion control measures which would reduce these indirect impacts to a less-than-significant level through stormwater pollution prevention measures.

5.3.1 Recommended Mitigation Measures

Mitigation Measure BIO-2: Stormwater and Erosion Control

If the project area is one acre or greater, the District must enroll under the State Water Quality Control Board's Construction General Permit prior to the initiation of construction. In conjunction with enrollment under this Permit, a Storm Water Pollution Prevention Plan, Erosion Control Plan, and a Hazardous Materials Management/Spill Response Plan must be created and implemented during construction to avoid or minimize the potential for erosion, sedimentation, or accidental release of hazardous materials.

If the total disturbance area is less that one acre, the Proposed Project shall implement temporary erosion control measures (e.g., silt fencing, staked straw bales) in areas where runoff from construction areas has the potential to enter off-site aquatic resources, including Clear Lake and its associated keys. Construction activities should be scheduled outside of peak runoff periods. Soil stockpiles shall be properly covered and/or stabilized to prevent release into waterways. Disturbed areas shall be re-vegetated after completion of construction activities.

5.4 POTENTIAL IMPACTS TO WILDLIFE MOVEMENT, CORRIDORS, ETC.

Will the project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

No wildlife corridors or fishery resources exist within the Proposed Project improvement areas. However, wildlife corridors exist nearby in the marshlands of Clear Lake, and Clear Lake contains important fishery resources. The Proposed Project will either replace existing structures or introduce new, small structures to existing developed areas so there will be no habitat loss. No structures will be built that will impede wildlife access or wildlife corridors. The Proposed Project will therefore have a less-than significant impact to wildlife movement or corridors.

5.4.1 Recommended Mitigation Measures

No mitigation is necessary.

5.5 POTENTIAL CONFLICTS WITH ORDINANCES, HABITAT CONSERVATION PLANS, ETC.

Will the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Will the project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

The Proposed Project is not located in an area covered by an adopted Habitat Conservation Plan or Natural Community Conservation Plan. Lake County has policies protecting oak woodlands; however, the Proposed Project would not involve the removal of oak trees. As such, there would be no impact.

5.5.1 Recommended Mitigation Measures

No mitigation is necessary

Section 6 | References

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, and T.J. Rosatti, editors. 2012. The Jepson Manual: Vascular Plants of California, second edition, thoroughly revised and expanded. University of California Press, Berkeley, California. 1,600 pp.

Cowardin, L. M., V. Carter, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Office of Biological Services, U. S. Fish and Wildlife Service, Washington, District of Columbia. 45 pp. Available electronically on the Internet at http://www.fws.gov/nwi/Pubs_Reports/Class_Manual/class_titlepg.htm.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Vicksburg, Mississippi. 92 pp.

Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento, California. Available electronically at http://davisherb.ucdavis.edu/cnpsActiveServer/index.html.

Sunset Western Garden Collection. 2025. Sunset Climate Zones. Sunset Publishing Corporation. Available on the Internet at: https://www.sunsetwesterngardencollection.com/climate-zones.

Section 7 | Qualifications of Surveyors and Authors

G.O. Graening, Ph.D., M.S.E.

G. O. Graening holds a Doctorate in Biological Sciences and a Master of Science in Biological Engineering and is a certified arborist (International Society of Arboriculture). Dr. Graening has 26 years of experience in environmental assessment and research, including the performance of numerous wetland delineations and aquatic restoration projects. Dr. Graening also served as an adjunct professor of biology at California State University Sacramento for 10 years and was an active researcher in the area of conservation biology and groundwater ecology.

Jennifer Wade, Principal

Jennifer Wade is an environmental specialist with over 20 years' experience in the environmental consulting field, including biological surveys and oversight of biological resources reports. Ms. Wade has assisted federal agencies and Native American tribes with Section 7 Endangered Species Act consultation and Clean Water Act Section 404/401 permitting and certification. Prior to founding Acorn Environmental, she was the Northern California Land Management Program Manager within the Biological Resources group at Environmental Science Associates. Ms. Wade is currently one of the owners of Acorn Environmental and leads the biological resources group.

Attachment A: Database Queries

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: 01/07/2026 23:16:22 UTC
Project Code: 2026-0033815
Project Name: CLOCWD Revised Water Infrastructure Rehabilitation Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

PROJECT SUMMARY

Project Code: 2026-0033815
Project Name: CLOCWD Revised Water Infrastructure Rehabilitation Project
Project Type: Water Supply Facility - Maintenance / Modification
Project Description: rehabilitation of District water supply elements, such as tanks, pumps, lines, etc.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.0295504,-122.6764014088613,14z



Counties: Lake County, California

ENDANGERED SPECIES ACT SPECIES

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
California Condor *Gymnogyps californianus* Population: Pacific Northwest NEP No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8193 General project design guidelines: https://ipac.ecosphere.fws.gov/project/QTFTRCHHNRGPNOREMXVOTOKKDI/documents/generated/11271.pdf	Experimental Population, Non-Essential
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123 General project design guidelines: https://ipac.ecosphere.fws.gov/project/QTFTRCHHNRGPNOREMXVOTOKKDI/documents/generated/11271.pdf	Threatened

REPTILES

NAME	STATUS
Northwestern Pond Turtle *Actinemys marmorata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1111 General project design guidelines: https://ipac.ecosphere.fws.gov/project/QTFTRCHHNRGPNOREMXVOTOKKDI/documents/generated/11271.pdf	Proposed Threatened

FISHES

NAME	STATUS
Clear Lake Hitch *Lavinia exilicauda chi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9298	Proposed Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743 General project design guidelines: https://ipac.ecosphere.fws.gov/project/QTFTRCHHNRGPNOREMXVOTOKKDI/documents/generated/11271.pdf	Proposed Threatened

FLOWERING PLANTS

NAME	STATUS
Burke's Goldfields *Lasthenia burkei*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/4338

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: G.O. Graening
Address: 343 Carpenter Hill Road
City: Folsom
State: CA
Zip: 95630
Email ggraening@gmail.com
Phone: 9164525442

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Lucerne (3912217) OR Clearlake Oaks (3912216))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Amsinckia lunaris bent-flowered fiddleneck	PDBOR01070	None	None	G3	S3	1B.2
Antrozous pallidus pallid bat	AMACC10010	None	None	G4	S3	SSC
Archoplites interruptus Sacramento perch	AFCQB07010	None	None	G1	S1	SSC
Arctostaphylos manzanita ssp. elegans Konocti manzanita	PDERI04271	None	None	G5T3	S3	1B.3
Brasenia schreberi watershield	PDCAB01010	None	None	G5	S3	2B.3
Clear Lake Drainage Cyprinid/Catostomid Stream Clear Lake Drainage Cyprinid/Catostomid Stream	CARA2530CA	None	None	GNR	SNR	
Clear Lake Drainage Seasonal Lakefish Spawning Stream Clear Lake Drainage Seasonal Lakefish Spawning Stream	CARA2550CA	None	None	GNR	SNR	
Coastal and Valley Freshwater Marsh Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G4	S2	SSC
Dubiraphia brunnescens brownish dubiraphian riffle beetle	IICOL5A010	None	None	G1	S1	
Gonidea angulata western ridged mussel	IMBIV19010	None	None	G3	S2	
Great Valley Mixed Riparian Forest Great Valley Mixed Riparian Forest	CTT61420CA	None	None	G2	S2.2	
Hesperolinon adenophyllum glandular western flax	PDLIN01010	None	None	G2G3	S2S3	1B.2
Hesperolinon bicarpellatum two-carpellate western flax	PDLIN01020	None	None	G2	S2	1B.2
Hysterocarpus traskii lagunae Clear Lake tule perch	AFCQK02013	None	None	G5T3	S3	SSC
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G4	S3S4	
Lavinia exilicauda chi Clear Lake hitch	AFCJB19011	Proposed Threatened	Threatened	G4T1	S1	
Layia septentrionalis Colusa layia	PDAST5N0F0	None	None	G2	S2	1B.2
Lupinus antoninus Anthony Peak lupine	PDFAB2B0C0	None	None	G2	S2	1B.2

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Potamogeton zosteriformis eel-grass pondweed	PMPOT03160	None	None	G5	S3	2B.2
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Taricha rivularis red-bellied newt	AAAAF02020	None	None	G2	S2	SSC

Record Count: 23

CALIFORNIA NATIVE PLANT SOCIETY

CNPS Rare Plant Inventory

Search Results

8 matches found. Click on scientific name for details

Search Criteria: , CRPR is one of [**1A:1B:2A:2B**] , Quad is one of [**3912217:3912216**]

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	CA ENDEMIC	DATE ADDED	PHOTO
Amsinckia lunaris	bent-flowered fiddleneck	Boraginaceae	annual herb	Mar-Jun	None	None	G3	S3	1B.2	Yes	1974-01-01	 © 2011 Neal Kramer
Arctostaphylos manzanita ssp. *elegans*	Konocti manzanita	Ericaceae	perennial evergreen shrub	(Jan)Mar-May(Jul)	None	None	G5T3	S3	1B.3	Yes	2001-01-01	 ©2018 Dean Wm. Taylor
Brasenia schreberi	watershield	Cabombaceae	perennial rhizomatous herb (aquatic)	Jun-Sep	None	None	G5	S3	2B.3		2010-10-27	 ©2014 Kirsten Bovee
Hesperolinon adenophyllum	glandular western flax	Linaceae	annual herb	May-Aug	None	None	G2G3	S2S3	1B.2	Yes	1974-01-01	 © 2002 John Game

Hesperolinon bicarpellatum	two-carpellate western flax	Linaceae	annual herb	(Apr)May-Jul	None	None	G2	S2	1B.2	Yes	1974-01-01	 © 2016 John Doyen
Layia septentrionalis	Colusa layia	Asteraceae	annual herb	Apr-May	None	None	G2	S2	1B.2	Yes	1994-01-01	 © 2013 Jake Ruygt
Lupinus antoninus	Anthony Peak lupine	Fabaceae	perennial herb	May-Jul	None	None	G2	S2	1B.2	Yes	1980-01-01	 ©2018 John Doyen
Potamogeton zosteriformis	eel-grass pondweed	Potamogetonaceae	annual herb (aquatic)	Jun-Jul	None	None	G5	S3	2B.2		1994-01-01	No Photo Available

Showing 1 to 8 of 8 entries

Go to top

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California Native Plant Society, Rare Plant Program. 2026. Rare Plant Inventory (online edition, v9.5.1). Website https://www.rareplants.cnps.org [accessed 22 January 2026].

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Attachment B: Site Photographs



View looking south from Highway 20 of the water treatment plant



Looking north to Highway 20 on Sulphur Springs Drive at Project 11 (pothole valves)



Pluth Tank Site on entrance drive looking west



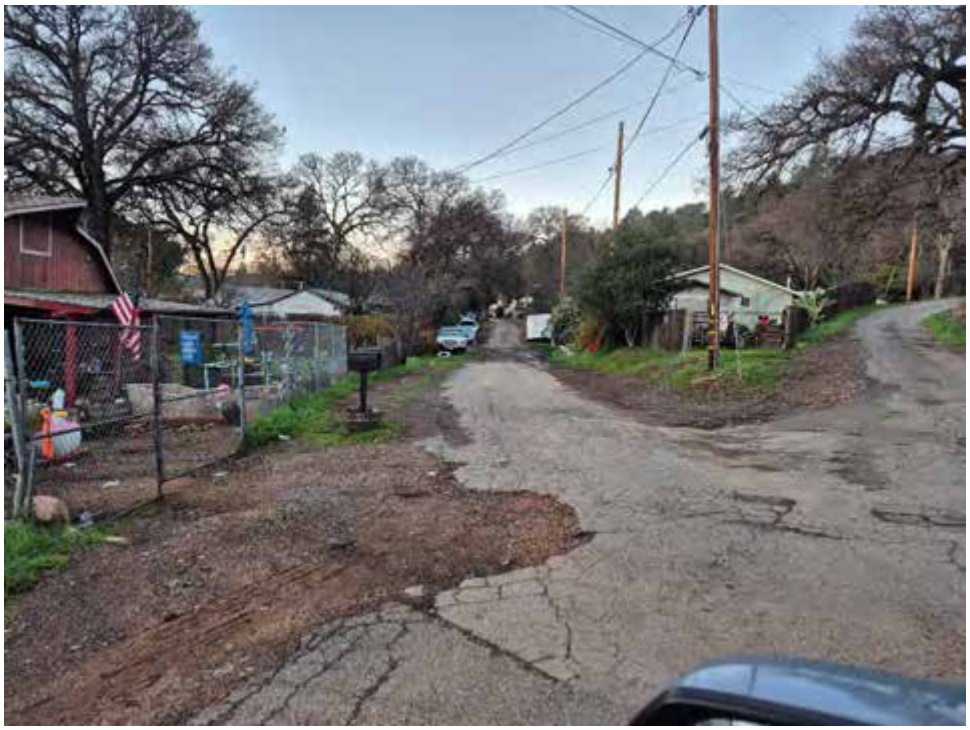
Looking east at Pluth Tank Site



High Valley Tank and Booster Site, looking south from entrance drive



High Valley Tank and Booster Site, looking west, with invasive giant reed in foreground



Looking southwest along Center Way (pipeline segment)



Looking north on Short Street towards Highway 20 (Pipe segment)



Looking west and uphill at Shady Lane Tank Site



Looking east at old tank foundation and existing tank at Shady Lane Tank Site



Looking north at Konocti Tank in its fenced compound



Looking south at Konocti Tank and telecom facility in their fenced compounds



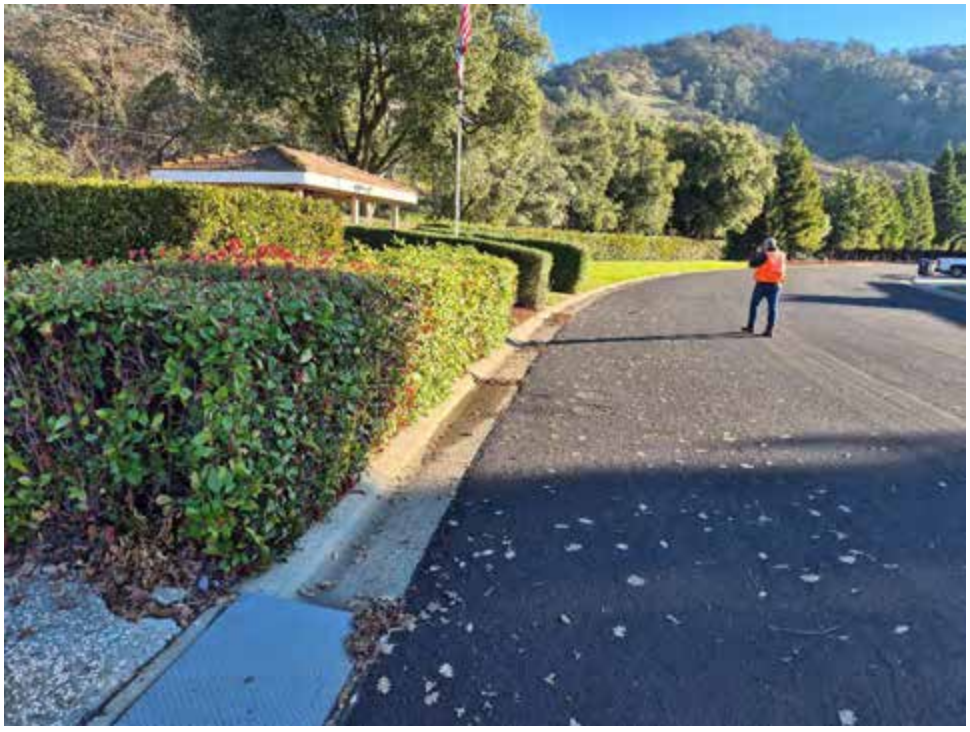
Looking southeast at tank site on Harvey Boulevard



Looking south at tank site on Harvey Boulevard



Looking east at intersection of Harvey Blvd and Highway 20 at vault



Looking east along Paradise Valley Boulevard at water pipe junction



Looking northwest on private drive at the Paradise Valley tank and fenced compound.



Looking south on private drive at the Paradise Valley tank and fenced compound.



Looking west along 4th Street (pipeline segment) in Clear Lake Keys community